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Cost Analysis of Diabetic Therapy: A Focus on Type 2 Diabetes Patients in Ahmedabad

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1. Abstract

1.1. Background: Diabetes is rapidly becoming a global health crisis, affecting the population with its extended treatment requirements. To better understand the economic impact of this disease, a cost analysis study was conducted in Ahmedabad City, Gujarat, India, aiming to provide an overview of diabetes-related expenses.

1.2. Method: It is an observational, cross-sectional study. The study was conducted in an outpatient department and a total of 300 sample were analyzed for the cost related burden in diabetes treatment.

1.3. Result: In this study of 300 patients, 175 (58.33%) were predominantly Male, aged between 55-65 years (50.67%). Most patients (49.33%) were overweight, and 29% had lived with diabetes for over 10 years. A notable 51.33% reported a family history of type 2 diabetes, with hypertension (31.15%) and dyslipidemia (29.05%) as the most common comorbidities. The cost analysis revealed that patients on a combination of OHA and insulin incurred a mean monthly cost of 5211.8 INR, significantly higher than those on OHA alone. The dual FDC's (Metformin + Glimepiride) was about 21.85% more expensive than their generic counterparts. Monthly non-medical costs for 38.67% of patients ranged from 1000-1999 INR per month, while lab costs varied between 1000-2999 INR per quarter, and consultation costs averaged 800-1100 INR per visit.

1.4. Conclusion: This study aims to provide a better understanding of the overall economic burden in association with Type 2 Diabetes Mellitus. This will enable healthcare providers and policymakers to develop more effective strategies tailored to the needs of the entire diabetic population.

1.5. Index Terms: Drug Cost Analysis, Diabetes mellitus, Direct medical cost, Health economics, Branded vs Generic drugs.

2. Introduction

Diabetes Mellitus has significantly escalated in India over the past three decades, altering the healthcare landscape. In 2022, approximately 77 million people in India were affected by Type 2 Diabetes Mellitus, and this number is projected to rise to 134 million by 2045, potentially affecting 5.39% of the Indian population. As a result, India ranks as the second country in the world with the highest number of diabetic individuals, earning the title of the "Diabetic Capital" of the world. The impact of this growing burden can be evaluated by estimating healthcare costs. [1] The economic consequences of Diabetes Mellitus are dire, leading to substantial health related costs in low- and medium-income countries like India. In 2021, global diabetes related healthcare expenditure was approximately USD 966 million, with projections estimating it will reach USD 1,054 million by 2045.[2] According to the International Diabetes Federation, DM-related health expenditure in India was estimated at USD 8.5 billion in 2021 and is projected to rise to USD 10.3 billion by 2030. [3] Moreover, healthcare resources in India and other developing countries are scare with less than only 5% of Gross Domestic Product (GDP) being spent on healthcare. Thus, India has one of the lowest public health expenditures globally (1.15% of GDP) [4], resulting in a very high out-of-pocket health expenditure in the world [5]. Consequently, accessing healthcare services remains a significant challenge for the general population.

Diabetes presents a distinct set of challenges in India, including increased healthcare costs, limited health care resources, changing reimbursement patterns and variable effectiveness of treatments. These factors make it difficult to adopt conventional healthcare approaches, resulting in newer strategies. The key lies in identifying solutions that are economical, affordable and efficacious to mass in general. Thus, these questions made way for the evolution of Pharmacoeconomics. [6] The study aims to shed light on the health care expenditure by examining the direct costs associated with T2DM patients. While there have been limited studies on economic burden of diabetes in our region, our research focuses to analyze the drug cost analytics of T2DM patients. The objective of this study is to provide a detailed exploration of the costs related to diabetes mellitus.

3. Materials And Methodology

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This was a Retro-prospective observational study conducted at Outpatient Department (OPD) of private Diabetic clinics and Hospital in Ahmedabad city during November 2023 to February 2024, after approval from Institutional Ethic Committee. A total of 321 were screened during this period out of which 300 complete documented cases were collected. The study included type 2 diabetes patients aged more than 35 years, either gender and had taken treatment with oral hypoglycemic agents for minimum 3 months of duration. Type 1 diabetes, gestational diabetes, indoor patients were excluded from the study. The data was collected from patient files and Electronic medical record data. The socio-demographic details included were age, gender, and BMI were collected. Clinical and biochemical data included duration of diabetes, co-morbidities, complications, drugs prescribed. The cost of most prescribed drugs were contrasted for the branded and generic drugs of same strength. For, the generic drug the data and the cost were taken from the government scheme Pradhan Mantri Jan Aushadhi Yojana. Data was collected on three working days per week during study duration. The data was analyzed using SPSS version 22, python library and Microsoft excel 2016.

Need of the Study: To our knowledge, there have been fewer studies over the past decade assessing the economic impact of Type 2 Diabetes Mellitus (T2DM) in Ahmedabad City, Gujarat, India. By addressing this, we aim to provide insights for healthcare providers to address the challenges posed by this chronic condition.

4. Result

Sample Description: Among the 300 patients examined, 175 patients were male, representing 58.33% of the total population. The age range was categorized between 35 and 65 years old out of these, 152 patients (50.67%) were in the 55-65 years age group. The other demographic details such as BMI categories, Diabetes duration & Precipitating Factors such as Complications and Underlying Conditions, Family history and Social history are summarized in Table 1.

Sample Description: Among the 300 patients examined, 175 patients were male,

	Vision Deformities	12	3.66
	Retinopathy	7	2.13
	No complications	203	61.28

Table 1: Demographic Details

Variables	Description	Frequency	% Frequency
Gender (N=300)	Male	175	58.33
	Female	125	41.67
Age in years (N=300)	35-44	52	17.33
	45-54	96	32
	55-65	152	50.67
BMI (N=300)	18.5-24.9	48	16
	25.0-29.9	148	49.33
	>30	104	34.67
Duration of Diabetes in years (N=300)	<1	3	1
	01-Feb	64	21.33
	03-Apr	66	22
	05-Oct	80	26.7
	>10	87	29
Underlying Conditions (N=568)	Hypertension	177	31.15
	Dyslipidemia	165	29.05
	Cardiovascular disease	63	11.09
	Thyroid	50	8.8
	Anxiety/Depression	38	6.69
	Other	39	6.86
	No underlying condition	36	6.34
Complica -tions (N=328)	Neuropathy	32	9.76
	Sexual Dysfunction	30	9.15
	Gangrene	27	8.23
	Nephropathy	17	5.18
	Vision Deformities	12	3.66
	Retinopathy	7	2.13
	No complications	203	61.28

4.1. Direct Mean Cost

It was noted that 80 individuals out of 300 sample were receiving a combination of both oral hypoglycemic agents (OHA) and Insulin therapy. A significant difference was found while comparing the costs between the combined therapy and the OHA alone. The mean monthly cost for patients on the OHA plus insulin regimen was recorded at 5211.8 INR. This cost was observed to be approximately 4 fold higher than that for patients who were only on OHA therapy.

Table 2: Direct Mean Cost

Type of cost	Frequency	% Freq -uency	Mean cost INR (Monthly)	Mean cost INR (yearly)
OHA cost	220	73.33	1293.4	15520.8
OHA + Insulin	80	26.67	5211.8	62541.6

4.2. Drug Cost Analysis of Oral Antidiabetic Drugs

The prescriptions were analyzed to understand the prescribing patterns and the following results were observed. The prescription was observed for the categories - Monotherapy, Dual FDC's and Triple FDC's The most common drug prescribed for monotherapy category was observed to be Biguanides (Metformin) at 71.42%. While for Dual FDC's most prescribed was Biguanides + Sulfonylureas (Metformin + Glimepiride) at 25.09% and Triple FDC's were Biguanides + Sulfonylureas + A-GI (Metformin + Glimepiride + Voglibose) at 46.43%. The drugs were observed from three

different sites and the cost was compared with its generic counterpart. The drug cost for branded and generic for a strip of 10 tablet per strip. And it is observed that branded drugs were more expensive than the generic counterparts.

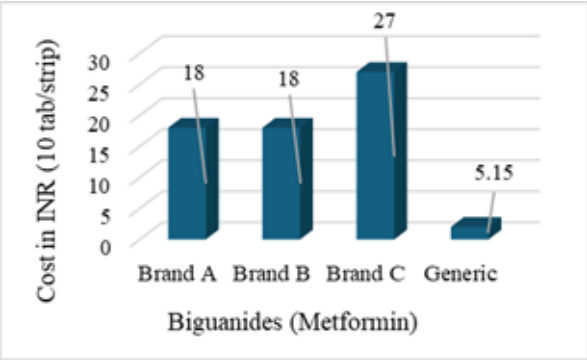
Table 3: Brand Vs Generic Cost Analysis

Description	Drug class	Brand Cost (in INR)	Generic Co -st (in INR)	Cost (INR) Difference
Monotherapy	Biguanides	27	5.15	21.85
Dual Therapy	BG + SU	100	17.7	82.3
Triple Therapy	BG + SU + A-GI	150	31.9	118.1

4.3. Concomitant Therapy and Nondiabetic Medication Cost

Diabetes is significantly associated with an increased risk of comorbidities and complications over time. The commonly prescribed blood pressure lowering agents was observed to Beta blocker in 89 patients (23.93%), and statins plus anticoagulants were 94 (31.13%). Additionally, 18% of the population received thyroxine, while multivitamins were widely prescribed as supplements (33.70%) within the sample. The patient population were also evaluated for other non-medical costs are the following results were obtained: The duration of follow was observed to further understand the adherence of the patients making a visit to the clinics. It was observed that 36.67% of patients had a regular trimonthly visits. The non-medical cost for majority of patients accounting for 38.67% (116) had the cost range of 1000-1999 INR every month, Lab cost was 1000-2999 INR quarterly and consultation cost was 58.67% in the category of 800- 1100 INR per visit.

Figure 1: Cost Analysis of Biguanides



5. Discussion

Diabetes imposes a financial burden on both patients and healthcare systems worldwide. The healthcare economics hold within the total expenditure for the treatment of disease along with reduced quality of life due to illness. Moreover, diabetes being a chronic condition is often associated with comorbidities and complications, greatly increasing the cost of care. In countries like India, where access to healthcare services is limited and sparse national welfare schemes for diabetes, treatment can be unaffordable for many. Ultimately, the patients bear the brunt of these costs, with lifelong expenses for medications, supplies, and medical treatments. The financial burden persists throughout a patient's life and affects their family in terms of both direct and indirect expenses. Our study aimed to focus on the patient related direct cost, including doctor visits, medications, Insulin, Lab test cost, over-the-counter medications, supplements and dietary medications. In our study, a total of 300 patients were included. The majority were male population accounting 175 (58.33%) and aged between 55-65 years comprising 152 patients (50.67%). Over half of the participants were overweight (BMI 25.0-29.9 kg/m^2), encompassing 148 patients (49.33%). Nearly one third of the patients (87 patients or 29%) had diabetes for duration more than of 10 years. A positive family history of diabetes was observed in slightly over half of the population of 154 participants (51.33%). While 52 participants (7.33%) reported substance use history.

Figure 2: Cost Analysis of Dual FDC's

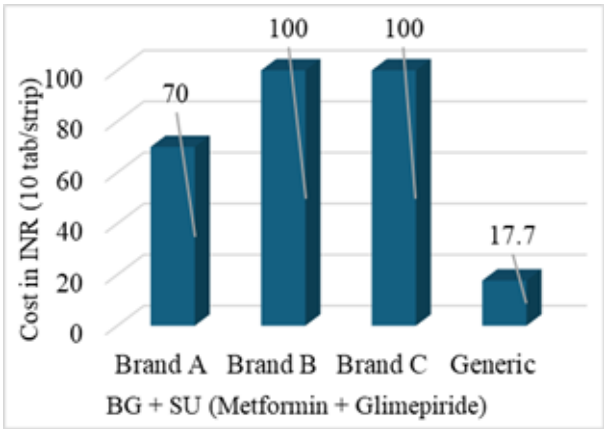
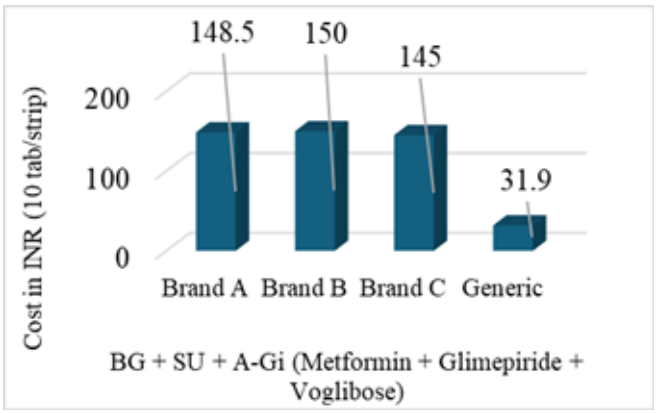


Figure 3: Cost Analysis of Triple FDC's



The analysis of the most prescribed drugs across various categories revealed that Metformin (500 mg) was the most frequently prescribed medication, both as a monotherapy and in dual and triple fixed-dose combinations. The cost analysis of the most commonly prescribed anti-diabetic medications showed significant differences between branded

and generic versions of the same strength across three different sites. Branded versions of all combinations were found to be approximately five times more expensive than their generic counterparts. Our cost analysis of oral hypoglycemic agents verses insulin for type 2 diabetes mellitus revealed the following results. The treatment guideline of type 2 DM states use of OHA in the first line medicines in most cases. Insulin is indicated in patients that had treatment failure to OHA or in case of severe uncontrolled diabetes. In our study, the mean direct medical cost in OHA only medications were found to be 15520.8 INR yearly and for the OHA + Insulin cost was 62541.6 INR yearly. This is indicative that the Insulin plus therapy is nearly 25 times more expensive than only OHA therapy. Insulin only increases the financial burden on the patient adding to the out of the pocket expenses of the patient. Cost of insulin was much higher as compared to OHA medicines.

While some studies showed slight contrasting results from our study. In Prajapati A et al. observed that the mean cost was 9949.40 INR in insulin group vs. 2145.71 INR in OHA group.[7] Similar findings were seen in two national studies, by Kumar A et al and by Bhaskaran VP et al. This finding suggests that insulin therapy is very costlier as compared to OHA therapy. [8] For monotherapy, Metformin (71.42%) was the most prescribed drug. The branded version was priced at 27 INR (10 tablets per strip), while the generic variant cost only 5.15 INR (10 tablets per strip). The results showed a cost difference of 21.85%, making the branded version nearly five folds costlier than the generic variant. In dual combination therapy, Metformin + Glimepiride (25.09%) at a strength 1000 mg/ 2gm was noted, [10][11] where the branded drug costed 100 INR (10 tablets per strip) whereas the generic variant was 17.7 INR (10 tablets per strip). Thus, the cost difference was observed at 82.3%, again making the branded drug approximately five times costlier than the generic.

For triple combination therapy, Metformin + Glimepiride + Voglibose (46.43%) at a strength 500/2/0.2 mg was analyzed. The branded drug costed at 150 INR (10 tablets per strip), while the generic version costed 31.9 INR (10 tablets per strip). The cost difference accounted to 118.1%, making the branded drugs nearly five times more expensive. The findings of our study were found to be similar to other various studies. A study by Yuvanesh et al. reported that generic antidiabetic drugs can be 0–90% cheaper than their branded counterparts,[12] and research by Mohith et al. found that generics are typically 10–70% less expensive. [13] The concomitant drugs were also analyzed to understand the non-diabetic drug cost burden and the following results were observed. It was seen that comorbidities and complications associated with diabetes tend to increase the cost burden of patients. The most commonly prescribed blood pressure lowering agents were observed to be in 89 patients (23.9%), and statin plus anticoagulants were given to 94 sample population (31.1%). Additionally, multivitamin supplements were widely prescribed within the sample (33.70%) for better disease prognosis. The cost burden for other medication was observed to be in the cost range of 1000-2999 INR per month. These results were in line with the other studies that showed mean nondiabetic drug cost to be at 442.41 INR per month. [9]

6. Conclusion

Our findings, highlights the cost comparison between branded and generic OHAs with indicative of a fivefold price difference, underscore the substantial economic impact on diabetes patients. In conclusion, addressing the financial challenges of diabetes management requires a holistic approach. Policymakers and healthcare providers must prioritize enhancing access to affordable medications, promoting the use of cost-effective generic drugs, and implementing comprehensive national welfare programs for diabetes care. These measures are essential to improve patients' quality of life and ensure equitable healthcare access for individuals living with diabetes in India and other low- and middle-income countries.

7. Limitations

The study focused exclusively on the costs associated with Type 2 Diabetes Mellitus, overlooking the Type 1 Diabetic patients. Furthermore, it examines only the direct costs of the condition, neglecting the indirect costs that accompanies diabetes management, such as lost productivity, caregiver expenses, and quality of life adjustments. Moreover, the research was conducted on a limited population, making it difficult to extrapolate the findings to the broader population.

7.1. Future Scope: This article may provide as a future scope for further research on the economic burden of a type 2 diabetic patients.

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