SAS Journal of Medicine
Abbreviated Key Title: SAS J Med
ISSN 2454-5112
Journal homepage: https://saspublishers.com

OPEN ACCESS

Pharmacy Practice

Drug Utilization and Pharmacoeconomic Evaluation of Oral Hypoglycemic Agents in the Endocrinology Department of a Tertiary Care Hospital

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DOI: 10.36347/sasjm.2022.v08i08.013 | **Received:** 19.07.2022 | **Accepted:** 22.08.2022 | **Published:** 30.08.2022

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Abstract **Original Research Article**

The objective of the study was to assess the drug utilization pattern and pharmacoeconomic evaluation of oral hypoglycemic agents in a tertiary care hospital. A prospective observational study was conducted among 153 diabetic patients above 18 years who visited the endocrinology outpatient department for 6 months, and who were prescribed at least one oral hypoglycemic agent. Cost-effectiveness was calculated using the Average Cost-Effectiveness Ratio. Drug utilization pattern of Oral Hypoglycemic Agents monotherapy showed that Metformin was utilized more in that hospital (n=35). Among combination therapy, Glimepiride + Metformin combination was prescribed the most (n=66). The average number of drugs per encounter was 5.88. 18.2% of drugs were prescribed by generic name. 17.64 of drugs encounter with an antibiotic. 13.07% of drug encounters with injections. 55.82% of drugs were prescribed from the Essential Drug List. Among the diabetes population, Metformin was the most utilized drug, followed by Vildagliptin, and Glimepiride + Metformin combination was utilized most. Overall, the prescribing trend of drugs was found to be irrational. Cost-effectiveness analysis found that Glimepiride 1 mg was the cost-effective drug, and also found that the combination of Glimepiride 0.5mg+ Metformin 500 mg was the cost-effective hypoglycemic agent.

Keywords: Drug utilization, Pharmacoeconomics, Oral hypoglycemic drugs, Diabetes mellitus, cost-effectiveness ratio.

INTRODUCTION

Diabetes mellitus (DM) is a chronic disorder characterized by hyperglycemia and caused by inadequate insulin secretion, which may or may not be accompanied by Insulin resistance. The prevalence of T2DM is rising. In 2002, the economic cost of DM was estimated to be 132 billion dollars. Only approximately two-thirds of the 18.2 million Americans with diabetes have been diagnosed. T2DM is becoming more common, accounting for up to 90% of all instances of diabetes, and the total prevalence of T2DM in the United States is 8.7% in those aged 20 and above [1].

Drug use evaluation is a continuous, authorized, and systematic quality improvement process that examines drug use and/or prescribing patterns provides results to clinicians and other interested parties, develops criteria and standards that describe optimal drug use, and promotes appropriate drug use through education and other interventions [2]. World Health Organization developed core prescribing indicators to measure the degree of polypharmacy, the tendency to prescribe drugs by generic name, and the overall level of use of antibiotics and injections. The degree to which the prescribing practice adheres to the essential drug list (EDL), formulary, or standard treatment guidelines is also measured.

The pharmacoeconomic analysis is critical for obtaining effective treatment programs at the lowest possible cost, allowing poor and middle-class Indians to access high-quality healthcare. CEA is a pharmacoeconomic approach for comparing and contrasting the health benefits and resources consumed by various healthcare programs. It assists policymakers in selecting the optimal option from a variety of options. CEA entails a review of programs or treatments with varying levels of safety and effectiveness. Efficacy is measured in natural unit changes in health care. CEA may also be represented as a ratio. The average cost-effectiveness ratio (ACER)

and incremental cost-effectiveness ratio (ICER) are the two most commonly used ratios [3].

$$ACER = \frac{\text{health } care\ cost\ in\ rupees\ or\ Dollars}{\text{Clinical } outcomes}$$

Our study aimed to identify the drug utilization and pharmacoeconomic evaluation of oral hypoglycemic agents and to analyze whether the prescription pattern is according to the WHO core prescribing indicators.

MATERIALS AND METHODS

A prospective observational study was conducted for 6 months, from March to September 2021. The study protocol was cleared and approved by the ethical committee of the institution. Patients seeking treatment for DM from endocrinology and those who comply with the inclusion criteria were recruited as subjects for the study after receiving their written Informed consent of participation. Details regarding demographics, food habits, family history, and epidemiological data were collected.

Data about fasting blood sugar, laboratory investigations, co-morbid conditions, current medical conditions, and prescription drugs were collected from the patient's case report and through direct patient interviews and recorded in the patient's data collection form.

Drug utilization pattern was assessed by using WHO Prescribing Indicators which are as follows [4]:

- Average number of drugs per encounter
$$= \frac{Total\ number\ of\ drugs\ prescribed}{Total\ number\ of\ encounters\ sampled}$$

- Percentage of drugs prescribed by generic name
$$= \frac{\text{Number of drugs prescribed by generic name}}{Total\ number\ of\ drugs\ prescribed} \times 100$$

- Percentage of encounters with an antibiotic prescribed
$$= \frac{Number\ of\ patients\ encounters\ with\ an\ antibiotic}{Total\ number\ of\ encounters\ sampled} \times 100$$

- Percentage of encounters with an injection prescribed
$$= \frac{Number\ of\ patients\ encounters\ with\ an\ injection}{Total\ number\ of\ encounters\ sampled} \times 100$$

- Percentage of drugs prescribed from EDL
$$= \frac{Number\ of\ drugs\ prescribed\ from\ EDL}{Total\ number\ of\ prescribed\ drugs} \times 100$$

The cost of Anti Diabetic drugs that were prescribed in this hospital was collected from the pharmacy and was cross-checked with the Current Index of Medical Specialties, April 2021 edition.

- Cost-effectiveness was calculated in terms of ACER. (average cost effectiveness ratio)

$$ACER = \frac{Healthcare\ cost\ for\ four\ weeks\ of\ therapy}{Mean\ reduction\ in\ FBS\ level\ over\ four\ weeks}$$

DATA ANALYSIS

The data were analyzed using MS Excel-2010 and results were expressed in frequency and percentage.

RESULT

A total of 153 patients who were diagnosed with type 2 diabetes mellitus who are on oral hypoglycemic agents were enrolled in the study. The patients were distributed into three age groups, out of which most of the patients belonged to the age group above sixty years old. The total number of patients in this age group was 76 (49.7%), followed by the age group 46-60 years which contained 67 patients (43.8%).

Out of 153 patients, male patients were more and comprised 51 percent of the total patients (n=78) and females were 49 percent (n=49)**.**In this study, the majority of the patients had one or more co-morbid conditions. 128 patients enrolled in this study (83.7%) were with co-morbidities. 25 patients had no other co-morbid conditions (16.3).

Table 1 shows the prescription pattern of oral antidiabetic drugs as monotherapy. After studying the drug utilization pattern of OHA monotherapy among the patients, it was found that Metformin was the most commonly prescribed as monotherapy in this hospital.

Table 1: Anti-diabetic drug prescribing pattern for single drugs

Sl. No	Drug	Number of prescription	Percentage
1	Glimepiride	20	17.8
2	Teneligliptin	11	9.8
3	Vildagliptin	31	27.6
4	Metformin	35	31.2
5	Voglibose	8	7.1
6	Others	7	6.2

Metformin was most commonly prescribed as monotherapy as shown in table 1. This aligns with the American Diabetes Association's current T2DM treatment protocol. This research is comparable to those

of Goyal *et al*., [7] and Premlatha *et al*., [8], in which Metformin was the most commonly used medication. Vildagliptin, on the other hand, was the second most commonly used medication in our research. This finding differs from that of Premlatha *et al*., and Goyal *et al*., [7, 8], who found Glimepiride as the second most utilized drug in their investigations.

Table 2 shows the prescription pattern of combination drugs. Among the OHA combination therapy, Glimepiride+ Metformin was the most commonly prescribed drug regimen.

Table 2: Anti-diabetic drug prescribing pattern for combination drugs

Sl. No	Drug	Number of prescription	Percentage
1	Glimepiride + Metformin	66	71.7
2	Glimepiride + Metformin + Voglibose	5	5.4
3	Gliclazide + Metformin	3	3.2
4	Vildagliptin + Metformin	11	11.9
5	Glibenclamide + Metformin	1	1.0
6	Metformin + Teneligliptin	2	2.2
7	Metformin + Glimepiride + Pioglitazone	2	2.2
8	Metformin + Glipizide	2	2.2

A total of 92 antidiabetic combination drugs were used in this study. Among them, the most commonly used was Glimepiride + Metformin as shown in Table 2. Our findings are consistent with those of Abidi *et al*., Patel B *et al*., and Nithin *et al*., [9-11].

Table 3 shows the analysis of prescriptions of antidiabetic drugs as per WHO drug prescribing indicators. The total number of drugs prescribed for the population of 153 diabetic patients in the hospital was 901.

Table 3: summary of results after comparing the prescription with WHO prescribing indicators (n=153)

Sl. No	Prescribing indicators	Total drugs or encounters	Average or percent	Standard derived or ideal
1	Average number of drugs per encounter	901	5.88	1.6-1.8
2	Percentage of drugs prescribed by generic name	164	18.2%	100%
3	Percentage of drug encounter with antibiotic	27	17.64%	(20.0-26.8)%
4	Percentage of drug encounter with injections	20	13.07%	(13.4-24.1)%
5	Percentage of drugs prescribed from EDL	503	55.82%	100%

In this study, the average number of drugs per prescription was 5.88, which is above the standard (1.6-1.8), derived to serve as ideal. This might be related to the comorbid diseases that are common among diabetes individuals. Our findings are very identical to those of Ramachandran G *et al*., [12], who found that the average number of medications per prescription was 5.15 as shown in Table 3.

In this study, the percentage of drugs prescribed by generic names was only 18.2%, which was below the standard (100%) derived to serve as ideal. The rest had brand names printed on them. Physicians should be encouraged to prescribe generic medications since they are less expensive. Abidi *et al*., [9] and Das L *et al*., [13] published research that was found to be similar to ours.

The percentage of drug encounters with injections was 13.07%. This result was just below the standard (13.4-24.1%). Only type 2 DM patients seeing endocrinology in the OPD were included in this study, only a small percentage of injections were used. Insulin was the only injection that was prescribed. Our findings are in line with Mandal S *et al*., research [14].

The percentage of encounters in which antibiotics were prescribed in our hospital was 17.64%. This result is below the standard (20.0-26.8%) derived to be ideal. The percentage of drugs prescribed from EDL (India) was 55.82% according to our study, which is less than the standard, which serves as ideal. Our findings are in line with those of Abidi *et al*., who found 43.5 percent, and Das L *et al*., who found 19.43 percent [9, 13].

As per study results, large variation in average cost per unit reduction in FBS (ACER) of OHA therapy prescribed (from 29.32-137.97 among monotherapy, from 26.74- 257.58 among combination therapy) as seen in table 4 and 5. A similar difference was found in the study conducted by Acharya et al and Amandeep Singh [15, 16].

Cost-effectiveness analysis was done after taking all the drugs that were prescribed for at least nine patients. Table 4 shows the cost-effectiveness analysis

of single drugs. In this study, we found that Glimepiride 1 mg is the cost-effective drug in OHA monotherapy followed by Teneligliptin.

Table 4: Cost-effectiveness analysis of Single Drugs

Sl. No	Drug	n	n%	Total Cost	Average FBS	ACER
1	Glimepiride 1mg	10	6.5	1398.75	47.7	29.3239
2	Glimepiride 2mg	9	5.9	5115	51.44	99.43624
3	Teneligliptin 20mg	11	7.2	3355.8	60.9	55.10345
4	Vildagliptin 50mg	31	20.3	7218.9	52.32	137.9759
5	Metformin 500mg	30	19.6	2104.2	37.33	56.36753

In our study, cost-effectiveness evaluation was conducted separately for monotherapy and combination therapy. Among monotherapy, Glimepiride 1 mg was found to be the cost-effective drug, with an ACER of 29.32, followed by Teneligliptin 20 mg (ACER = 55.10) as shown in Table 4. This study was, in contrast to the study conducted by Divya Singh *et al*., [17], where Metformin was more cost-effective than Glimepiride. A similar study conducted by Kasim *et al*., [18] and Aliasghor *et al*., [19] found that Voglibose was a cost-effective drug in monotherapy.

Table 5 shows the cost-effectiveness analysis of OHA combination therapy showing that the most effective drug regimen was Glimepiride0.5+ Metformin 500 mg, followed by Vildagliptin 50 mg+ Metformin 500 mg.

Table 5: Cost-effectiveness analysis of combination Drugs

Sl. No	Drug	n	n%	Total cost	Average FBS	ACER
1	Glimipiride 0.5mg + Metformin 500	12	7.8	1560	58.33	26.74439
2	Glimipiride 1mg + Metformin 500mg	29	19	10426.95	40.48	257.5828
3	Glimipiride 2mg + Metformin 500mg	20	13.1	7545.6	66.05	114.2407
4	Vildagliptin 50mg + Metformin 500mg	11	7.2	3429	55.09	62.2436

In this study, a cost-effectiveness analysis of combination drugs showed that Glimepiride 0.5 mg + Metformin 500 mg was the cost-effective drug (ACER 26.74), followed by Vildagliptin 50 mg+ Metformin 500 mg (ACER 62.24) as shown in table 5. Different studies conducted by other authors showed contrasting results from our study. The study conducted by Divya Singh *et al*., [17] found that a combination of Glimepiride 1 mg + Metformin 500 mg was cost-effective. Das et al found that a combination of Biguanide and Sulphonylureas was effective. Kumutha *et al*., [6] considered HbA1C reduction and found that the cost-effective combination was Glibenclamide and Metformin.

CONCLUSION

Drug utilization and Pharmacoeconomic analysis of drugs provide feedback to the physicians regarding the safe and rational use of drugs. Rational drug prescriptions and cost-effectiveness are major factors that determine the quality of health care delivery. In this study, it was found that the overall prescription pattern was irrational. Only a small percentage of drugs were prescribed by generic names. The average number of drugs per prescription was high. This study also showed an inclination towards combination therapy of oral hypoglycemic agents rather than monotherapy. Among the monotherapy, Metformin was the most prescribed drug, followed by Vildagliptin. Among combination therapy, Glimepiride + Metformin combination was prescribed more commonly.

A Cost-effectiveness analysis study reveals that the cost of therapy relating to diabetes mellitus is huge and it varies greatly. The cost-effectiveness study of various treatments can help in rationalizing the treatment and in providing the best health care with limited resources. Cost-effectiveness analysis of monotherapy revealed that Glimepiride 1 mg was the cost-effective drug, followed by Teneligliptin. Cost-effectiveness analysis of combination drugs found that Glimepiride 0.5 mg + Metformin 500 mg was the cost-effective oral hypoglycemic agent's combination therapy.

Conflict of Interest: The authors have no conflict of interest regarding the investigation.

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