COST ANALYSIS OF BRANDED VERSUS GENERIC ANTIDIABETIC THERAPIES- THE INDIAN LANDSCAPE

Dissertation submitted to

The IIHMR University, Jaipur

For the partial fulfilment for the award of the degree of

Master of Business Administration (MBA)

In

Pharmaceutical Management

By

Dhanvi Shekhar

Under the supervision and Guidance of

Dr. Saurabh Kumar Banerjee

2021

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled “COST ANALYSIS OF BRANDED VERSUS GENERIC ANTIDIABETIC THERAPIES- THE INDIAN LANDSCAPE” is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Name of Student

Date

CERTIFICATE OF COMPLETION

This is to certify that Dhanvi Shekhar in partial fulfilment of the requirements for the award of the degree of MBA (Pharmaceutical Management) from the IIHMR University, Jaipur has successfully completed her/his internship at ZS Associates during March 22, 2021 to June 19, 2021.

Place: Preceptor/Head of the Organization

Date: Name of the organization

CERTIFICATE

This is to certify that dissertation titled "**COST ANALYSIS OF BRANDED VERSUS GENERIC ANTIDIABETIC THERAPIES- THE INDIAN LANDSCAPE"** is a record of the research work undertaken by Dhanvi Shekhar in partial fulfilment of the requirements for the award of the degree of MBA (Pharmaceutical Management) from the IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.

Faculty Guide
IIHMR University, Jaipur

Date

School Dean
IIHMR University, Jaipur

Date

Abstract

Type II Diabetes Mellitus (T2DM) has increased in India in recent years. The majority of doctors prescribing drugs do not realize the potential of financial saving and reducing financial burden offered by generics.

Aim: To analyse the cost variations of branded and generic antihyperglycemic medications used for the management of T2DM.

Methodology: CIMS (current index of medical stores) is used to determine the prices of branded drugs and the generic prices are taken from the National List of Essential Medicines (NLEM) under Jan Aushadhi scheme. The cost variations and potential savings that can be realized by substituting available anti-diabetic regimens on In the calculation of cost based on the use of generic drugs, the standard formula was applied and the costs were calculated in Indian rupees (as of 2021).

Analysis of branded drugs showed a variation of 118.49% to 490.80% observed with acarbose and metformin individually. Pioglitazone proposed the highest cost variation (173.48% - 901.48%) and Teneligliptin (31.31% - 242.63%) had the lowest variation in price relative to generics. The highest level of cost-saving per year (INR 4442.95) with alpha-glucosidase inhibitors regimen and the lowest (INR 2549.16) with Sulfonylurea treatment regimen.

In conclusion, substituting generic chemotherapeutic drugs could potentially result in cost savings. Patients and healthcare professionals should think about generic medicines when achieving goals in T2DM treatment. Generic drugs are more cost-effective.

Acknowledgements

I am highly indebted to my esteemed supervisor, Dr. Saurabh Kumar Banerjee, Associate Professor and Dean, for not only giving me a research topic in accordance with my interest but also guiding me constantly throughout this dissertation period, despite the impact of the Covid-19 pandemic on our academic and personal lives.

I would like to express gratitude to Dr. P. R. Sodani, President, IIHMR University, for the opportunity to pursue this dissertation.

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Introduction

It is estimated that Type 2 DM contributes a significant part of the global burden, with India contributing a significant share of the burden. Diabetes was initially identified in 1988 as part of metabolic syndrome.[1] Type 2 DM (previously non-insulin dependent DM) is marked by hyperglycaemia, impaired insulin action, and relative insulin deficit, while being the most prevalent type of DM. [2] T2DM is caused by a combination of genetic, environmental, and behavioural factors. [3]

Type 2 diabetics are particularly vulnerable to long-term and short-term complications, which are often responsible for untimely mortality. Due to late diagnosis and common onset of type 2 diabetes, patients with this disease typically have an increased mortality rate and morbidity, especially in resource-poor countries like Africa.[4]

The most common type of diabetes is type 2 diabetes. Diabetic mellitus is prevalent in rural populations at 2.4% and 11.6% in urban populations.[5]

The management of type 2 diabetes mellitus involves lifestyle and dietary changes. Several studies have shown that type 2 diabetes incidence can be significantly reduced by maintaining a BMI of 25 kg/m^2, a reduced-fat diet, moderate exercise, and refraining from smoking and excessive consumption of alcohol, [6-8] Suggesting a healthy lifestyle is a key element in preventing most type 2 DM cases The lifestyle recommendations for patients with type 2 DM should be tailored to their physical and functional abilities based on a medical nutrition evaluation. [9]

Pharmacological Agents for Type 2 diabetes mellitus

Biguanides

Metabolic syndrome: biguanides inhibit glucose synthesis, raise insulin sensitivity, increase glucose uptake through their phosphorylation of the GLUT-enhancer factor, increase fatty acid oxidation, and inhibit gastrointestinal glucose absorption.[10] A 2008 study also demonstrated that metformin activates AMP-activated protein kinase, an enzyme involved in the expression of hepatic glucose biosynthesis.[11] Patients with

impaired renal function should use metformin with caution because of risk of lactic acidosis. Compared to sulfonylureas, it has a relatively low risk of hypoglycemia. [10]

Sulfonylureas

The majority of these medications do not cause any adverse effects, but do present a risk of hypoglycemia because they stimulate the body's own insulin production. [9] Compared to younger diabetes patients, older patients who are treated with sulfonylureas are more likely to have hypoglycemia.[12] Glyburide elicits higher rates of hypoglycemia than glipizide.[13] Hyperglycemia may be caused by aging, insulin or insulin sensitizer use along with sulfonylurea use, abuse of alcohol, restriction of calorie intake, consuming multiple medications, or taking medications that enhance their effects.[14] In elderly people suffering from DM, glipizide should be preferred to long-acting sulfonylureas like glyburide. [9]

Meglitinides

The anti-aging agents repaglinide and nateglinide act similarly to sulfonylureas in that they stimulate insulin to be released from beta cells by activating an ATP-dependent K-channel, though their binding sites differ.[15] Additional benefits include a short acting period (4-6 hrs) and a reduced risk of hypoglycemia. Postprandial glucose control with meglitinides is achieved before meals. Taking repaglinide preprandial allows for longer cutting off times without greater hypoglycemia risk. [16] The liver metabolizes repaglinide most efficiently, with the kidneys clearing very little.[15]

Thiazolidinediones

In contrast to insulin, Thiazolidinedione binds specifically to peroxisome proliferator-activated gamma. Among the first drugs available for treating type 2 diabetes with insulin resistance were pioglitazone and rosiglitazone,[17] a class primarily comprised of pioglitazone after rosiglitazone was restricted by the Food and Drug Administration (FDA)'s guidelines due to cardiovascular side effects reported.[7] Pioglitazone is well tolerated in older adults and does not cause hypoglycemia. Nevertheless, elderly individuals with diabetes can find it difficult to use due to concerns about edema, fluid retention, and fractures. Patients with heart failure of class III-IV should avoid pioglitazone if they suffer from congestive heart failure in the elderly.[18]

Inhibitors of alpha-glucosidase

Although Adacarbose, Voglibose, and Miglitol have not been studied extensively for type 2 DM treatment, they have a good chance of being effective and safe. When there is serious renal impairment, these agents are not recommended for treating postprandial hyperglycemia. Due to their high side-effect rates such as diarrhoea and flatulence, their use is usually limited. [9] A study of a newly developed drug, Voglibose, has shown that it improves glucose tolerance, and in addition, the proportion of patients who achieve normoglycemia is significant.[19]

Therapies involving incretins

Analogues of GLP-1 (glucagon-like peptide 1) are used as part of incretin-based therapies designed to target previously unidentified markers of diabetes pathophysiology in order to improve glycaemic control and body weight management for patients.[20] The drugs are available for use as solo or combined therapy in adults with type 2 Diabetes. Incretin mimickers such as Exenatide and Liraglutide are examples of these molecules.[9]

GLP-1 therapies are not associated with hypoglycaemia (unless they are used in conjunction with insulin secretagogues). In addition, there is evidence to suggest that therapies based on incretin might be beneficial for inflammation, heart health, liver function, sleep, and neurological health positively.[20]

Dipeptidyl-Peptidase IV Inhibitors

Inhibitors of dipeptidyl peptidase-4 (DPP-4), a widespread enzyme that inhibits GLP-1 and GIP production, induces the production of these hormones, resulting in improved insulin activity and glucose control in type 2 DM.[21] DPP-4 inhibitors are also anti-diabetogenic drugs with comparable efficacy to currently available treatment. Patients whose blood glucose levels cannot be controlled by diet and exercise can benefit from these drugs. They are also effective when added to metformin and thiazolidinediones. Weight is not affected by the DPP-4 inhibitors. They are well tolerated, produce little hypoglycaemia, and carry low risks of weight gain. The cost is relatively high, however. [21] Additional research is required on the long-term effects of beta-cell morphology and function on glycaemic control. [21,22]

Insulin

Diabetes is treated with insulin alone or in conjunction with oral hypoglycemic medications When some beta cell function remains, basal insulin augmentation therapy

can be helpful. Beta cells must be replaced with basal-bolus insulin if they are exhausted. If glucose toxicity occurs, rescue therapy using replacement insulin is needed. The therapy must mimic the process by which beta cells release insulin normally.[22] There is a wide range of insulin subtypes and their corresponding doses-some are rapidly releasing and others are long acting. When compared to short acting forms, long acting forms tend to cause less hypoglycaemia.

Insulin analogues

The ability of insulin therapy was limited with respect to imitating the normal physiologic release of insulin. There are several limitations to the current long-acting and intermediate-acting insulins (NPH insulin, insulin lens, insulin ultra-lens) including their inconsistent release and peaks of action that occasionally result in hypoglycemia. [23,24] There are two types of insulin analogues available on the market, which differ significantly from regular insulin in their onset and duration of action, which range from rapid to prolonged. The current market for insulin analogues consists of two rapid-acting drugs, insulin lispro and insulin aspart, as well as one long-acting drug, insulin glargine. [23,24]

Future in Drug Therapy Inhaled Insulin

A rapid acting insulin inhaled medication became available in 2006,[25] after it was approved by both FDA and the EMEA to treat both type 1 and type 2 diabetes. [25,26] Specifically indicated to be used in adults with type 1 or type 2 diabetes, this rapid acting insulin contains the advantage of entering the body directly via the lungs. Research has shown that inhaled insulin is equally effective to short acting insulin, but not better. [25] Due to low sales, the manufacturer pulled it from the market in October 2007.

Bromocriptine

There has been a recent development in treating type 2 diabetes with a quick-release bromocriptine. Although not completely understood, the mechanism of action appears to be complex. The HbA1c levels were shown to be reduced by 0.0% to 0.2% as a result of 24 weeks of therapy.[27]

Others

The following therapies were evaluated in order to develop new medications for diabetes patients.[28]

- Increased renal glucose elimination can be achieved with sodium-glucose cotransporter 2 inhibitors
- Inhibitors of 11ß-hydroxysteroid dehydrogenase are used to inhibit the action of glucocorticoids on hepatic and fatty tissue.
- Activators of insulin-releasing glucokinase
- Fat-acid receptor agonists with pancreatic G-protein coupling
- Antagonists of the glucagon receptor
- Metabolism-inhibiting substances in the liver

It is estimated that by 2030, there will be 79.4 million diabetic patients in India.[6] Because of the poor execution of the national program and lack of access to treatment for chronic patients, the bulk of diabetic patients require private care, incurring substantial out-of-pocket expenses.[7] India has one of the highest per capita out-of-pocket expenditures, so generic drugs can save a lot of money in comparison to commercial drugs, money which can be directed toward other health problems. [8]

Generic Drugs

In other words, a generic drug is another named brand drug that is created to have the same characteristics as the name brand drug, such as dosage form, safety, strength, route of administration, quality, and performance characteristics.[8] Since generic drugs offer a substantial discount over brand name drugs, significant savings in healthcare costs can be achieved.[8] In generic drug manufacture, preclinical and clinical testing are not an extra cost. Generics are more affordable than brand-name drugs; this allows for a country to save money on drug expenditures. [9]

Despite being bio-equivalent to their innovator counterparts and manufactured in similar facilities according to good manufacturing practices, generic medicines are widely accepted as inferior to branded ones in terms of therapeutic efficacy and quality.[9] Marketing advertising used by manufacturers of imported branded medicines additionally contributes to this belief.[10]

Review of Literature

A patient who is diagnosed with diabetes will require a significant amount of resources, including glucose monitors, medications, regular medical appointments, and referral to specialists for complications management. Diabetes care can cost 25% or more of a person's family income for a family with a low income in India. Diabetes complications caused by long-term management are both costly and have a significant social impact on patients and their families.

Presently, Indian medicines are sold under brand names (trade names) and are referred to as branded generics or branded medicines. The Indian market hardly has branded medicines (an innovator product commonly known as a branded drug) due to the fact that India did not recognize product patents until January 2005. There are two types of pharmaceutical products manufactured by companies in India, branded and branded-generic products, both advertised and marketed through doctors and retailers, respectively. Pharmaceuticals which are often sold under the name of "branded medicine," are manufactured and promoted by multinational companies or reputed Indian firms. The manufacturer of branded generics doesn't advertise or promote them. The formulations in this class are commonly called 'generics' worldwide. All branded-generic medicines are perceived the same way by patients and doctors, regardless of the manufacturer.

Due to the fact that generic substitutions in India are not permitted, patients' knowledge about generics is limited; doctors and patients are unwilling to change a tradename prescribed by their doctor. As a result, generic drugs are not known to most consumers and there is a lack of variety in trade names and price fluctuations. Hence, a study that documents the price structure and quality of branded products as well as their generic versions manufactured in India is necessary.

A new initiative launched by the Department of Pharmaceuticals of the Government of India in 2008 was “Jan Aushadhi Yojana” (literally translated as “Medicine for People”). By setting up retail outlets with the government's help, the program sought to make unbranded quality medicines affordable to poor people in the country. In addition to setting up Jan Aushadhi stores that sell generic medicines to the extent possible, it has also granted preference to public sector undertakings in the pharmaceutical sector. [29] Until June 20, 2021, 7700 shops belonging to Jan Aushadhi were operated in 33 states and union territories. [30] Jan Aushadhi stores are not sufficient. There are over 8

lakh retail pharmacies, but approximately 7,000 stores. Many rural areas are still unattended.

The Medical Council of India amended its code of conduct for doctors in October 2016, recommending that every physician prescribe drugs with generic names that are legible and ensures that the prescription promotes the use of generic drugs.[31]. A law may be introduced in India to require doctors to prescribe generic medicines. [32]

A study conducted by Singal et al. indicates that both branded and generic versions of medicines meet all the criteria prescribed by statutory standards and have all the same quality. It is therefore imperative to conduct more such studies and to publish them widely in order to remove the general misconception and doubt regarding the quality of the branded-generic version of medicines. It is possible to lower the price of branded-generic drugs by making suitable changes to the drug price policy. At least for generics, pharmaceutical trade needs to be transparent about the manufacturers' MRP fixing and clear guidelines for mark-ups. To build confidence among prescribers, pharmacists, and consumers, the government needs to establish generic promotion schemes and general awareness programs. To make medicines affordable, generics and branded generics with a lower price tag and an assured quality must be available on the market.

Methodology

Antihyperglycemic drugs of all classes have been taken into consideration for this study as per the following list:

1. Biguanides
    a. Metformin
2. Sulfonylureas
    a. Glimepiride
    b. Gilbenclamide
    c. Gilclazide
    d. Glipizide
    e. Tolbutamide
3. Meglitinides
    a. Repaglinide
    b. Nateglinide
4. Thiazolidinediones

    a. Pioglitazone
    b. Rosiglitazone
5. Alpha-glucosidase Inhibitors
    a. Acarbose
    b. Glyset
    c. Miglitol
    d. Precose
6. Incretin Mimetic Drugs
    a. Exenatide
    b. Liraglutide
7. DPP-4 Inhibitors
    a. Teneligliptin
    b. Sitagliptin
    c. Saxagliptin
    d. Linagliptin
    e. Alogliptin
8. Bromocriptine

For the scope of this study and report, one drug from each class was analysed. Meglitinides, Incretin mimetic drugs and Bromocriptine have not been included in the cost comparison because of lack of consistency in dose and pack size and the absence of a generic counterpart under the Jan Aushadhi Yojana.

For branded drugs, the CIMS (current index of medical stores) was used, and for generic drugs, the Jan Aushadhi scheme was used. The percentage cost variation and potential savings on substituting a generic drug for available ones for diabetes regimens were calculated using standard formulas and the costs are expressed in Indian Rupees (INR).

The list of branded drugs per molecule covered in this study is not exhaustive and is chosen taking brand popularity and market size into account.

In order to compare the price of branded and generic medications used to treat Type I Diabetes, a Cost minimization analysis was performed. We accessed CIMS online and reviewed the price data for branded diabetic drugs used as adjuvant systemic therapy (most expensive and least expensive). Using the most up-to-date master list of the Pradhan Mantri Bharatiya Jan Aushadhi scheme, we extracted data on generic costs.

Considering that the costs of administration, physician visits, and other healthcare costs are similar across brands and generics, we looked at the drug prices for the same doses and dosage forms for both and have displayed them in Indian rupees (INR). Using the following formula, we calculated the percentage variation in cost:

Percentage cost variation= [(Cost of the most expensive drug - Cost of the least expensive drug)/ Cost of the least expensive drug] x 100

Results

Cost comparison of branded versions of type 2 diabetes drugs.

Note: All prices are in Indian Rupees (INR) only. The highest values are highlighted in red whereas the lowest ones are in green.

Metformin

Brand Name	Company	Dose	Pack Size	Cost per unit	Price per tablet
Insumet	Cadila	500 mg	10	9.74	0.97
Metlead-SR	GSK	500 mg	10	17.53	1.75
Metadoze-IPR	Biocon	500 mg	10	19.2	1.92
Diabeta-SR	Torrent	500 mg	10	19.95	2.00
Metgem	Sun	500 mg	10	19.33	1.93
Okamet	Cipla	500 mg	20	22.12	1.11
Glumet	Cipla	500 mg	10	5.33	0.53
Zomet	Intas	500 mg	10	8.01	0.80
Gluconorm	Lupin	500 mg	15	31.49	2.10

Table 1: Metformin branded drugs cost list

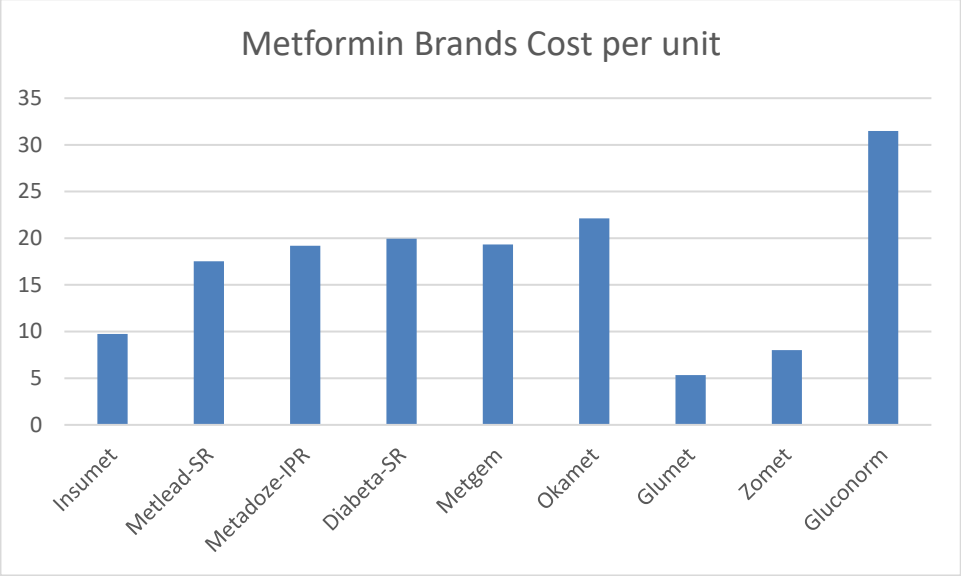

Figure 1: Metformin 500 mg Monotherapy Branded Drug Cost List

Percentage cost variation between most expensive and least expensive branded = (31.49 – 5.33)/ 5.33 = 490.80%

Generic drug cost per unit = 5.15 INR

Percentage cost variation between most expensive branded and generic = (2.10-0.515)/0.515 = 307.76%

Percentage cost variation between least expensive branded and generic = (0.53-0.515)/0.515 = 2.91%

Glimepiride

Brand Name	Company	Dose	Pack Size	Cost per unit	Price per tablet
Azulix	Torrent	1 mg	10	39.25	3.93
Blisto	Biocon	1 mg	10	36.46	3.65
Dibiglim	Novartis	1 mg	10	28.21	2.82
Euglim	Zydus	1 mg	15	37.78	2.52
Glador	Lupin	1 mg	10	37.2	3.72
Glimcip	Cipla	1 mg	10	39.31	3.93
Glimestar	Manking	1 mg	10	26.46	2.65
Glimpid	Ranbaxy	1 mg	10	25.29	2.53
Glimulin	Glenmark	1 mg	15	58.97	3.93

Table 2: Glimepiride branded drugs cost list

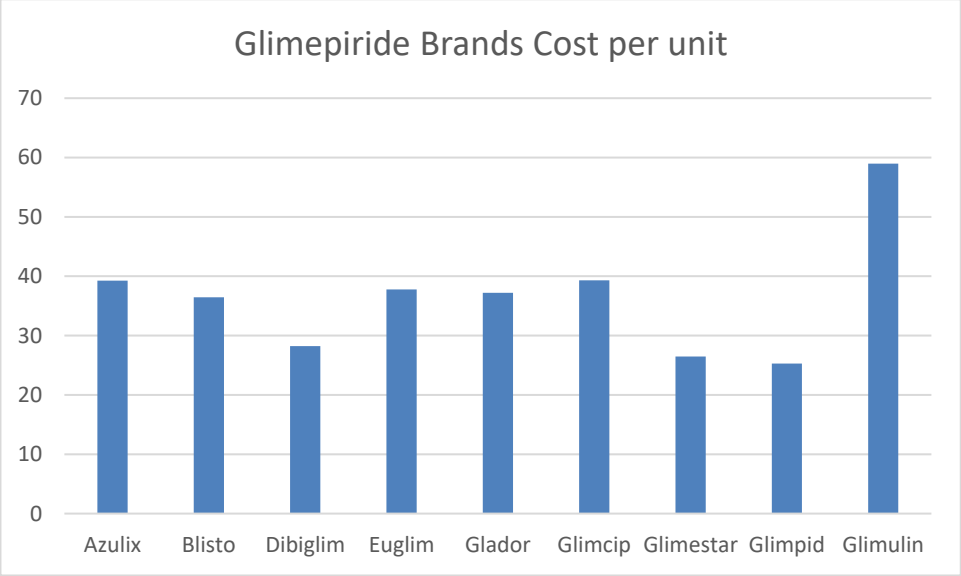

Figure 2: Glimepiride 1 mg Monotherapy Branded Drug Cost List

Percentage cost variation between the most expensive and least expensive branded drug = 56.09%

Generic drug cost per unit = 4.38 INR

Percentage cost variation between the most expensive branded drug and the generic drug= 1246.35%

Percentage cost variation between the least expensive branded drug and the generic drug = 762.56%

Pioglitazone

Brand Name	Company	Dose	Pack Size	Cost per unit	Price per tablet
Pionorm	Micro Labs	15 mg	10	45	4.50
Piodart	Biocon	15 mg	10	38.31	3.83
Piozone	Abbott	15 mg	10	41.1	4.11
Piolem	Alembic	15 mg	10	42.81	4.28
Piopod	Torrent	15 mg	10	50.05	5.01
Piolet	Intas	15 mg	10	44.5	4.45
Pioglit	Sun	15 mg	10	53.5	5.35
Oglo	Panacea	15 mg	10	67.6	6.76
Pioglar	Ranbaxy	15 mg	10	53.5	5.35
Diavista	Dr. Reddy's	15 mg	10	18.46	1.85

Table 3: Pioglitazone branded drugs cost list

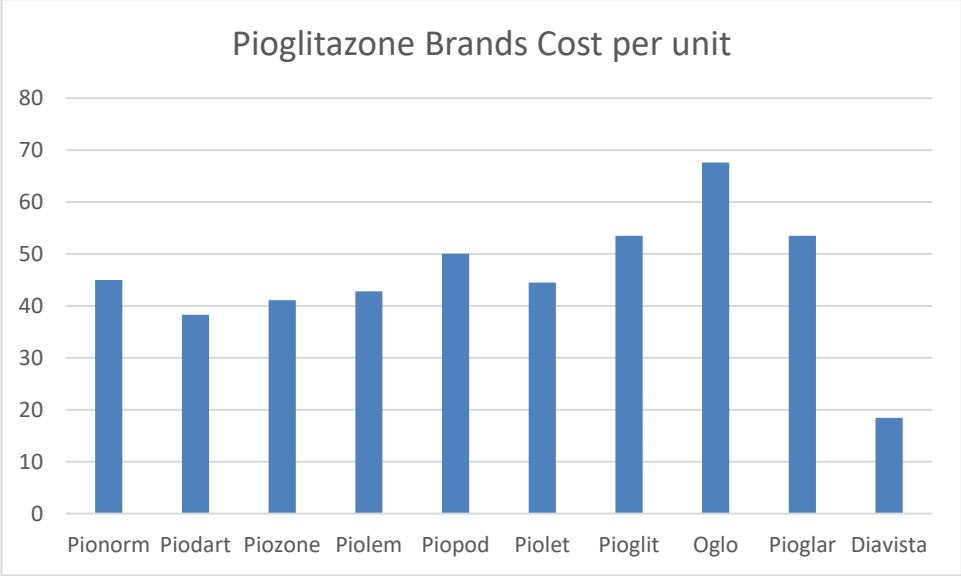

Figure 3: Pioglitazone 15 mg Monotherapy Branded Drug Cost List

Percentage cost variation between the most expensive and least expensive branded drug = 266.19%

Generic drug cost per unit = 6.75 INR

Percentage cost variation between the most expensive branded drug and the generic drug= 901.48%

Percentage cost variation between the least expensive branded drug and the generic drug = 173.48%

Acarbose

Brand Name	Company	Dose	Pack Size	Cost per unit	Price per tablet
Carbonid	Olcare	50 mg	10	129	12.90
Diabose	Micro Labs	50 mg	10	117	11.70
Abacus-50	Emcure	50 mg	10	65	6.50
Acarb	Orchid	50 mg	10	94.5	9.45
Asucrose	Wockhardt	50 mg	10	69.5	6.95
Glucar	Glenmark	50 mg	10	140.5	14.05
Glucobay	Bayer	50 mg	10	142	14.20
Glucobose	Medley	50 mg	10	91.22	9.12
Rebose	Sun	50 mg	10	112	11.20
Recarb	Bal Pharma	50 mg	10	96	9.60

Table 4: Acarbose branded drugs cost list

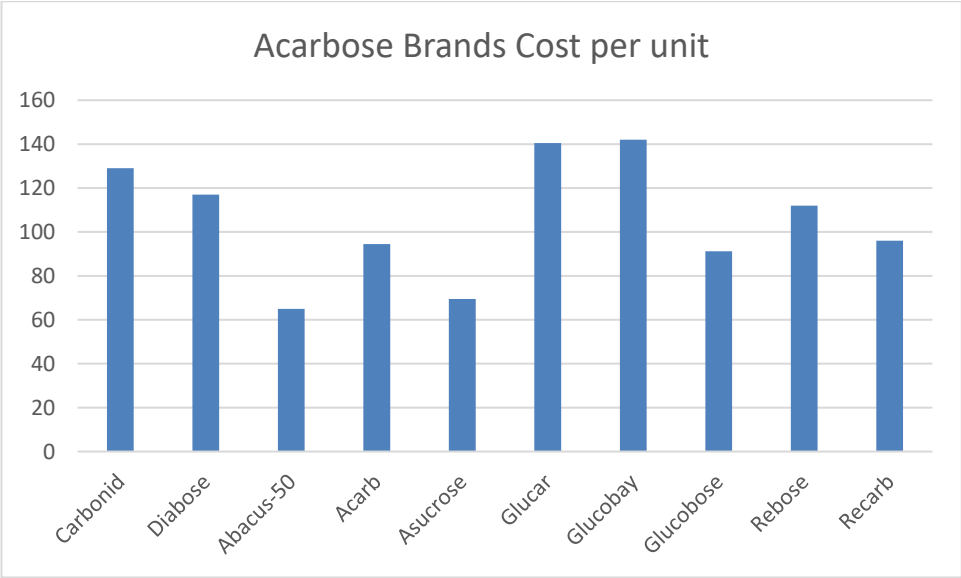

Figure 4: Acarbose 50 mg Monotherapy Branded Drug Cost List

Percentage cost variation between the most expensive and least expensive branded drug = 118.46%

Generic drug cost per unit = 55.9 INR

Percentage cost variation between the most expensive branded drug and the generic drug= 154.03%

Percentage cost variation between the least expensive branded drug and the generic drug = 16.28%

Teneligliptin

Brand Name	Company	Dose	Pack Size	Cost per unit	Price per tablet
Afoglip	Torrent	20 mg	10	108.8	10.88
Diaten	Bal Pharma	20 mg	10	99	9.90
Dynaglipt	Mankind	20 mg	10	65	6.50
Eternex-T	Alembic	20 mg	10	169.6	16.96
Glipon	Aristo	20 mg	10	75	7.50
Glipsov	Emcure	20 mg	10	119.55	11.96
Glytrin	Medley	20 mg	10	130	13.00
Megagliptin	Aristo	20 mg	10	80	8.00
Tenepride	Micro Labs	20 mg	10	96	9.60
Tenepure	Torrent	20 mg	10	131.25	13.13

Table 5: Teneligliptin branded drugs cost list

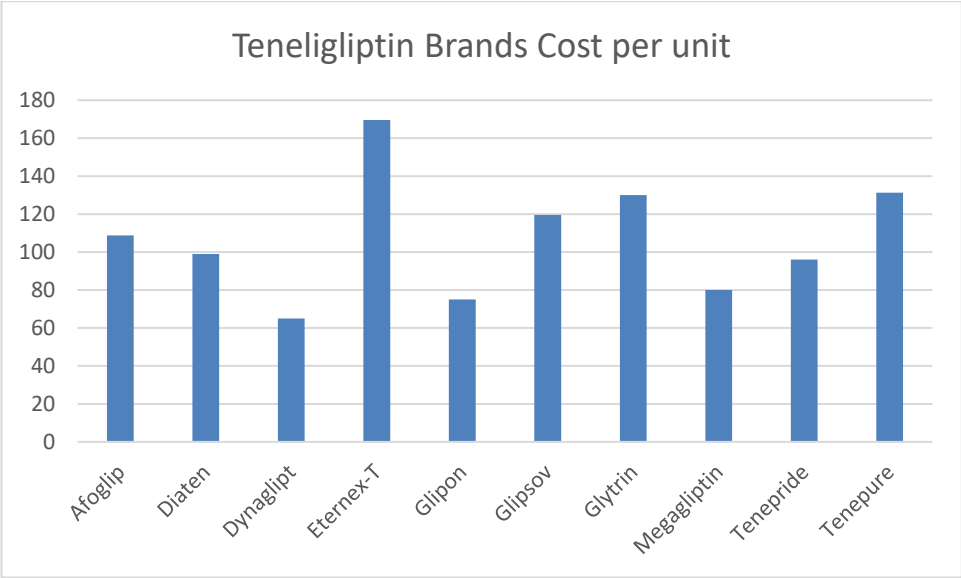

Figure 5: Teneligliptin 20 mg Monotherapy Branded Drug Cost List

Percentage cost variation between the most expensive and least expensive branded drug = 160.92%

Generic drug cost per unit = 49.5 INR

Percentage cost variation between the most expensive branded drug and the generic drug= 242.62%

Percentage cost variation between the least expensive branded drug and the generic drug = 31.31%

Cost variation of various drugs used in Type 2 Diabetes

Drug	Class	Most Expensive Branded Drug	Lease expensive branded drug	% cost variation between expensive and least expensive branded	Generic Drug Cost	% Cost variation btw expensive and generic	% cost variation between least expensive and generic
Metformin	Biguanides	31.49	5.33	490.80%	5.15	307.76%	2.91%
Glimepiride	Sufonylureas	58.97	37.78	218.05%	4.38	1246.35%	762.56%
Pioglitazone	Thiazolidinediones	67.6	18.46	266.20%	6.75	901.48%	173.48%
Acarbose	Alpha-glucosidase inhibitors	142	65	118.46%	55.9	154.03%	16.28%
Teneligliptin	DPP-4 Inhibitor	169.6	65	160.92%	49.5	242.63%	31.31%

Table 6: Cost variation of various drugs used in T2DM

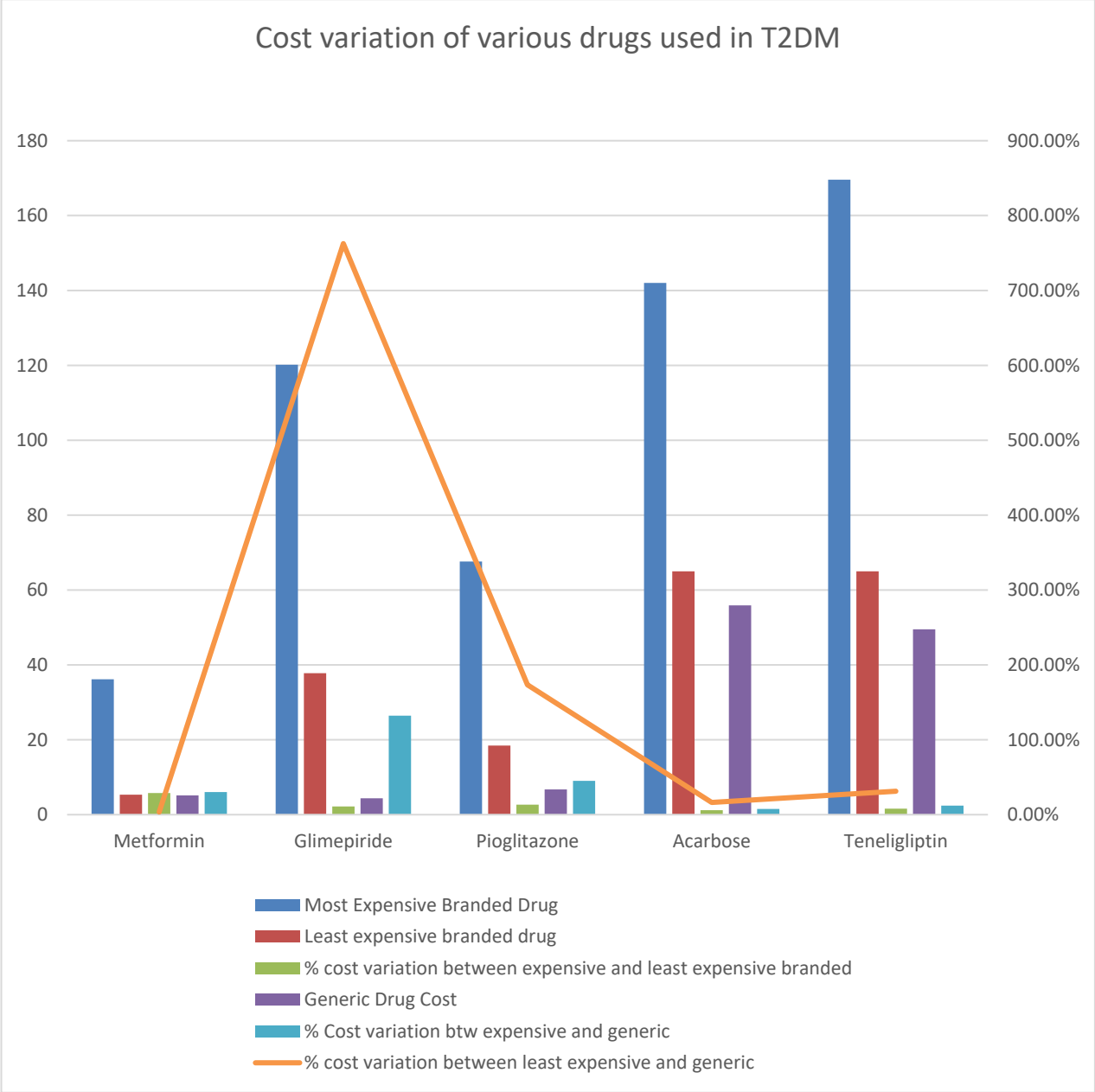

Figure 6: Overview of Cost and Cost variation in T2DM therapies

Price cost saving comparing expensive branded drug and generic drugs in the Type II Diabetes regimen.

Regimen	Class	Dose (mg)	Dosage	Expensive brand cost per tablet	Generic drug cost per tablet	Cost saving per dose	Cost saving per day	Cost saving per year	Cost saving in 25 years
Metformin	Biguanides	500	2	2.1	0.515	1.585	3.17	1157.05	28926.25
Glimepiride	Sufonylureas	1	2	3.93	0.438	3.492	6.984	2549.16	63729
Pioglitazone	Thiazolidinediones	15	2	6.76	0.675	6.085	12.17	4442.05	111051.25
Acarbose	Alpha-glucosidase inhibitors	50	2	14.2	5.59	8.61	17.22	6285.3	157132.5
Teneligliptin	DPP-4 Inhibitor	20	2	16.96	4.95	12.01	24.02	8767.3	219182.5

Table 7: Price cost savings: Expensive branded drugs vs. Generic drugs

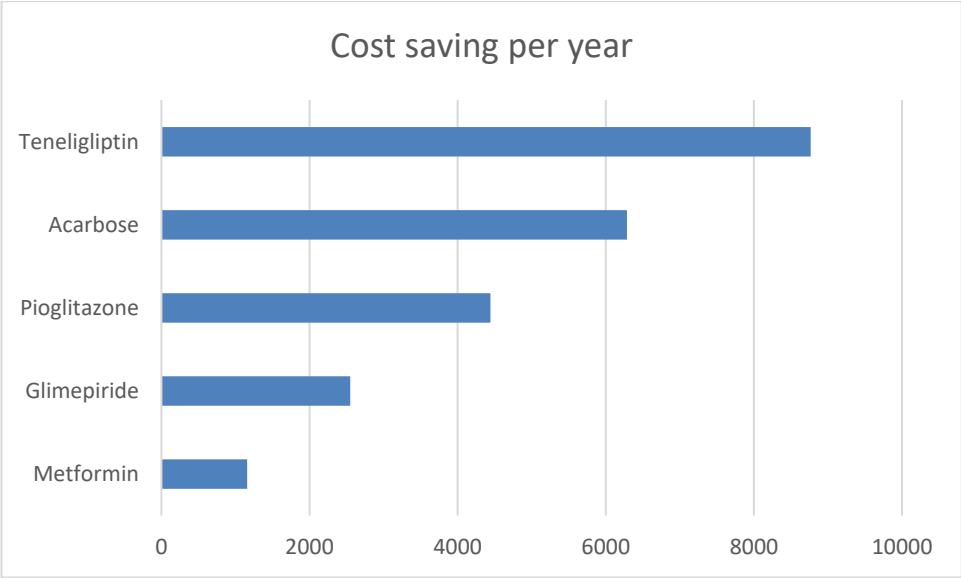

Figure 7: Cost Saving per year across various antidiabetic drugs (Expensive branded vs. Generic)

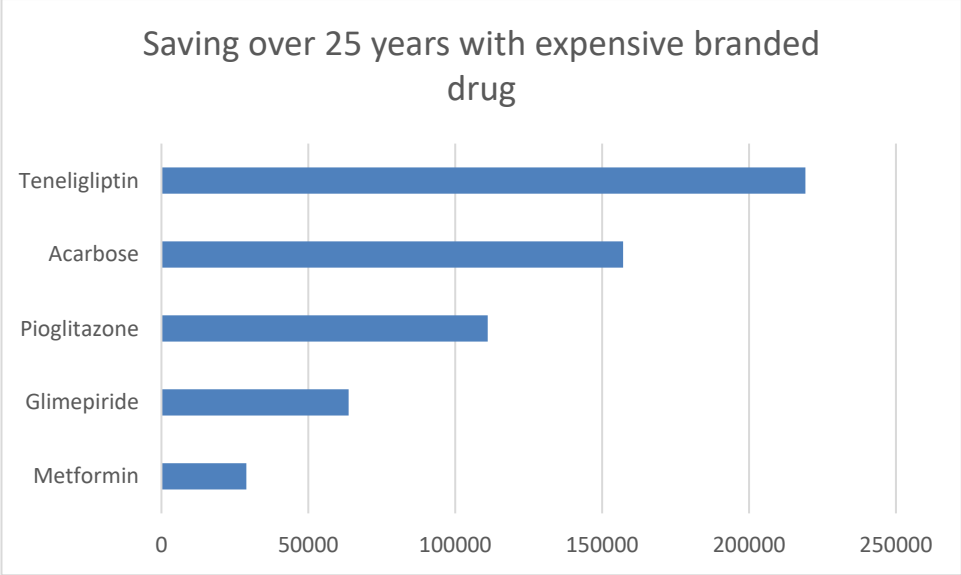

Figure 8: Cost Saving over 25 years across various antidiabetic drugs (Expensive branded vs. Generic)

Price cost saving comparing least expensive branded drug and generic drugs in the Type II DM regimen

Regimen	Class	Dose (mg)	Dosage (tablets/day)	Least expensive brand cost per tablet	Generic drug cost per tablet	Cost saving per dose	Cost saving per day	Cost saving per year	Cost saving in 25 years
Metformin	Biguanides	500	2	0.53	0.515	0.015	0.03	10.95	273.75
Glimepiride	Sufonylureas	1	2	2.52	0.438	2.082	4.164	1519.86	37996.5

Pioglitazone	Thiazolidinediones	15	2	1.85	0.675	1.175	2.35	857.75	21443.75
Acarbose	Alpha-glucosidase inhibitors	50	2	6.5	5.59	0.91	1.82	664.3	16607.5
Teneligliptin	DPP-4 Inhibitor	20	2	6.5	4.95	1.55	3.1	1131.5	28287.5

Table 8: Price cost savings: Least expensive branded drug vs. Generic drug

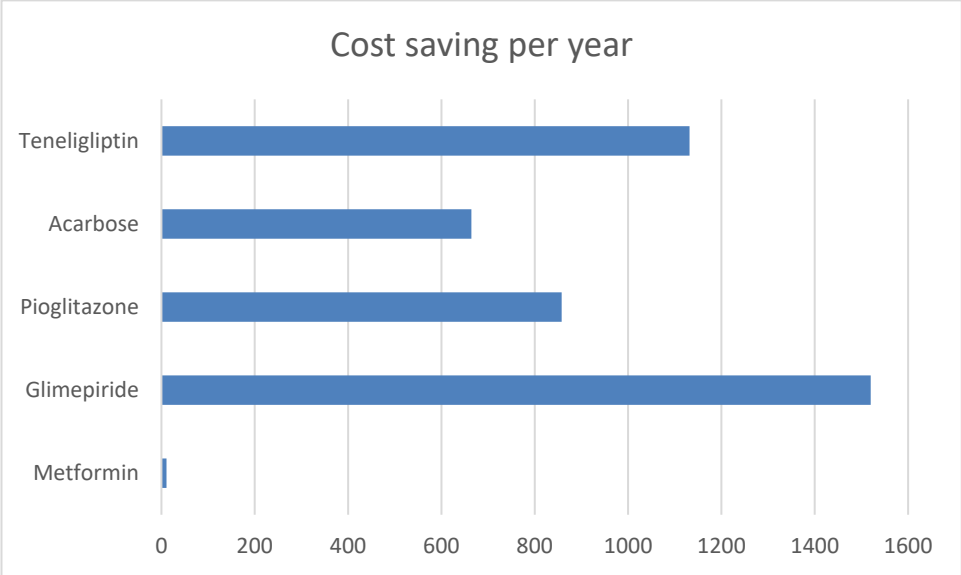

Figure 9: Cost Saving per year across various antidiabetic drugs (least expensive branded vs. Generic)

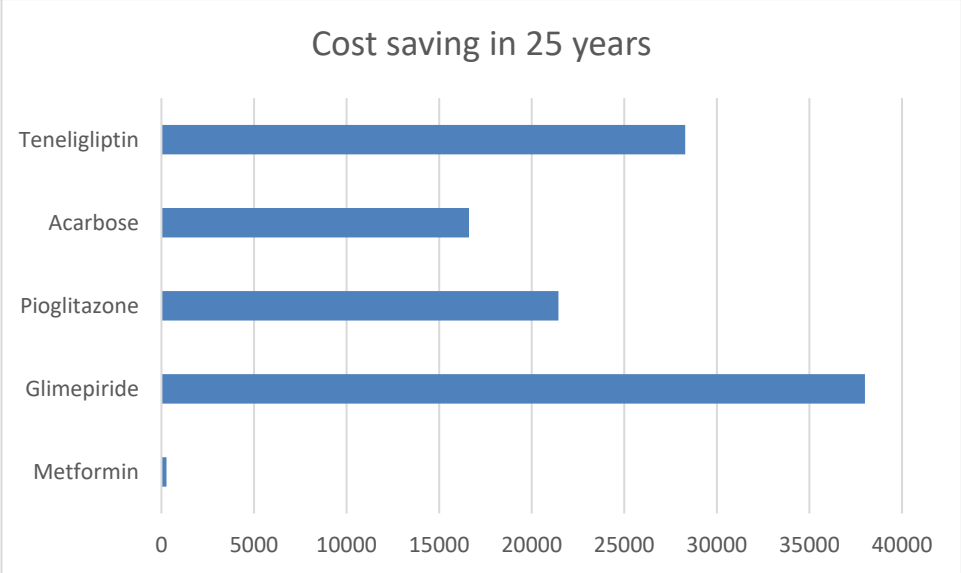

Figure 10: Cost Saving over 25 years across various antidiabetic drugs (Least expensive branded vs. Generic)

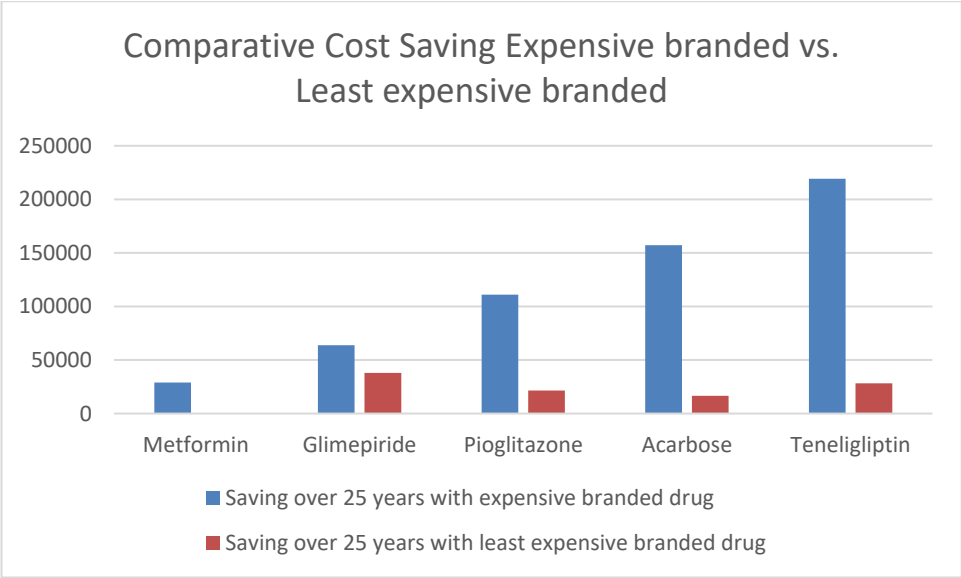

Figure 11: Comparative Cost Saving over 25 years across various antidiabetic drugs (Expensive branded vs. least expensive branded)

Discussion

In addition to lowering out-of-pocket expenses and offering affordable, high-quality medicine, the Pradhan Mantri Bharatiya Jan Aushadhi scheme played an important role in making healthcare more accessible to the general Indian populace. In addition to the price control of drugs, tax reductions and updating of the essential medicine list as needed, this scheme has many advantages. Furthermore, cardiac stents and knee implants were reduced by about 50–70%, and cardiovascular drugs and chemotherapeutic drugs by 60–90% [33].

When we look at the Pharma industry sectors, reports say that there were a number of disadvantages. During the last three years, pharma industries' growth dropped from 13.5 to 10 percent, and the Jan Aushadhi scheme could affect 20% (INR 25,000–30,000 crores) of India's pharmaceutical industry by 2020–21. Since generic drugs have become more accessible and consumers are more aware of them, the sales of brands have slowed and the production has fallen by half [34].

Clinical pharmacists and healthcare professionals should be familiar with generic drug efficacy and prices, as well as their opinions concerning generic drugs. An analysis of physician, pharmacist, and patients' perceptions on generic medication concluded there is improving opinion on generic medicine, but mistrust and the belief in myths remain.

Hence, physicians and pharmacists should counsel patients by educating them on the importance of switching to generic drugs based on their economic situation [32].

A patient's attitude towards generic drugs can be important since some patients don't need lower-cost drugs because they spend time, energy, and money on diagnostics and consultations. Patients may never select a cheaper counterpart of a drug because of their misconceptions [35]. Though the names and corporate reputations of particular brands may lead to bias in patients and misunderstandings about generic drugs, it is doctors and policymakers who create confidence about them [36].

As much as possible, healthcare cost analysis is important in today's environment, particularly to provide as many people as possible access to affordable high-quality, non-compromised medical care. Most of the cost of diabetes treatment in India is related to out-of-pocket expenditure for inpatient care, which amounts to approximately 80–90% of all medical care costs.

These results may help researchers explain how substituting generic drugs can result in cost savings for healthcare professionals when making diabetes treatment decisions, including taking the patient's economic status into account. In addition to educating patients and overcoming issues such as noncompliance with branded drugs associated with high costs and misconceptions about generic drug costs.

In my cost analysis, I only included Type II DM since it has a rising incidence in India than other disorders of the metabolic syndrome, and cost variation analysis provides the best economic analysis for comparing generic and branded drugs and providing economic evaluation results. In spite of reports of substandard drugs marketed in India, the study assumes brand and generic drugs are of the same quality and clinical effectiveness and safety, and there are no reports of substandard drugs marketed for diabetes treatment. In terms of treating other commonly occurring diseases, generic drugs from the Indian market could potentially be cheaper. Additional research is needed to investigate whether or not generic drugs can help save money in such cases.

I derive from my study that generic drugs will be more cost-effective than branded drugs for administering anti-hyperglycaemic therapy. Comparing generic to most and least expensive brands also produced similar results.

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