

## DRUG UTILIZATION PATTERNS OF ANTIDIABETIC MEDICATIONS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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### Abstract

Type 2 Diabetes Mellitus (T2DM) is a major global health concern characterized by chronic hyperglycemia and long-term metabolic complications. Appropriate pharmacological management is essential for controlling blood glucose levels and preventing disease progression. Drug utilization studies provide valuable insights into prescribing patterns and help evaluate the rational use of antidiabetic medications in clinical practice. A retrospective observational study was conducted in a tertiary care hospital to assess the utilization pattern of antidiabetic medications among patients with T2DM. A total of 80 patient records were reviewed. Data were collected from medical records and prescription charts, including demographic characteristics, duration of diabetes, type and number of medications prescribed, and therapy patterns. Descriptive statistics were used to summarize the data. An independent sample t-test was performed to compare medication use between male and female patients, and multiple linear regression analysis was conducted to identify predictors of medication utilization. The majority of patients belonged to middle-aged and older age groups, with a slightly higher proportion of male participants. Monotherapy and dual therapy were the most frequently used treatment approaches, while triple therapy and insulin-based therapy were less common. Commonly recommended antidiabetic medications were widely prescribed, indicating adherence to standard treatment practices. Statistical analysis showed no significant difference in the number of medications prescribed between male and female patients. However, the duration of diabetes was identified as a significant predictor of medication utilization. The study highlights current prescribing patterns of antidiabetic medications in a tertiary care setting and emphasizes the importance of rational drug use in diabetes management. Continuous monitoring of prescribing trends may help optimize therapeutic strategies and improve patient outcomes.

**Keywords:** T2DM, Drug Utilization Pattern, Antidiabetic Medications, Prescribing Trends, Combination Therapy, Pharmacotherapy.

## 1. Introduction

Type 2 Diabetes Mellitus (T2DM) has become one of the greatest health issues of the twenty-first century at the international level. Urbanization and lead sedentary lifestyles, unhealthy eating habits and ageing of the population have enhanced the prevalence of diabetes at a very high rate. It is a metabolic disorder that is characterized by insulin insensitivity and insulin production, which leads to long-term hyperglycemia and various chronic complications of the cardiovascular, renal, neuronal, and ophthalmic systems. The growing T2DM burden has resulted in a significant healthcare cost, poor living standards, and deaths across the world (Adhikari et al., 2017). Diabetes should be well managed in order to minimize complications and patient outcomes. In the treatment of T2DM, pharmacological therapy is very important especially when the modification of lifestyle does not lead to satisfactory glycemic control. Proper medication treatment can control the level of glucose in the blood, and decrease the possibility of developing microvascular and macrovascular complications. Antidiabetic drugs are usually prescribed based on the clinical guidelines that consider the personal approach to treatment with an accent on the patient characteristics, the severity of diseases, and comorbidities (Alatorre et al., 2017). The correct treatment of the medications is thus crucial towards the advancement of clinical benefits and disease prevention.

There are various antidiabetic drugs which are used to treat T2DM. These are the traditional oral agents, i.e. metformin and sulfonylureas, and newer classes of therapeutic agents, i.e. sodium-glucose co-transporter-2 (SGLT2) inhibitors, dipeptidyl peptidase-4 (DPP-4) inhibitors and glucagon-like peptide-1 (GLP-1) receptor agonists. Insulin therapy is not an exception, especially in long-term disease patients or when patients are not responding to oral agents. Multiple therapeutic options have increased the flexibility of treatment and enabled clinicians to use therapeutic drugs depending on the specific needs of patients (Amaeze et al., 2018). Although there are many treatment choices, there remains a significant variation in prescribing practices in different healthcare settings and geographical regions. The literature has indicated that there are disparities in the use of oral antidiabetic drugs and insulin treatment as per healthcare systems, preferences of physicians, and patient factors. As an illustration, a study carried out in England and Wales showed the discrepancy in the antidiabetic drug prescriptions among T2DM patients (Datta-Nemdharry et al., 2017). Such differences may influence treatment efficacy, medication and long term patient adherence.

Another key determinant of successful management of diabetes is medication adherence. Because T2DM is a long-term medical condition, frequent use of prescribed drugs is critical to glycemic control and eliminating complications. Adherence in people with diabetes can be affected by a number of factors such as cost of medication, complexity of treatment, patient education, and perceived side effects (Dehdari and Dehdari, 2019). Prescribing patterns and treatment strategies thus can offer valuable results on how to enhance therapeutic outcomes.

Recent studies have pointed to the changing trends in the prescribing of antidiabetic drugs by the introduction of newer therapeutic agents and revised clinical guidelines. Practical experience of the diabetes registries has proven that the prescription of antidiabetic drugs is significantly changed over time (Engler et al., 2020). On the same note, a growing use of GLP-1 receptor agonists in the management of T2DM has been reported using retrospective cohort studies (Federici et al., 2018). With the emergence of SGLT2 inhibitors, the treatment of diabetes is also going to change as it has been found that the use of these agents has increased since it positively affects the process of glycemic control and cardiovascular disease (Ito et al., 2019). Also, it has been noted that hospital-based research has prioritized the need to track the trend in prescribing antidiabetic drugs to avoid irrational use of these medications (Kumar et al., 2017). The assessment of drug use is thus necessary to know the actual clinical practice and safe and effective drug interventions (Losada et al., 2018).

Despite the fact that several studies have been carried out to identify the patterns of antidiabetic drug use in various countries, there are gaps in the literature. Most studies are based on huge population databases and thus are likely to not be reflective of prescribing behavior in the usual clinical setting. To illustrate, studies on the Mediterranean population have revealed disparities in the nature of treatment among minor groups of patients with T2DM (Mata-Cases et al., 2021). Likewise, research on the intervention based on lifestyle change has shown a decrease in the use of medications, but these results are not necessarily representative of the actual prescribing practices (McKenzie et al., 2017).

Changing trends in the use of antidiabetic drugs were reported in the long-term research in the United States, with the rising use of combination therapy, as well as the newer pharmacological agents (Montvida et al., 2018). Some of the factors that affect the choice of treatment that is selected have also been identified in global observational research and include patient characteristics, healthcare policies, and physician prescribing behavior (Nicolucci et al., 2019). Also, European multi-database studies have found that there were considerable differences in national treatment behaviors, which indicates that the use of medication depends on local health care systems (Overbeek et al., 2017). Regardless of these results, there is limited current study on real-world drug use patterns that is based on retrospective hospital-based research. It is necessary to understand the trends in prescribing in order to optimize the treatment of diabetes and rational use of drugs. The studies on drug utilization are useful in terms of information about prescription and use of medications in a clinical practice. This type of study can be used to determine tendencies in the choice of therapy and calculate whether the therapeutic practices are based on the recommendations or not. Indicatively, studies comparing the use of antidiabetic therapy with patients having cardiovascular disease have noted the need to select the right medication to enhance clinical outcomes (Pantalone et al., 2018).

Other than prescribed drugs, a large number of patients with T2DM incorporate complementary or alternative medical treatments with traditional treatment. Research carried out in different parts of the world has documented that diabetic patients make significant use of such therapies and therefore, there is a need to understand patient behaviour and treatment

preferences better (Radwan et al., 2020). The research on drug utilization in hospitals is thus relevant to offer detailed information regarding the prescribing practices in a particular clinical context. Research studies in the tertiary care hospitals have found differences in the use of oral antidiabetic agents and insulin therapy (Raphael et al., 2017). Furthermore, the analyses conducted at the national level have revealed that the use of diabetes medications has been shifting across the years with the emergence of new treatments and various changes in treatment guidelines (Raval & Vyas, 2020).

**Research Objectives**

1. To analyze the drug utilization pattern of antidiabetic medications among patients with T2DM.
2. To identify the frequency and distribution of different classes of antidiabetic drugs prescribed in the study population.
3. To evaluate the pattern of monotherapy and combination therapy used in the management of T2DM.

**2. Methodology**

**2.1 Study Design and Setting**

The current research was carried out as a retrospective observational study in a tertiary care hospital/diabetes clinic in which diabetes patients are provided with special medical care and treatment. The retrospective design enabled the researchers to test the previous documented patient data to determine the prescribing practices and use of antidiabetic medications in everyday clinical practice. Reliable sources of information concerning the demographics of patients, their diagnosis, and prescribed medications were in the hospital medical records, as a result of which it was possible to conduct systematic evaluation of the use patterns of drugs among T2DM.

**2.2 Study Population and Sample Size**

The target population comprised the patients with T2DM who were undergoing antidiabetic treatment at the chosen healthcare facility within the study period. The male and female patients were taken into consideration to get a complete picture of how the treatment is being done. This was analyzed on 80 patient records that qualified to meet the study criteria. To obtain data regarding the attributes of patients and medications prescribed, the chosen records were reviewed to identify the patterns of widespread drug use among the study population.

**2.3 Inclusion and Exclusion Criteria**

The articles were included in the study provided that the patient records pertained to individuals diagnosed with T2DM and were on one or more antidiabetic drugs, as well as the patient records included full and well-recorded data on treatment details. The patients who had Type 1 Diabetes Mellitus, gestational diabetes or whose clinical or prescription information was incomplete or missing were not included in the study to make sure that the analysis was accurate and reliable.

**2.4 Data Collection**

Patient medical records and prescription charts were accessed on the hospital database and used to obtain the data retrospectively. A systematic data gathering method was employed to draw out pertinent data regarding such variables as the patient age and gender, the length of diabetes, type and amount of antidiabetic drugs given to the patient, and the regimen of treatment (monotherapy or combination therapy). This data allowed determining the prescribing patterns and the trends of antidiabetic drug use in the participants of the study.

**2.5 Data Analysis**

The obtained data were entered into Excel. Demographic data, drug classes and therapy patterns have been summarized using descriptive statistics such as frequencies and percentages, whereas continuous data were presented as mean and standard deviation (SD). The independent t-test was used to compare the mean values of the number of antidiabetic medications in the male and female patients, and multiple linear regression analysis was utilized to determine how the chosen variables affect the use of medication.

**3. Results**

**3.1 Demographic Profile**

The demographic variables of the participants of the study were examined to gain an insight into how the patients with T2DM are distributed within the study. The respondents were of varying ages with the prevalence being observed in the middle aged and the older adults as this is the typical age demographic related to the incidence of T2DM. Both male and female patients were used as the study population, which means that individuals of both sexes are susceptible to the disease in the clinical environment (Table 1).

**Table 1.** Demographic Profile (n = 80)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	30–40	16	20.0
	41–50	20	25.0
	51–60	24	30.0
	>60	20	25.0

Gender	Male	45	56.25
	Female	35	43.75

The population traits of the participants of the study (age group as well as gender distribution) are presented in Figure 1.

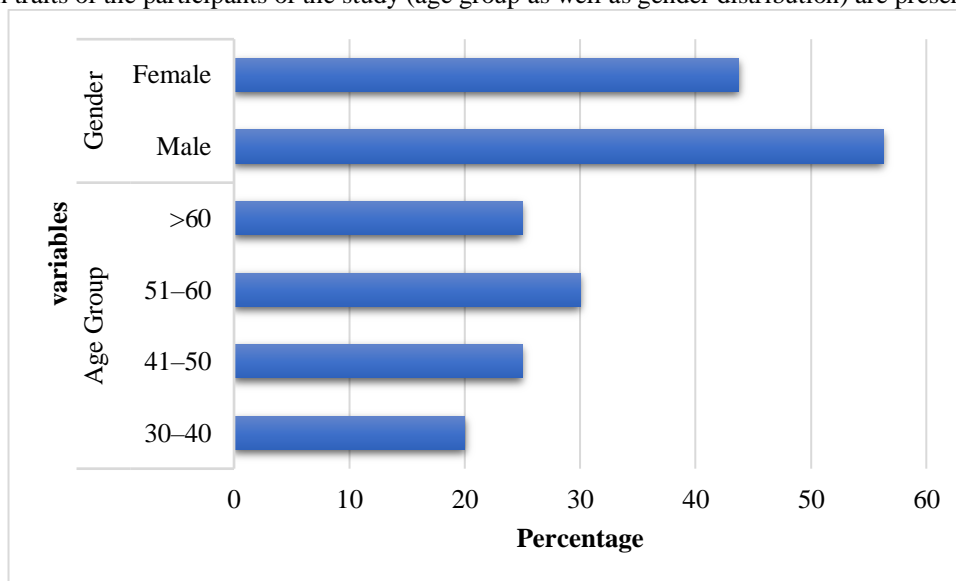


Figure 1. Demographic Distribution of Study Participants

The representation demonstrates that most of the patients were middle-aged and older, with a minor majority of the male respondents over the female respondents.

### 3.2 Therapeutic Regimen Patterns in Diabetes Management

Patients with T2DM had different therapeutic methods applied to them. These methods comprised the treatment with a single antidiabetic drug and combination therapies with a number of drugs (Table 3). In other instances, patients who needed more intensive glycemic control were administered insulin-based therapy. The differences in clinical management approaches based on patient condition and treatment needs are seen in the distribution of treatment regimens used in the study population.

Table 2. Therapy Pattern in T2DM Patients (n = 80)

Therapy Type	Frequency (n)	Percentage (%)
Monotherapy	30	37.5
Dual Therapy	25	31.25
Triple Therapy	15	18.75
Insulin-based Therapy	10	12.5

Figure 2 demonstrates the distribution of the various antidiabetic classes of drugs used in treating patients with T2DM.

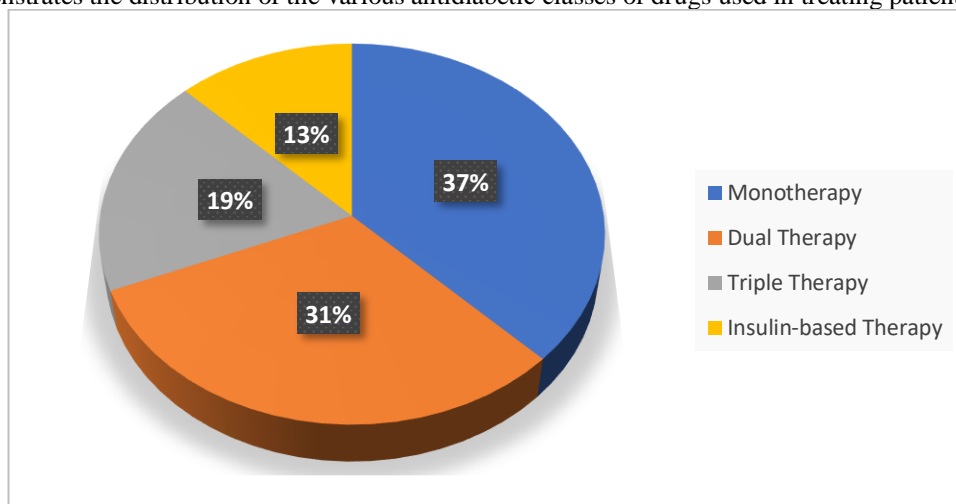


Figure 2. Pattern of Antidiabetic Therapy

The figure indicates that metformin occupied the highest percentage of prescribed drugs with sulfonylureas and DPP-4 inhibitors coming second, and SGLT2 inhibitors, insulin, and other agents had a lower percentage of prescription.

### 3.3 Comparison of Antidiabetic Drug Use Between Male and Female Patients

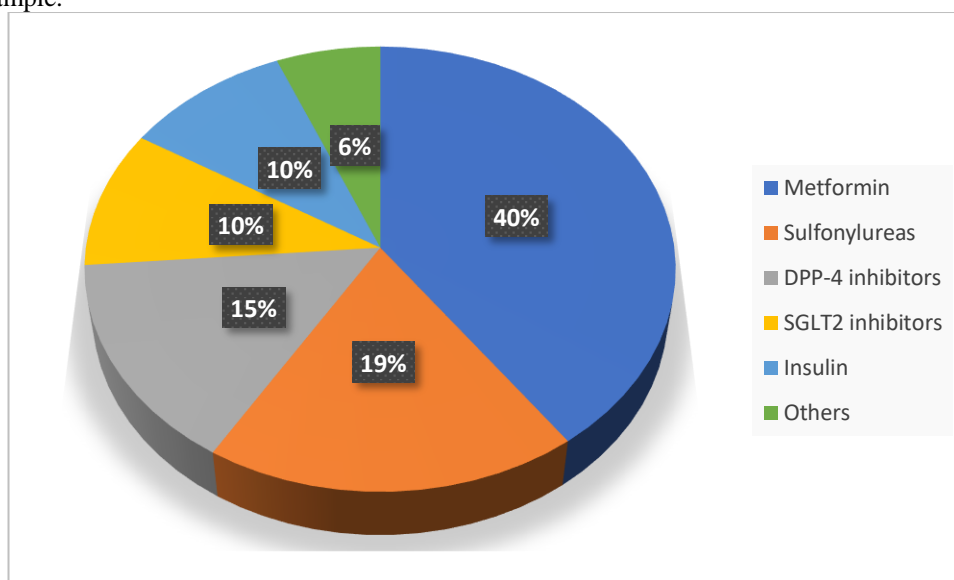
The independent sample t-test findings showed that the mean number of antidiabetic medication prescribed to male and female patients did not significantly differ. Despite the fact that male patients had a highly insignificant higher mean number of medications than female patients, the difference did not result in significant statistical significance indicating that gender did not have a significant effect on the strength of pharmacological intervention in patients with T2DM (Table 4).

**Table 3.** Independent t-test Comparing Number of Antidiabetic Drugs by Gender

Gender	Mean ± SD	t-value	p-value
Male (n=45)	2.02 ± 0.81	1.21	0.23
Female (n=35)	1.83 ± 0.74		

### 3.4 Utilization Pattern of Antidiabetic Drug Classes

The comparison of the use of antidiabetic drugs revealed that the most used medication was metformin, followed by sulfonylureas and DPP-4 inhibitors; the least used were the SGLT2 inhibitors, insulin use, and other drugs (Figure 3). These results show that the first-line medications suggested are widely used in the treatment of patients with T2DM in the research sample.



**Figure 1.** Distribution of Antidiabetic Drug Classes

### 3.5 Predictors of Antidiabetic Medication Utilization

The multiple linear regression model revealed that the duration of diabetes was statistically significantly linked with the number of antidiabetic drugs prescribed and it was found that, patients with long period of disease were more likely to get more medications (Table 4). Conversely, age was not significantly related to the use of medications. The model has attributed a moderate percentage of the fluctuation in the quantity of medications prescribed to the T2DM patients.

**Table 4.** Multiple Linear Regression Analysis

Predictor Variable	β (Beta)	t-value	p-value
Age	0.17	1.38	0.17
Duration of Diabetes	0.36	2.74	0.008*
<b>R<sup>2</sup></b>	<b>0.22</b>		
<b>Adjusted R<sup>2</sup></b>	<b>0.20</b>		

\*Significant at  $p < 0.05$

## 4. Discussion

The study assessed the drug use of antidiabetic drugs in patients with Type 2 Diabetes Mellitus (T2DM) in the tertiary care clinical environment. The findings provide insight into the demographic table of the patients, the tendencies of pharmacological treatment and the predictors of the use of medications. These prescribing patterns are pertinent in the area of knowledge on improving the management of diabetes and rational utilization of medications as a common phenomenon in clinical practice. The population composition of the research participants formed that the majority of the patients in the study were aged middle and aged. This observation concurs with the natural epidemiology of T2DM,

whereby, it is more assiduously diagnosed on individuals beyond the age of forty due to the gradual resistance of insulin and other metabolic difficulties with age. The slightly higher proportion of male patients of the study population may be due to a lack of similarity in healthcare use, lifestyle decisions, or occurrence of the disease in the study region. These age distributions explain why there is a need to pursue more focused screening and containment interventions involving middle aged and older age groups, which are more prone to contracting diabetes. The review of the therapeutic regimens showed that monotherapy was widely applied in the treatment of T2DM, as well as combination therapy. The use of monotherapy was common in patients who were either newly diagnosed or had a relatively well-controlled glycemic level, whereas a combination therapy was applied in patients who needed an intensification of pharmacological control. There is an implication in the use of dual or triple therapy, which implies that a large number of patients will need multiple drugs to attain optimal glycemic control as the disease is progressive. The prescription of insulin-based therapy was made in a lesser percentage of patients, usually where oral antidiabetic agents were no longer effective to sustain the level of glycemic control. These patterns of treatment indicate the gradual increase of treatment in accordance with the clinical guidelines where treatment is increased in response to disease progression and response.

The analysis of antidiabetic drug classes showed that the prescription of some medications was more common than the prescription of others, which implied the problem of the impact of developed treatment guidelines and clinical preferences. The increased use of first-line therapy that is recommended most of the time implies compliance with the evidence-based therapeutic practices. Simultaneously, the employment of newer classes of drug indicates the gradual presence of the modern pharmacological agent that presents more advantages in the form of better glycemic regulation and minimized chances of complications. On the whole, the described prescribing trends can be characterized as a balanced approach in which clinicians pay attention to existing and new therapeutic means when working with T2DM patients. The statistical test which analyzed the correlation between sex and medication prescribed showed that the difference between the male and female patient in terms of medication use was not statistically significant. This observation indicates that the decision to treat pharmacologically was rather grounded in clinical variables including the severity of the disease and the response to the treatment as opposed to the demographic variables. In addition, regression analysis revealed that the length of time the individual had diabetes was a significant issue affecting the amount of medication dispensed. The increased disease duration was associated with patients taking more than one drug, which is in line with the progressive type of the T2DM and the intensification of therapy with time.

The results of the current study can be compared to a number of past studies that have investigated the patterns of the drug use among patients with T2DM. As an example, Singla et al. had found that the use of metformin-based therapy and combination regimens was prevalent in managing diabetes in clinical practice (Singla et al., 2019). Equally, Sridhar et al. noted that monotherapy and dual therapy were the most common treatment approaches given to patients with T2DM in a tertiary care hospital (Sridhar et al., 2021). A study carried out in Singapore also proved the changing patterns of medication use and more frequent use of combination therapy to get better glycemic control (Tan et al., 2019). Moreover, research studies in the United Kingdom have reported the shift in the prescribing trends of antidiabetic drugs over the years, which is associated with the introduction of new therapeutic agents and changes in clinical practice (Wilkinson et al., 2018). The other studies have focused on the possible long-term effects of using antidiabetic medication, such as its link to cognitive outcomes and other health issues (Wium-Andersen et al., 2019). The longitudinal studies have also shown that there are consistent trends in the use of antidiabetic drugs across various healthcare systems with emphasis on the need to track prescribing patterns so as to optimize the treatment plans (Xu et al., 2018).

This study has significant implications for clinical practice and health policy. The use of drugs researches helps to understand prescribing practices and find aspects of treatment practice to be enhanced. The knowledge of the trends of medication usage can help medical professionals to promote the rational choice of the types of drugs, increase the effectiveness of the treatment, and reduce the number of adverse drug reactions. Moreover, these investigations can help to create evidence-based recommendations and assist healthcare facilities in energy-saving measures that can enhance the quality of diabetes management.

This study has certain limitations, which must be acknowledged. The study has been conducted on a rather limited sample and on a single clinical setting only, which so may limit the ability to generalize the findings to other healthcare settings. The retrospective nature of the study was also informed by the fact that a medical information had already been documented and that this may have limited the potentiality of accessing some clinical variables such as glycemic controls variables, lifestyle variables, and patient compliance to the treatment. These limitations are suggestive that the results may be used cautiously when generalizing them to other groups.

Further studies ought to use bigger multi-centered studies with varied groups of patients to give a more detailed picture of the use of drugs in T2DM. Future research, which would factor in the clinical outcomes, including glycated haemoglobin, adherence to therapy, and chronic complications, would yield more information on the efficacy of various treatment options. Also, the ongoing research can investigate the economic factors of antidiabetic treatment and determine the cost-efficiency of newer pharmacological agents. In this way, such studies would assist in enhancing the management approach to diabetes and evidence-based clinical practice decision-making.

## 5. Conclusion

The study investigated the drug use habits of antidiabetic drugs in patients with T2DM in a tertiary care clinical unit. The results are valuable in the current clinical practice in the prescription trend, therapeutic practices, and factors affecting the use of medications in the regular practice. The demographic profile showed that most of the patients were in middle-aged

and older age groups, which explained the prevalence of T2DM in those individuals who were more than forty years. An increased percentage of male patients was also noted in the study population, although slightly. The review of treatment regimens showed that monotherapy and combination therapy had been widely used in the treatment of diabetes. In the relatively controlled glycemic levels, monotherapy was typical among the patients, but dual and triple therapy were applied in those patients who needed more vigorous treatment. An insulin-based therapy was applied in less percentage of patients, especially when oral medication is not enough to achieve adequate glycemic control. The antidiabetic drug classes distribution showed that frequently prescribed first-line medications were widely prescribed, while new drug classes were introduced into treatments in those cases where suitable. Statistical analysis also indicated that gender was not a significant factor in determining the number of antidiabetic medications prescribed, and hence the decisions to treat diabetes were rather driven by clinical factors than demographic factors. Conversely, the number of years of diabetes was discovered to be an important predictive factor of pharmacological use, which showed that the patient with a lengthy disease history tended to experience a more intensive pharmacological treatment. On the whole, the results imply the need to track prescribing trends and enhance therapeutic results by fostering rational drug consumption in the treatment of T2DM.

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