ORIGINAL RESEARCH

The prescribing pattern of anti-diabetic agents and factors promoting adherence or compliance with them

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ABSTRACT
Background: In developing nations, diabetes mellitus (DM) is a serious public health issue. Drug usage studies of antidiabetic medications are crucial for encouraging patients with DM to take their medications sensibly and for providing the medical staff with useful information. **Aims & Objective:** To determine trends in the prescription of antidiabetic medications for people with type 2 diabetes.**Materials and Methods:** Social, demographic, and clinical factors as well as medication use were assessed in patients with established type 2 diabetes who visited the endocrinology outpatient clinic. Prescriptions for antidiabetic medications written for 1185 established T2DM patients during a two-month period were analyzed from the pharmacy databases of five general family clinics. Six kinds of antidiabetic medications were evaluated in the study: glitazones, α-glucosidase inhibitors, biguanides, sulfonylureas, insulin, and dipeptidyl peptidase-4 (DPP-4) inhibitors. **Results:** The majority of patients (41.6%) were prescribed metformine, followed by glimipride (25.3%), glipizide (8%), glibenclamide (10.6%), insulins (9.04%), voblibose (6.3%), and pioglitazone (5.7%). In the overall utilization pattern, about 22.7% of the patients were receiving monotherapy.**Conclusion:** The recommended medication is metformin, and the most popular combination with it is glibenclamide. Insulin as a monotherapy was not favored. The postprandial glucose levels were out of range despite combination treatment, which may indicate either poor patient compliance or improper therapy or insufficient dose. These individuals may benefit from the services of a clinical pharmacist in addition to medications.
Keywords: Antidiabetic drug, Glycemic control, Tertiary care hospital, T2DM India

INTRODUCTION
As early as 1500 B.C., Egyptian doctors identified diabetes mellitus and characterized it as a condition linked to "the passage of much urine"[1]. It is one of the most terrible and costly diseases that the world is now dealing with, and it is spreading rapidly at an alarming pace, becoming a "epidemic."2. Between 30 and 70 percent of people across all age categories in the majority of industrialized and developing nations are afflicted by this fatal illness. There is a genetic component to diabetes, and it often runs in families from generation to generation.3. Diabetes may appear at any point. But up to the age of 40, its susceptibility develops gradually; beyond that, it increases quickly. According to reports, women have a substantially greater rate than males.4.The percentage of diabetic patients is 2.3% in IDehradooni, 2.3% in Lucknow, 2.3% in Mumbai, 3.0% in Calcutta, 4.1% in Hyderabad, 8.7% in Trivandrum, and 11.3% in Chennai. This is expanding rapidly in India5. In 2010, the global prevalence is estimated to be 220 million. Hyperglycemia, hypertriglyceridemia, and hypercholesterolemia are hallmarks of diabetes mellitus (DM), a set of metabolic illnesses caused by abnormalities in either the production or action of insulin, or both.6 Uncontrolled diabetes leads to persistently elevated blood glucose levels (>200 mg/dl), which may cause micro and macrovascular disease consequences, including blindness, amputations of lower extremities, kidney disease, coronary heart disease, and stroke, in a variety of ways.

A multidisciplinary healthcare strategy that combines medication and/or insulin treatment, nutrition, exercise, and behavior change to guarantee long-term compliance is essential for the successful management of diabetes mellitus. medication that is often used to treat hyperglycemia at the site of action.

Unfortunately, patients often have a negative attitude toward diabetes care strategies including insulin treatment, exercise, and dietary changes, which may eventually result in diabetic complications. While 52% of patients believed that solely sweets should be avoided, only 18% of patients believe that a balanced diet low in sugar and sweets is essential for managing diabetes. Lack of knowledge is one of the many factors that might lead to the development of a negative attitude. Therefore, to direct efforts to enhance diabetes treatment, a deeper understanding of patient and provider attitudes and perspectives is required9,10. Despite the fact that diabetes is the most deadly illness known to man, no thorough research has been done in this field. The purpose of this study is to ascertain the prevalence of diabetes-related complications and associated risk factors, the trends in the prescription of anti-diabetic medications in community clinics, the factors that influence the prescription of a specific anti-diabetic medication or a combination of medications, the identification of prescription errors, and treatment adherence in accordance with JNC VII guidelines and the associated obstacles.[11-15]

MATERIALS AND METHOD
The prescriptions of DM patients from three computerized pharmacy databases that dispensed medications for five private clinics were examined in this retrospective investigation.

Sample Size: Over the course of three months (March 2019 to May 2019), the pharmacy gathered 870 prescriptions for antidiabetic medications. Each prescription had the following details: name, sex, age, brand and generic names of the medications, dose, frequency of use, and name of the doctor. $n = 4Pq/l2$ was the formula used to determine the sample size. Since the sample size determines the quality of the data, over 870 prescriptions were examined in this research. Several metrics were used to categorize the patients. Patients who received just one antidiabetic medication, for instance, were classified as getting monotherapy; patients who received several active ingredients, on the other hand, were classified as receiving combination treatment.

RESULTS
The prescriptions of DM patients from three computerized pharmacy databases that dispensed medications for five private clinics in the Dehradun area were examined in this retrospective analysis. Based on their ages, the patients were split into six groups, which are referred to as groups I through VI: 10–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79, and 80–89 years. Patient demographics, including age, comorbidities, and gender, were examined. There were 461 prescriptions from male patients and 409 from female patients out of the 870 that were examined. (Table 1).

Table1: Demographic data of patients

Age (Years)	Men	Women	Total	
			Patients	**Percentage**
10-19	14	10	24	2.7
20-29	62	43	105	12.0
30-39	70	40	110	12.6
40-49	61	43	104	11.9
50-59	70	32	102	11.7
60-69	94	103	197	22.6
70-79	110	53	163	18.7
80-89	30	35	65	7.4
Total	511	359	870	

Major Prescriptions: The majority of patients (41.6%) were prescribed metformine, followed by glimipride (25.3%), glipizide (8%), glibenclamide (10.6%), insulins (9.04%), voblibose (6.3%), and pioglitazone (5.7%). In the overall utilization pattern, about 22.7% of the patients were receiving monotherapy. (Table2).

Table2: Prescriptions as monotherapy classified on the basis of oral hypoglycaemic

Drugs	No. of Patients	Percentage
Metformine	78	39.7
Glimipride	47	23.9
Glipizide	15	7.6
Glibenclamide	19	9.6
Insulin	16	8.1
Voglibose	11	5.6
Pioglitazone	10	5.1
Total	196	-

Glimepiride and metformin (20.4%) were the most often prescribed two-drug combination. These were

followed by glipizide and metformin (13.3%), glibenclamide and metformin (1.3%), pioglitazone and metformin (7.2%), glipizide and metformin (4.8%), and insulin and metformin (3.1%). The most often prescribed three-drug combination was metformin, voglibose, and insulin (1.8%), followed by metformine, pioglitazone, and insulin (0.8%), metformine, glimepiride, and sitagliptin (0.8%), metformine, glipizide, and insulin (0.5%), and metformine, pioglitazone, and voglibose (0.4%). We also looked at how antidiabetic drugs were prescribed for comorbid diseases. Of these comorbidities, 60.1% of patients with hypertension, 22% of patients with angina pectoris, and 21% of patients with hypercholesterolemia were taken antidiabetic medications. According to the survey, about 38.4% of patients were undergoing combo treatment for antidiabetic drugs. (Table 3).

Table3: Prescriptions for the patients suffering from diabetic complications

Complications	Prescriptions	No. of Patients	
Hypertension	Atenolol, Amlodepine, Telmisartan, Metoprolol, Olmesartan, Bisoprolol	192	58.3%
Angina pictoris	Ecospirin, Isosorbidedinitrate, Diltazem	70	21.2%
Hypercholesterolemia	Simavastatin, Atorvastatin, Fenofibrate	67	20.3%

DISCUSSION

There are two types of diabetes mellitus, each with a unique cause: type I diabetes (juvenile onset diabetes), which is brought on by a lack of the pancreatic hormone insulin, which is primarily responsible for promoting glucose homeostasis, and type II diabetes (maturity onset diabetes), in which insulin is present but improperly utilized. Type I diabetes, which affects around 1 in 600 children, is the more severe and uncommon of the two types. Each nation may have different statistics.Beta cells are killed in type I diabetes, most likely as a result of a viral infection or an assault by the body's immunological system16. In order to live, type I victims need daily insulin injections.17 Polydipsia (excessive thirst), polyphagia (increased food intake), polyuria (excessive urine output), fast weight loss, hyperventilation, mental disorientation, and potential loss of consciousness (due to increased glucose reaching brain) are the main signs and symptoms of type I diabetes. The hallmark of type 2 diabetes mellitus is hyperglycemia, which is brought on by an insulin secretory malfunction that makes a person resistant to insulin.18 Although not entirely, this resistance may lead to a relative insulin deficit. The majority of instances of diabetes are type 2 DM. The majority of these individuals are obese or have a higher proportion of body fat distributed in the abdomen. Numerous crippling and fatal microvascular and macrovascular consequences are common in both type I and type II diabetes. The high prevalence of this condition in society, which makes diabetes the third greatest cause of mortality, is mostly caused by these complications rather than the danger of ketoacidosis. Approximately 59% of patients with combination therapy prescriptions in the current study were taking antihypertensive drugs in addition to oral hypoglycemic agents, while 21% were taking antianginal drugs and 20% were taking hypercholesterolemia medications as a result of secondary complications in diabetic patients (Table 3).Male patients were more common than female patients, according to carefully analyzed statistics. Of the 850 patients, 399 (47%) were female and 451 (53%) were male. Additionally, the prescriptions were divided into eight groups according to the patients' ages. Patients between the ages of 60 and 69 accounted for the majority of these prescriptions (22.7%), followed by those between the ages of 70 and 79, who represented 18.9% of all cases getting monotherapy. Interestingly, a surprisingly high proportion (12.11%) of the total data were young individuals in the 20–29 age range. This is undoubtedly a cause for serious concern and a warning indicator of early onset of diabetes.The pattern of frequently prescribed oral hypoglycemic medications in monotherapy is shown by the findings reported in Table 2. Metformine, which was administered to 40.86% of the population, was the most common drug, followed by glimpiride (24.19%) and glibenclamide (9.7%). For the treatment of type II diabetes mellitus, also known as non-insulin dependent diabetic mellitus (NIDDM), the findings therefore support the use of medications from the chemical category biguanide derivatives and sulphonyl urea derivatives. In the presence of residual insulin, they exhibit a complicated peripheral effect that inhibits intestinal and hepatic glucose absorption while boosting glucose uptake in striated muscle.19 They also seem to work by promoting the release of insulin. More insulin is produced at all blood glucose concentrations as a consequence of the pancreatic cells known as ß-cells, which secrete insulin, being more receptive to both glucose and non-glucose secretagogues. Increasing tissue sensitivity to insulin is one of the extra-pancreatic effects that sulfonylureas may have, however these effects are not very significant from a therapeutic standpoint.

CONCLUSION

According to this research, males were more likely than women to have type 2 diabetes. Although younger people have a relatively high number of instances, older patients are more likely to have disease risk and symptoms. Just 21% of patients were treated with a single oral hypoglycemic medication, whereas almost 80% of prescriptions used combination therapy. The advanced stage of the illness and related problems with elevated blood sugar

levels might be the cause of this. The survey also revealed that the majority of doctors prescribe metformine as the main drug for the treatment of type II diabetes mellitus; in addition, doctors prefer to prescribe sulphonyl urea and biguanide derivatives. However, the number of prescriptions that included more than three medications was essentially negligible, indicating that drug usage is reasonable and the danger of polypharmacy is minimal.

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