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Drug Utilization Review of Antidiabetic Medications at Lady Reading Hospital MTI, Peshawar: Patterns, Trends, and Clinical Implications

Umair Zahid[1], Muhammad Ismail Tajik[2], Jawad Saeed[3], Mahnoor Malik[4], Maliha Manzoor[5], Tanish Singh[6], Saboor Ahmad[7], Ateeq Afzal[8], Khushnuma Zahid[2], Brekhna Zahid[3], Zahoor Khan[4]

[1,2,3,4,5,6,7,8]Department of Pharmacy, Faculty of Life and Environmental Sciences, University of Peshawar, Khyber Pakhtunkhwa, Pakistan

[2]Institute of Chemical Science, University of Peshawar, Khyber Pakhtunkhwa, Pakistan

[3]Department of Zoology, Qurtuba University, Peshawar

[4]Department of Environmental Sciences, Faculty of Life and Environmental Sciences, University of Peshawar, Khyber Pakhtunkhwa, Pakistan

Corresponding Author: Umair Zahid, Department of Pharmacy, Faculty of Life and Environmental Sciences, University of Peshawar, Khyber Pakhtunkhwa, Pakistan
Email: umairzahid4899@gmail.com

Jawad Saeed, Department of Pharmacy, Faculty of Life and Environmental Sciences, University of Peshawar, Khyber Pakhtunkhwa, Pakistan, Email: jawadsaeed@uop.edu.pk
ORCID ID: https://orcid.org/0000-0003-3073-2141

ABSTRACT

Diabetes mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia due to insulin resistance or deficiency, leading to multisystem complications. Optimizing patient care requires insight into prescribing patterns, comorbidities, treatment outcomes, adherence, and health literacy. This study evaluated the Drug Utilization Review (DUR) of antidiabetic medications, analyzing prescriptions by age, gender, and family history, assessing adherence and patient comprehension, and determining the economic burden of therapy. A descriptive observational study was conducted on 50 DM patients in the endocrinology ward of Lady Reading Hospital, Peshawar. Data on demographics, medical history, lab findings, and medication adherence were collected. Diabetic neuropathy (56%), cellulitis with foot ulcers (54%), and nephropathy (44%) were the most common complications. Combination therapy, particularly triple therapy, was preferred over monotherapy for better glycemic control.

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Medication adherence was suboptimal, with only 14% demonstrating excellent compliance, correlating with elevated HbA1c levels. Findings highlight the need for patient education, adherence strategies, and optimized pharmacotherapy to improve outcomes and reduce complications in tertiary healthcare settings.

KEYWORDS: Drug Utilization Review (DUR), Diabetes Management, Medication Adherence, Antidiabetic Therapy, Prescribing Patterns.

INTRODUCTION

Diabetes Mellitus (DM) is a complex and multifaceted metabolic disorder characterized by persistently elevated blood glucose levels, resulting from defects in insulin secretion, insulin action, or both (Bielka *et al*., 2024). This chronic condition can lead to a wide range of complications, including microvascular damage (nephropathy, retinopathy, and neuropathy), macrovascular disease (coronary artery disease, peripheral arterial disease, and stroke), and increased risk of infections, cognitive decline, and depression (Mathers and Loncar, 2006; World Health Organization, 2022). The global prevalence of diabetes has been increasing at an alarming rate, with the number of people living with diabetes projected to rise from 463 million in 2019 to 578 million by 2030 and 693 million by 2045 (International Diabetes Federation, 2022). This rapid increase in diabetes prevalence has significant implications for healthcare systems, economies, and societies worldwide. In 2021, diabetes was responsible for approximately 966 billion USD in global healthcare expenditure, which is expected to increase to 1045 billion USD by 2045 (Baynes, 2015). In Pakistan, the prevalence of diabetes is also alarmingly high, with over 33 million adults currently living with the condition (Care, 2021). The current prevalence of type 2 diabetes mellitus in Pakistan is 11.77%, with a higher prevalence in males (11.20%) than in females (9.19%) (Meo *et al*., 2016). Diabetes mellitus imposes a significant economic burden on healthcare systems worldwide, particularly in low- and middle-income countries like Pakistan. In 2021, healthcare expenditures associated with diabetes-related complications in Pakistan were estimated to reach 32.6 billion USD, and this figure is projected to escalate to 46.3 billion USD by 2045 (Meo *et al*., 2016). These costs stem from direct medical expenses—including hospitalizations, medications, and long-term care—as well as indirect costs related to productivity losses, disability, and premature mortality. Effective diabetes management necessitates a multifaceted approach, integrating lifestyle modifications (such as dietary changes, physical activity, and weight management),

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pharmacological interventions, and continuous monitoring and patient education (American Diabetes Association, 2022). However, despite advancements in treatment protocols and healthcare delivery, diabetes management remains suboptimal in many regions. Poor adherence to prescribed treatments, lack of access to healthcare facilities, and inadequate patient education contribute to poor health outcomes, decreased quality of life, and increased healthcare expenditures (Rubin and Peyrot, 1999). Given these challenges, there is a pressing need to enhance diabetes care and management strategies in Pakistan. One of the key aspects of improving outcomes is optimizing drug utilization, and ensuring that antidiabetic medications are prescribed appropriately, used effectively, and tailored to individual patient needs. Drug Utilization Review (DUR) plays a crucial role in this context by systematically evaluating medication use patterns, identifying prescribing trends, and assessing adherence and therapeutic outcomes. The World Health Organization (2013) emphasizes the importance of DUR as a tool to enhance the rational use of medicines, improve treatment efficacy, and reduce unnecessary healthcare expenditures. Among the different types of DUR, prospective DUR is particularly valuable in clinical practice as it allows for real-time evaluation of prescriptions before medication is dispensed (Lee and Bergman, 2012). This proactive approach helps prevent medication errors, identify potential drug interactions, and ensure that treatment regimens align with best practices and patient-specific requirements. By implementing effective DUR strategies, healthcare providers can enhance patient safety, improve glycemic control, and mitigate the financial burden associated with diabetes care. By examining each prescription for a specific patient, prospective DUR can help identify drug-related issues, such as therapeutic duplication, drug-drug interactions (DDIs), and drug-disease contraindications (Wettermark *et al*., 2024; Dar *et al*., 2022). The objective of this study was to evaluate the utilization patterns, effectiveness, and safety of antidiabetic medications in a tertiary care setting in Pakistan, aiming to identify opportunities for optimized diabetes management, improved patient outcomes, and enhanced adherence to treatment protocols.

2.0 Methodology

2.1 Study Type

This research follows a descriptive observational study design, conducted over one month, from September 20, 2024, to October 20, 2024. A descriptive observational study is a non-experimental research approach that focuses on systematically documenting and analyzing

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specific characteristics, patterns, or trends within a defined population without intervention from the researchers. The study aimed to assess the drug utilization patterns of antidiabetic medications among hospitalized patients, identifying prescribing trends, treatment adherence, and associated clinical outcomes. By employing an observational approach, the study provides real-world insights into current prescribing practices and patient responses to antidiabetic therapy. The chosen timeframe ensures a comprehensive yet focused data collection process, allowing for meaningful statistical analysis and interpretation.

2.2 Study Setting

This study was conducted in the Endocrinology Ward of Lady Reading Hospital-MTI, Peshawar, Khyber Pakhtunkhwa, Pakistan. Lady Reading Hospital (LRH) is one of the largest and most well-equipped tertiary care hospitals in the region, serving a diverse population with a high burden of endocrine and metabolic disorders, including diabetes mellitus. Conducting this study in a high-volume tertiary care setting ensures a comprehensive assessment of drug utilization patterns, prescribing practices, and patient adherence to antidiabetic medications in a real-world clinical.

2.3 Patient Population

To evaluate the population of patients with DM, data were collected from 50 patients. The dataset includes patients of all ages diagnosed with DM. Only subjects with a complete medical record and at least one attendant were included in the study. Subjects who did not wish to be interviewed or had incomplete medical records were excluded.

2.4 Data Collection

A well designed Performa was used for collection of data. The parameters included diagnosis, Patient demographic Information, History of present illness, Laboratory Data, Medication Chart, Check mark for counseling time, Understanding level scale (health literacy rate), and Adherence level scale.

2.5 Data Processing

The data was systematically analyzed concerning demographics, medical histories, and adherence metrics to investigate patterns in antidiabetic medication use within the study population. Prescribing trends were examined by evaluating the distribution and frequency of various antidiabetic treatment classes, including oral hypoglycemic agents and insulin formulations. The assessment of rational drug use was conducted using the World Health

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Organization (WHO) prescribing indicators, encompassing the average number of antidiabetic medications per prescription, total medications per prescription, and associated prescription costs. Additionally, drug interactions were identified and categorized based on their clinical significance, distinguishing between major and non-major interactions. The effectiveness of antidiabetic therapies was assessed by analyzing the relationship between medication adherence and glycemic control, particularly its influence on HbA1c levels and other relevant clinical outcomes.

2.6 Statistical Analysis

All data were tabulated using Microsoft Excel and analyzed using Graph Pad Prism (Version 8.0, San Diego, CA, USA). Descriptive statistics were computed and presented as frequencies and mean ± standard error of the mean (SEM). One-way ANOVA was applied to compare multiple groups, with $p \leq 0.05$ considered statistically significant. Graphical representations of the data were generated using GraphPad Prism to visualize trends and patterns effectively.

3 Results and Discussions

3.2 Age-based Prevalence of DM

The present study includes 50 cases, with participants ranging in age from 8 to 66 years. The mean age of the cohort is 46.9 years, with a standard deviation (SD) of 13.02. Graphical analysis indicates that diabetes mellitus (DM) is most prevalent in the 46–60 age group, which accounts for 25 cases (50%) of the total study population. This is followed by the 31–45 age groups with 13 cases (26%) and the 61–75 age groups with 6 cases (12%). In contrast, younger age groups exhibit significantly lower prevalence rates, with only 2 cases (4%) in the 1–15 age group and 4 cases (8%) in the 16–30 age group.These findings highlight a progressive increase in DM prevalence with advancing age, particularly from the mid-30s to the late 60s. This trend underscores the importance of early screening and preventive strategies in at-risk populations. The current study highpoints the need for targeted prevention and screening programs, especially for middle-aged adults, particularly those in their 40s (Figure 1). Lifestyle interventions, including a balanced diet, regular exercise, and routine health screenings, can help mitigate the risk. Previous studies have reported a high prevalence of DM in individuals aged 45–60, largely due to factors such as insulin resistance, sedentary lifestyles, and an increased risk of obesity. Conversely, the low prevalence observed in individuals under 30

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aligns with existing literature, which attributes lower rates to the absence of age-related risk factors (Group, 2003).

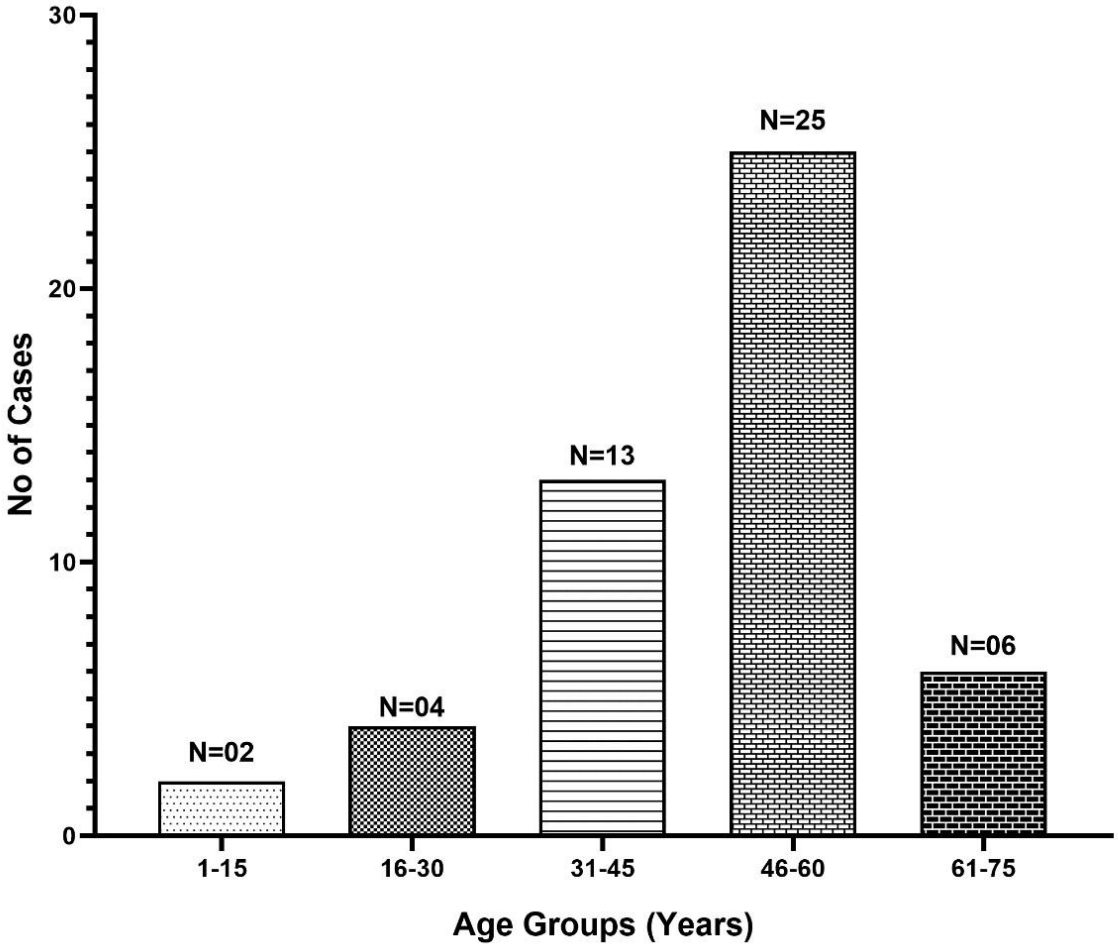

Figure 1: Graphical Representation of Age Based Prevalence of DM

3.3 Gender-based Prevalence of DM

The prevalence of diabetes mellitus (DM) by gender was assessed in a sample of 50 patients to determine potential differences between males and females. Among the participants, 23 (46%) were male, while 27 (54%) were female (Figure 2). This distribution indicates a slightly higher prevalence of DM among females in this particular sample. Although the difference is not substantial, it suggests the possibility of gender-specific variations in DM susceptibility, which could be influenced by genetic, hormonal, lifestyle, or socioeconomic factors. Further investigation into these potential contributing factors may provide insights into targeted preventive and management strategies for both genders.

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The higher prevalence of diabetes among females can be attributed to biological and sociocultural factors. Hormonal changes, especially menopause-associated ones, increase diabetes risk. Postmenopausal weight gain and body composition can exacerbate insulin resistance, increasing susceptibility. Pregnant women with gestational diabetes have a higher likelihood of developing type 2 diabetes later in life, further contributing to female predominance in diabetes statistics. Similar research works have demonstrated that in some areas, particularly in low- and middle-income nations, the prevalence of type 2 diabetes is frequently greater among women. It is believed that a mix of biological, environmental, and behavioral variables are responsible for this development. In particular, women are more likely than males to develop diabetes due to hormonal fluctuations, eating habits, and physical inactivity (Puig-García *et al*., 2023).

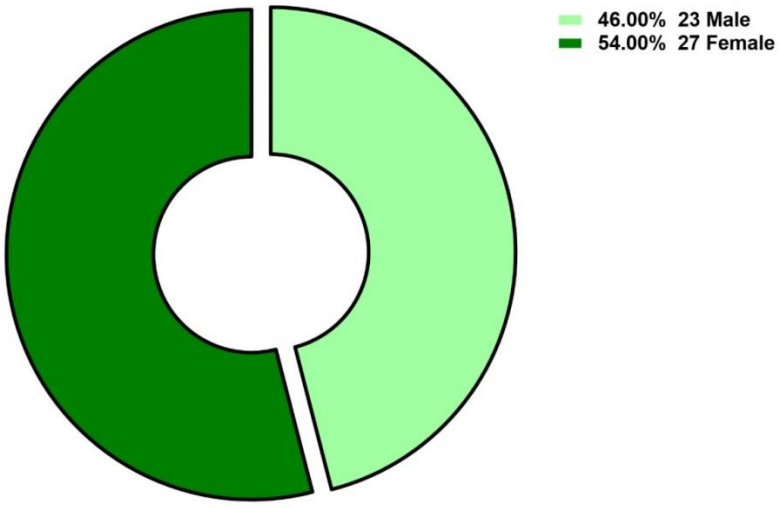

Figure 2: Graphical Representation of Gender Based Prevalence of DM

3.4 Family History-based Prevalence of DM

Individuals with a family history of diabetes mellitus (DM), specifically those with both parents diagnosed, exhibited the highest prevalence, accounting for 54% (n=27) of the cases. Those with one parent with diabetes were next, accounting for 16% (n=8) of the cases. On the other hand, 30% (n=15) of the sample who had no family history of diabetes. This distribution points to a substantial correlation between family history and the risk of getting DM with greater prevalence of diabetes among those with a family history, particularly from both parents (Figure 3). The importance of genetic predisposition in diabetes risk is highlighted by the examination of family history in diabetes prevalence. A study conducted found that a family history of diabetes, particularly when both parents have the disease, almost doubles the risk of

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getting it because of the shared lifestyle variables and inherited genetic susceptibility (Puig-García *et al*., 2023).

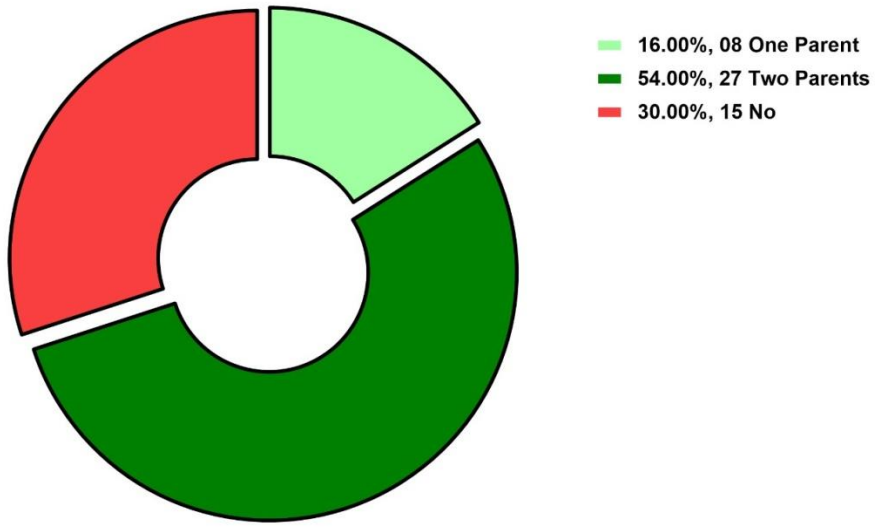

Figure 3: Graphical Representation of Family History Based Prevalence of DM

3.5 Prevalence of Significant Complications among DM Patients

In the study area, significant complications were observed among a group of 50 diabetes patients. The most prevalent conditions were diabetic neuropathy, affecting 28 patients (56%), and cellulitis associated with diabetic foot ulcers (DFU), observed in 27 patients (54%). Diabetic nephropathy was also common, occurring in 22 patients (44%). Diabetic ketoacidosis (DKA) was reported in two patients (4%), while gestational diabetes mellitus (GDM) was identified in one patient (2%). Notably, no cases of hyperosmolar hyperglycemic state (HHS) were observed in this sample (Figure 4).

The findings highpoint the significant prevalence of neuropathy and nephropathy among diabetic patients, which is consistent with previous studies on diabetes complications. Diabetic neuropathy, which occurs in 56% of patients, is frequently the most common consequence caused by the long-term effects of hyperglycemia on nerves. Diabetic nephropathy, which affects 44% of the population, is consistent with established hazards to renal function from chronic diabetes, potentially progressing to end-stage renal disease. Similar studies have been conducted which examined the prevalence of complications in diabetes patients and found similar tendencies, with diabetic neuropathy and diabetic nephropathy being the most common. In their investigation, neuropathy was seen in around 50% of the patients, and nephropathy was seen in around 30% of cases (Nisar *et al*., 2015).

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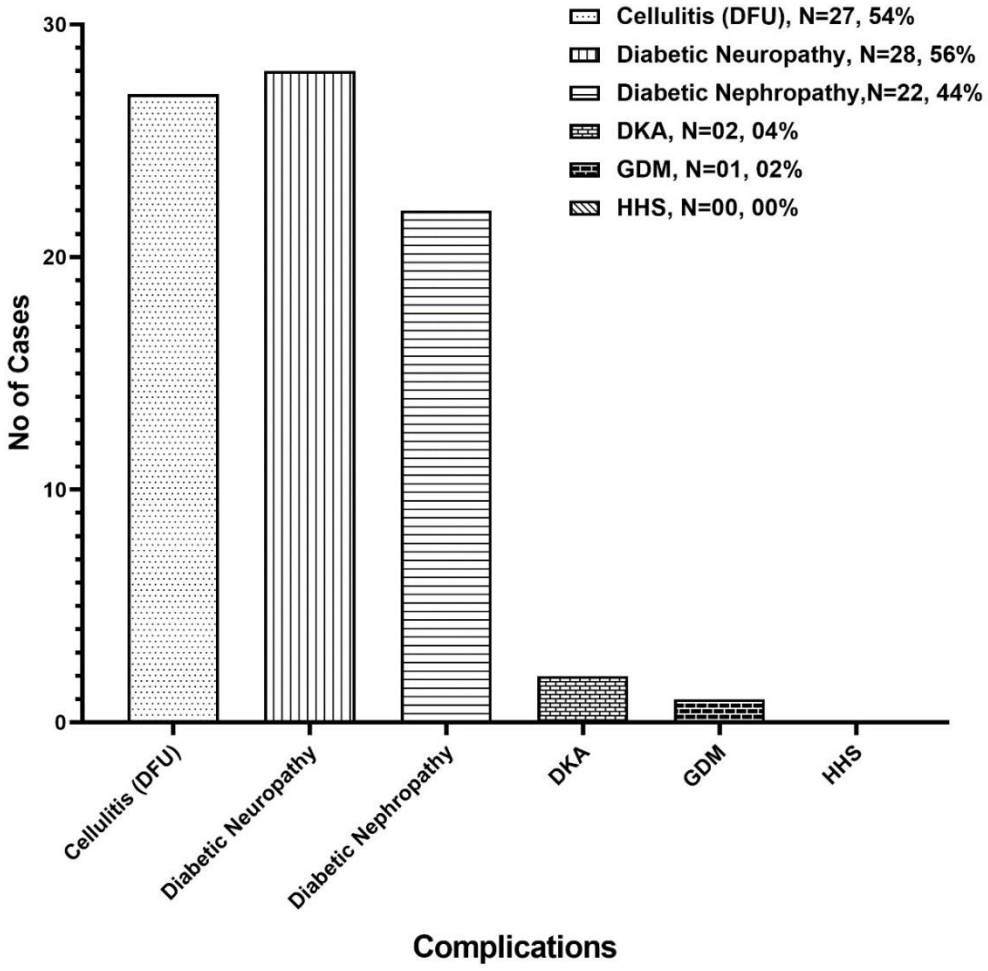

Figure 4: Graphical Representation of Significant Complications of DM

3.6 Prevalence of Significant Comorbidities among DM Patients

The high incidences of multiple comorbidities in a sample of 50 diabetic individuals (DM) were detected. The most common comorbidity is hypertension (HTN), which affects 58% of patients, demonstrating a significant link between diabetes and high blood pressure. Chronic kidney disease (CKD) is the second most common condition, affecting 20% of the population, highlighting the impact of diabetes on renal health. Cardiovascular disease (CVD) follows with a 12% frequency, emphasizing the cardiovascular hazards connected with diabetes. Other comorbidities include stroke (6%), dyslipidemia (2%), and obesity (2%) (Figure 5).

The study found a significant frequency of hypertension (58% in diabetic individuals), demonstrating a substantial relationship between diabetes and cardiovascular risk factors. Persistent hyperglycemia can produce vascular alterations, which raise blood pressure. Chronic

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kidney disease is also a typical complication caused by the harmful effects of elevated blood sugar on renal blood vessels. The low incidence of stroke, dyslipidemia, and obesity may reflect excellent risk management or sampling variation. In terms of dyslipidemia, 49 of the cases had no lipid profile, which is considered a limitation to studying metabolic variation. Studies were conducted which found similar patterns of comorbidities among diabetes individuals. Their study revealed hypertension in roughly 60% of diabetes patients, which closely matches the 58% identified in this group. CKD was present in approximately 15% of their group, which is equivalent to the 20% found here (Zhang *et al*., 2010).

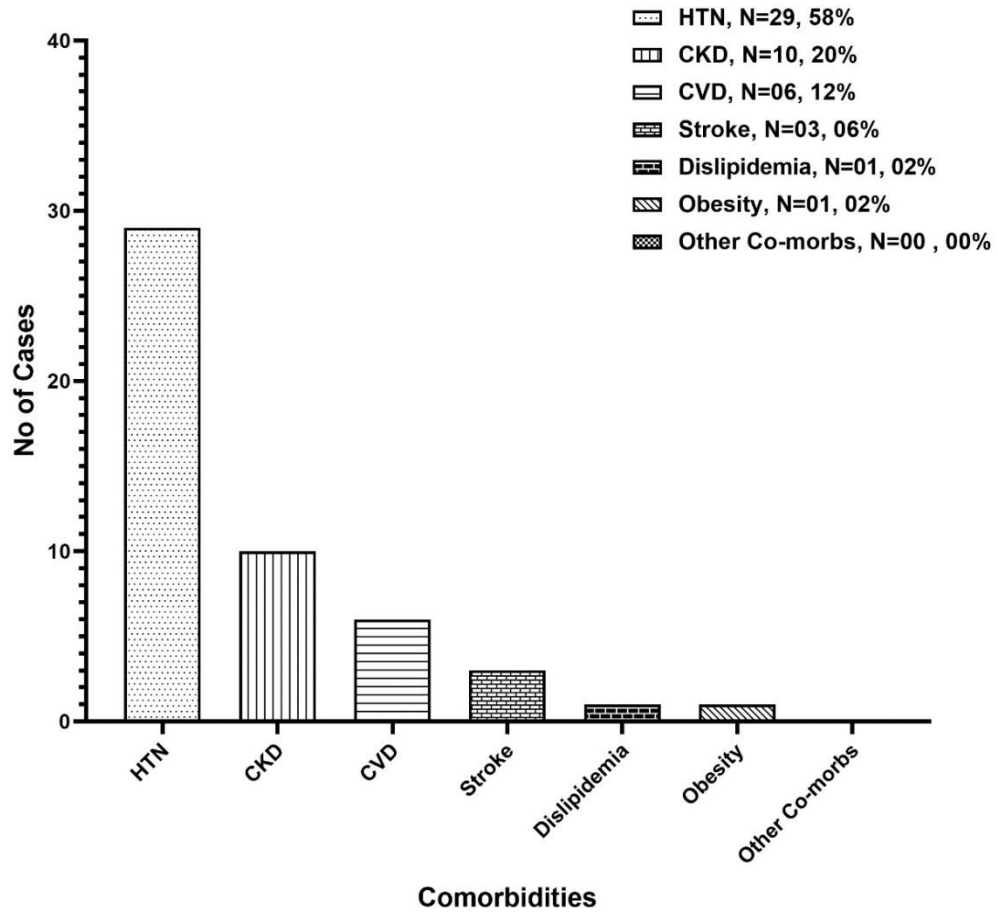

Figure 5: Graphical Representation of Significant Comorbidities of Patients with DM

3.7 Distribution of Oral Anti-diabetics Prescribed to the Patients

The biguanides were the most regularly prescribed oral anti-diabetic medication class for diabetic patients, accounting for 20 cases. Sulphonylureas and DPP-4 inhibitors were recommended in four cases each, followed by SGLT-2 inhibitors in two cases. Alpha-glycosidase inhibitors and thiazolidinediones were not advised in this study (Figure 6).

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The data emphasizes the relevance of biguanides in diabetes therapy, with current guidelines recommending it as the first-line treatment. SGLT-2 inhibitors are uncommon due to their recent launch and expensive cost, whilst alpha-glucosidase inhibitors and thiazolidinedione are less desired or reserved for certain instances. This is consistent with clinical strategies that prioritize drugs with demonstrated efficacy, safety, and cost-effectiveness for diabetes control. Studies conducted in the past demonstrate that biguanides is the most widely prescribed oral anti-diabetic drug due to its efficacy, safety, and minimal risk of hypoglycemia. It is also the first-line treatment for type 2 diabetes, significantly decreasing HbA1c while causing minimal weight gain. Sulphonylureas and DPP-4 inhibitors, on the other hand, are frequently utilized as adjunctive therapy when biguanides alone is insufficient (Care, 2021).

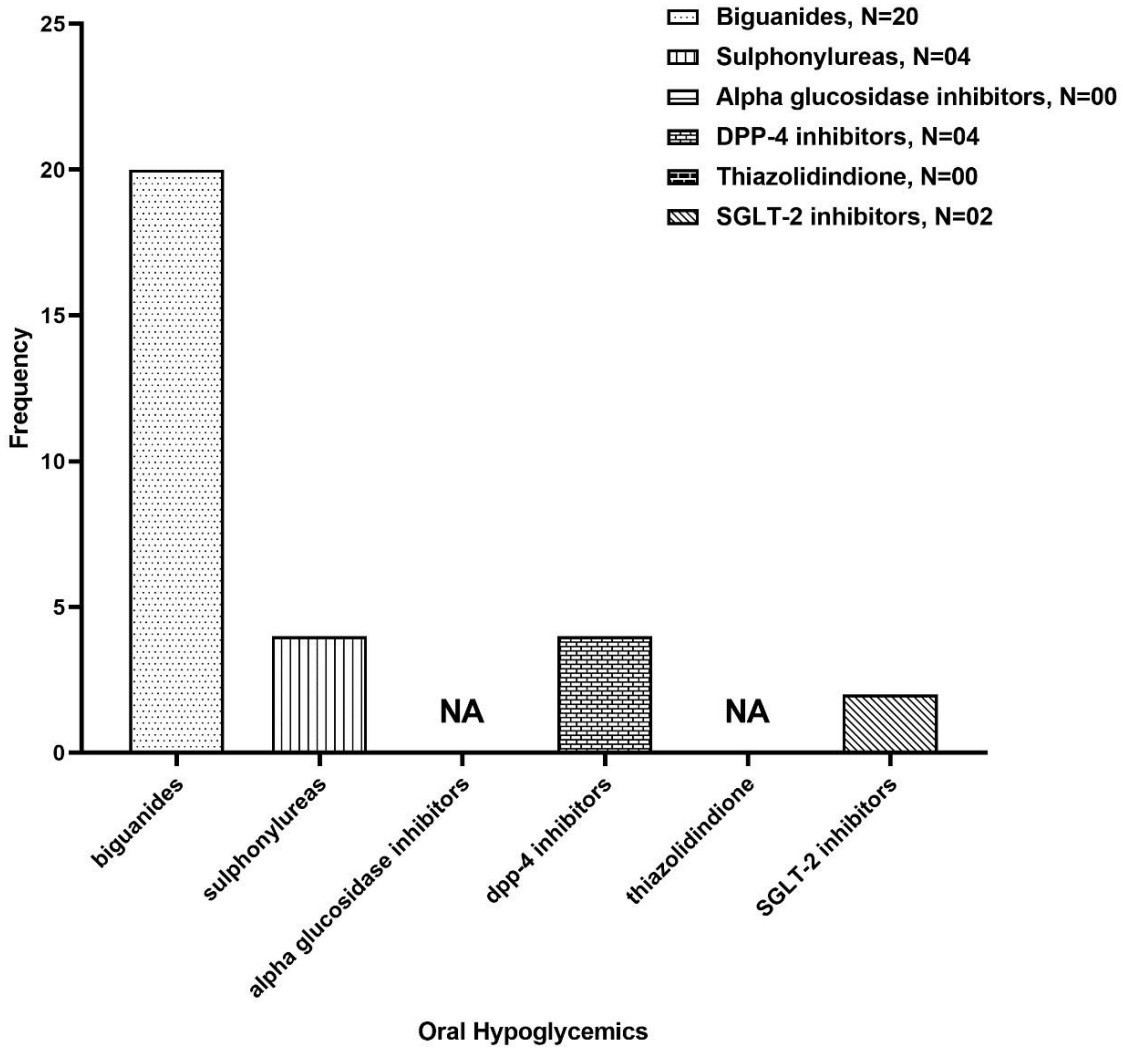

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Figure 6: Graphical Representation of Patterns of Oral Anti-Diabetics

3.8 Distribution of Different Insulin Classes Prescribed to the Patients

The distribution of various insulin types, including premixed, rapid-acting, short-acting, intermediate-acting, and long-acting, was analyzed. Premixed insulin was the most commonly used type, with a utilization rate of 64%. Short-acting insulin was prescribed to 32% of patients, long-acting insulin to 14%, and rapid-acting insulin to 4%, while intermediate-acting insulin was not prescribed to any patients (Figure 7).

According to the study, people with type 2 diabetes typically take premixed insulin because it makes the insulin regimen easier to follow and increases adherence. The low usage of intermediate-acting and rapid-acting insulin, however, might be the result of therapeutic priorities, which favor simpler regimens in order to improve patient compliance and lower dose errors. This sample's predominance of premixed insulin (64%) is consistent with previous studies showing that patients who take both basal and prandial glucose control need frequently to use it because of its convenient. According to the study, short-acting insulin is preferred over rapid-acting insulin because of its longer half-life and adaptability to controlling blood glucose levels in different contexts. Maintaining stable blood glucose levels using long-acting insulin supports the importance of basal control in the treatment of diabetes. This implies a preference for short-acting insulin over rapid-acting insulin, which could be brought on by patient features or clinician preferences (Davies *et al*., 2018).

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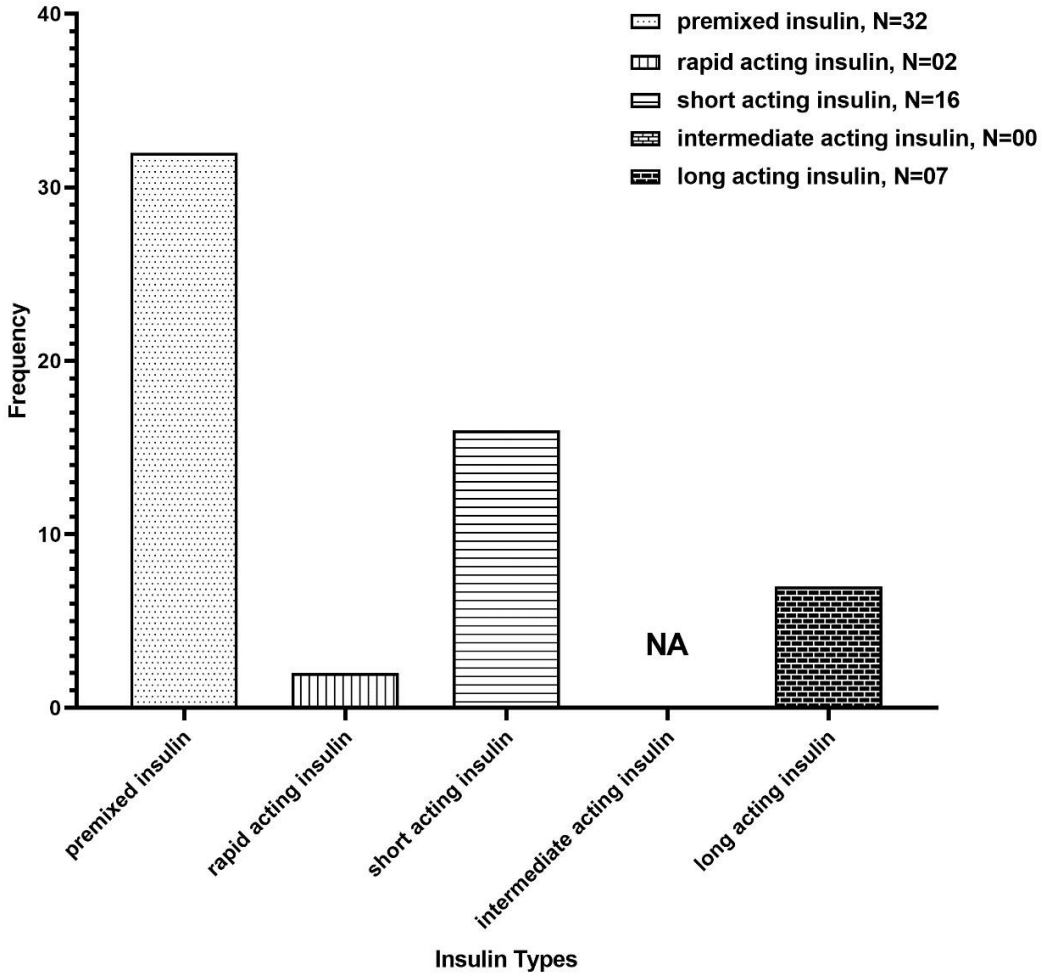

Figure 7: Graphical Representation of Distribution of Insulin Therapy

3.9 Type of Therapy Utilized for Glycemic Control

The distribution of different types of antidiabetic therapies among 50 patients was analyzed. The therapies were categorized as monotherapy, dual therapy, triple therapy, and quad therapy. Monotherapy was utilized by 28% of patients (n=14), dual therapy by 26% (n=13), triple therapy by 38% (n=19), and quad therapy by 8% (n=4) (Figure 8).

The results point a tendency to prescribe several drugs to treat diabetes, with triple therapy being the most frequent. In situations where typical monotherapy may not be sufficient to control blood glucose levels, this pattern shows a move away from monotherapy and toward more intense regimens. Combining several medications can assist address different diabetes pathophysiological variables, but it also adds complications like a higher chance of negative side effects and drug interactions. Due to the complexity and possibility for more adverse effects, quad treatment is among the least common. Previous research work also show anti-

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diabetic medication prescription trends. Their research demonstrated that combination treatments, particularly those combining sulfonylureas and metformin, were widely used because they were successful in lowering blood glucose levels, particularly in patients with advanced diabetes. Triple therapy was the most prevalent treatment, followed by mono and dual therapies, according to the study, which also revealed that combination therapy was common in addressing difficult situations where monotherapy and dual therapies were insufficient (Patel *et al*., 2013).

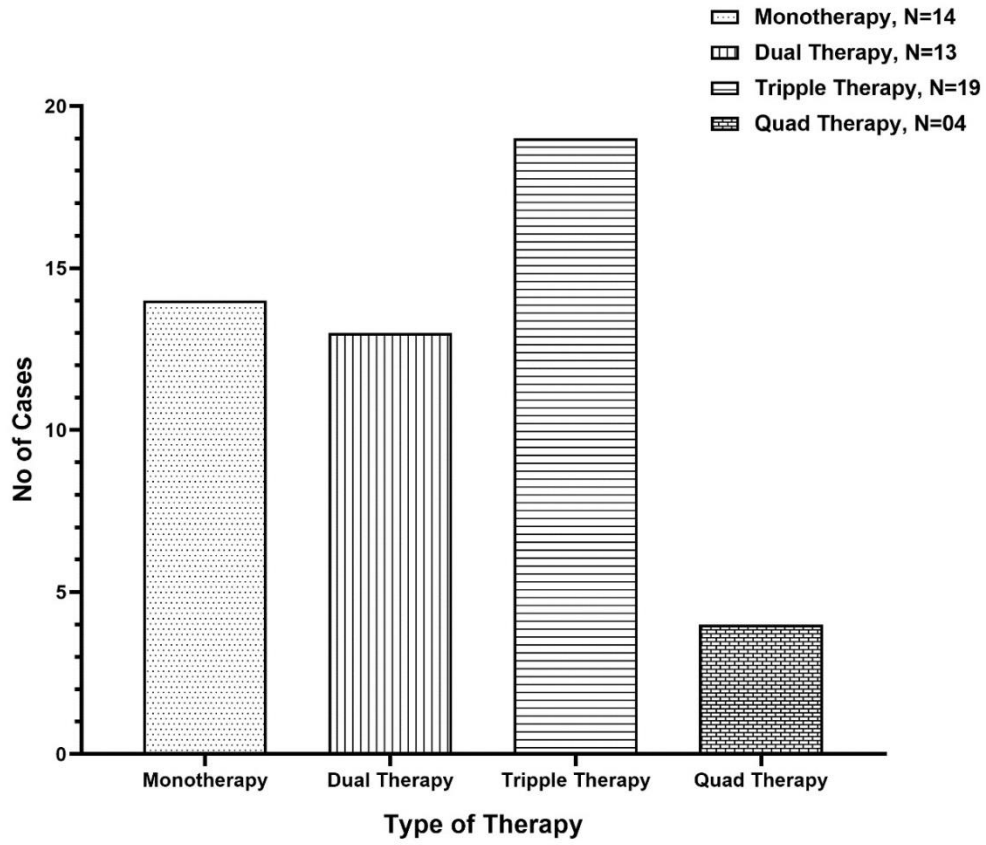

Figure 8: Graphical Representation of Type of Therapy Utilized for Glycemic control

3.10 WHO Prescribing Indicators

The analysis of WHO prescribing indicators revealed an average of 7.18 medications per prescription, with a standard deviation of 2.83. The average number of antidiabetic drugs (ADDs) per prescription was 2.26, with a standard deviation of 0.96. Prescription costs varied significantly, ranging from a minimum of Rs. 720.36 to a maximum of Rs. 5,873.38, with a mean cost per prescription of Rs. 2,975.60 (Figure 9).

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These result shows challenges in rational drug use due to a high average number of drugs per prescription, indicating a trend towards polypharmacy, increasing the risk of adverse drug interactions, particularly in chronic conditions. This suggests the need for improved guidelines on rational prescribing practices. High prescription costs raise affordability and accessibility concerns, potentially discouraging patient adherence and resulting in poorer health outcomes. Optimizing prescribing practices, implementing stricter guidelines, and promoting essential drug use could improve health outcomes. A research conducted which found that polypharmacy is common in healthcare settings, with an average of 5-6 drugs per prescription, particularly in chronic disease management (Ofori-Asenso and Agyeman, 2016). This highlights the economic burden of polypharmacy and suggests that high drug counts and associated costs are common issues in healthcare settings, particularly in chronic diseases (Maher *et al*., 2014).

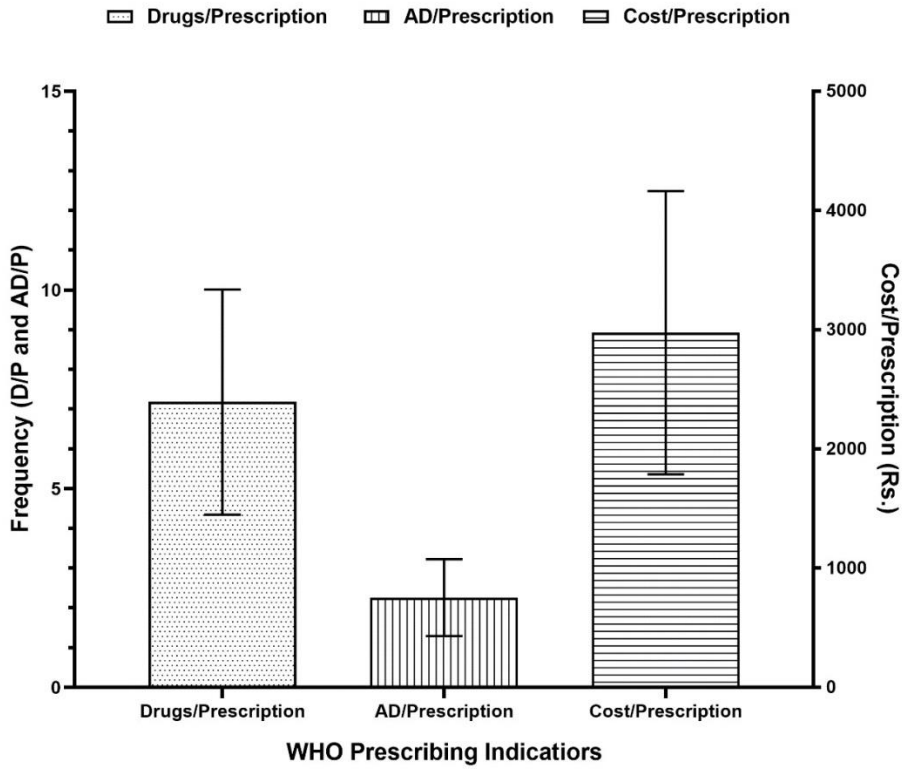

Figure 9: Graphical Representation of WHO Prescribing Indicators

3.11 Drug Interaction Analysis

A comprehensive analysis of the 50 interactions were conducted that revealed varying degrees of interaction severity (Figure 10). Among these, 2 cases (4%) exhibited no detectable interactions, indicating a lack of observable effects. In contrast, 31 cases (62%) displayed mild

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or non-significant interactions, suggesting a limited impact on the overall system. Notably, 17 cases (34%) demonstrated major or clinically significant interactions, underlining the potential for substantial influence on biological or pharmacological processes.

The comparatively high number of non-major interactions (62%) indicates that although these interactions may not put patients at immediate risk, they may result in cumulative dangers, especially in populations with polypharmacy. Major interactions which account for 34% of cases continue to raise serious concerns because of the potential for very negative consequences. The necessity of comprehensive drug interaction testing is highlighted by this investigation, particularly in clinical settings where patients are taking many drugs. Similar studies have been conducted in which the researchers examined the frequency and seriousness of drug-drug interactions (DDIs) in hospitalized patients. According to the a study, non-major drug interactions made up about 52% of instances, whereas at least one major drug interaction occurred in about 39% of patients (Hines and Murphy, 2011).

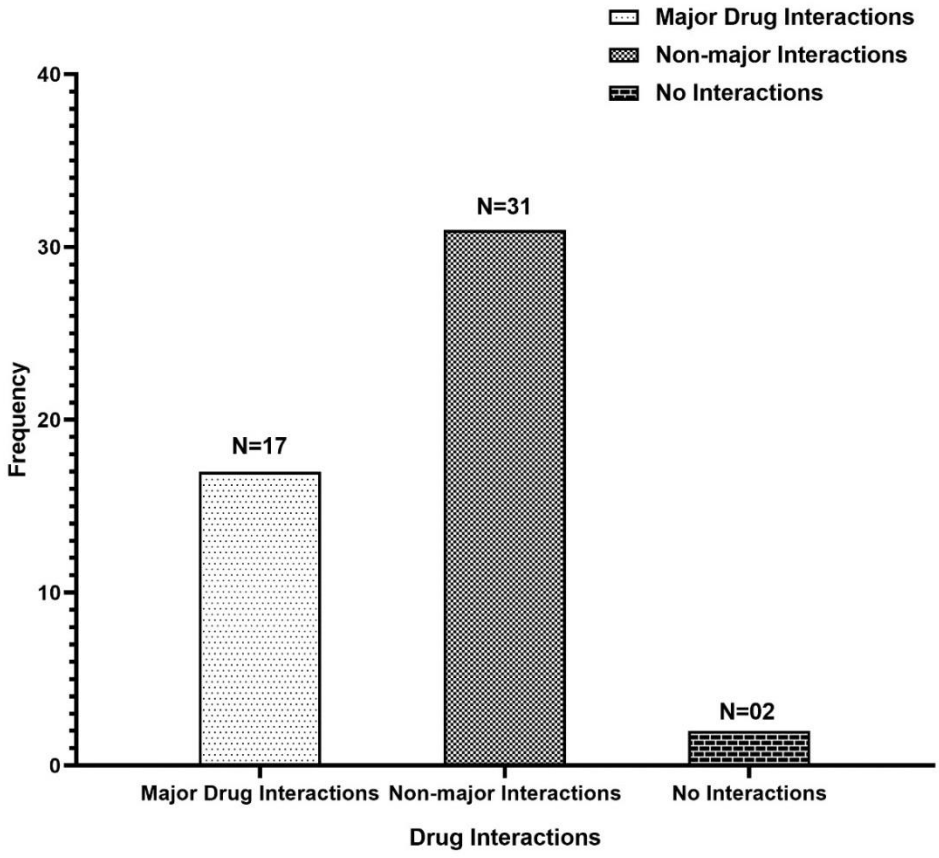

Figure 10: Graphical Representation of Drug Interaction Analysis

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3.12 Health and Medical Literacy

The four levels of health and medical literacy such as poor, average, satisfactory, and excellent—were assessed in the study (Figure 11). The analysis indicated that 15 individuals (30%) had low health literacy, 13 individuals (26%) exhibited an average level of literacy, 15 individuals (30%) demonstrated good literacy skills, and 7 individuals (14%) possessed an excellent level of health literacy. It was found that the amount of counselling time prescribed for each literacy level, those with low literacy levels were given the shortest counselling sessions (1–5 minutes), while people with high literacy levels were given the longest (16–20 minutes). The recommended counselling time for the satisfactory and average groups was 6–10 and 11–15 minutes, respectively.

The results show that the population's knowledge of health and medications varies, with most people having either poor or average literacy levels. 30% of the sample consisted of people with low literacy levels, and they were prescribed with considerably shorter counselling sessions (01–05 minutes). This highlights the necessity for appropriate, streamlined, and customized communication techniques for people with low literacy levels. On the other hand, 14% of the sample had outstanding literacy skills and were prescribed with more counselling time (16–20 minutes). In order to deliver effective, customized patient counselling and improve patient outcomes by prescribing the patients with accurate and optimum counselling time and to make sure that the patient is completely understood his treatment regimen by the health care provider. According to a study by Berkman *et al*. (2011) that examined the relationship between health literacy and health outcomes, those with low health literacy typically have lower health outcomes and use healthcare services in different ways than people with higher literacy levels (Berkman *et al*., 2011).

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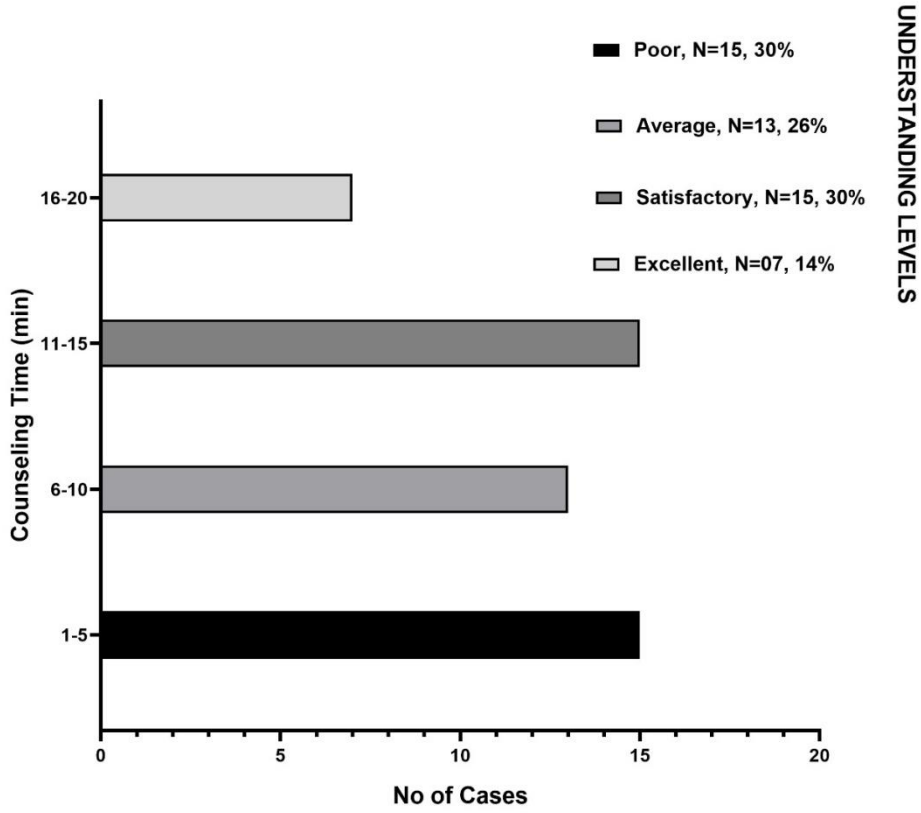

Figure 11: Graphical Representation of Health and Medication Literacy Rate

3.13 Medication Adherence and Outcomes

In the present investigation, medication adherence was categorized into four levels: Poor (<50%), Low (50-75%), Medium (76-90%), and High (>90%). The distribution of participants across these categories is illustrated in Figure 12. The analysis revealed that Poor and Medium adherence levels were the most prevalent, each accounting for 30% of the participants. This was followed by Low adherence at 26%, while High adherence was the least common, observed in only 14% of the participants.

The findings highlight the importance of medication adherence in achieving optimal clinical outcomes for diabetic patients. Poor adherence (<50%) is associated with high HbA1c levels 12-14%, suggesting a non-responsive outcome where patients likely struggle with controlling their blood glucose. Patients with Low adherence (50-75%) exhibit HbA1c levels between 10-11%, indicating deterioration in their condition. In contrast, Medium adherence 76-90% is linked to HbA1c levels of 8-9%, showing signs of improvement, and High adherence >90%, corresponds to the lowest HbA1c range >6-7%, suggesting stable outcomes with effective glycemic control. Improved adherence could reduce the risk of diabetes-related

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complications such as cardiovascular issues and neuropathy. This highlights the need for healthcare interventions to enhance adherence for improved patient outcomes. Higher medication adherence is substantially linked to better glycemic control in patients with type 2 diabetes, which lowers HbA1c levels (Ho *et al*., 2006).

4. Conclusion

This research provides valuable insights into key patterns in patient demographics, particularly the higher prevalence of diabetes among middle-aged individuals and women, as well as the significant role of family history in disease predisposition. Understanding these demographic factors is crucial for early detection, prevention, and the development of targeted interventions. The findings emphasize the importance of timely diagnosis and proactive disease management to mitigate long-term complications. A critical aspect of diabetes management identified in this study is medication adherence, which plays a fundamental role in achieving and maintaining optimal glycemic control. Poor adherence can lead to severe complications, increased healthcare costs, and a diminished quality of life. This study underscores the need for patient education programs that highlight the significance of adherence while addressing common barriers, such as medication side effects, financial constraints, and lack of awareness. Personalized communication strategies tailored to varying health literacy levels are essential to ensuring patients fully comprehend their treatment regimens and the consequences of non-adherence. This study highpoints the effectiveness of combination therapies, particularly triple therapy, in diabetes management. While beneficial for glycemic control and patient outcomes, careful monitoring is essential to minimize side effects and ensure safety. Healthcare providers must assess individual needs to balance efficacy and tolerability. Additionally, the study advocates for a patient-centered approach, emphasizing structured medication use reviews (DURs) to assess treatment efficacy, address medication challenges, and enhance adherence. Integrating DURs into routine practice can optimize medication management, reduce complications, and improve health outcomes. This research underlines the need for holistic, patient-centered strategies. Combining adherence interventions and evidence-based therapies can enhance treatment effectiveness, patient well-being, and diabetes management. Future efforts should focus on optimizing adherence, advancing personalized medicine, and strengthening healthcare support systems.

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