International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

ISSN: 2347-6567

IJAMSCR | Vol.11 | Issue 4| Oct - Dec - 2023

www.ijamscr.com

DOI : 28https://doi.org/10.61096/ijamscr.v11.iss4.2023.550-561

Impact of Clinical Pharmacy Interventions on Prescribing Trends of Oral Antidiabetic Agents and Associated Complications in a Tertiary Care Teaching Hospital

Deshmukh Pooja Vinod*[1], S.A. Sreenivas[2]

[1] *Research Scholar, School of Pharmacy, Monad University, Hapur, Uttar Pradesh, India.*
[2] *Research Guide, School of Pharmacy, Monad University, Hapur, Uttar Pradesh, India.*

*Author for Correspondence: Deshmukh Pooja Vinod
Email: poojasuyogpt@gmail.com

Published on: 28Oct 2025

Published by:
Futuristic Publications

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Abstract

The primary objective of this study was to assess the impact of clinical pharmacy interventions on current prescribing patterns of oral antidiabetic medications and the occurrence of diabetes-related complications in a tertiary care teaching hospital. The study population comprised hospitalized patients diagnosed exclusively with type 2 diabetes mellitus.

Comprehensive medication data for all enrolled patients were systematically collected using a structured and validated data collection form. Sociodemographic details, including age, sex, weight, and height, were recorded alongside clinical information such as past medical history, reason for hospital admission, and documented drug or food allergies. Detailed medication histories were obtained, encompassing drug name, dosage, route of administration, identified drug-related problems, rationale for pharmacist intervention, and recommendations provided by the clinical pharmacist.

Additionally, patients' dietary patterns, lifestyle behaviors, and medication adherence were evaluated. The acceptance and clinical relevance of pharmacist-led interventions were also assessed. Analysis of prescribing trends indicated that insulin therapy was favoured over oral hypoglycemic agents in patients with type 2 diabetes mellitus and associated complications. In many cases, insulin was prescribed in combination with oral hypoglycemic agents to achieve improved glycaemic control, particularly in patients presenting with significantly elevated blood glucose levels.

Regular insulin was the most commonly prescribed insulin formulation, while metformin emerged as the most frequently utilized oral hypoglycemic agent. The findings further highlighted the pivotal role of patient education on lifestyle modification and diabetes self-management in achieving optimal glycaemic outcomes. Overall, the implementation of clinical pharmacy services proved essential in educating patients, identifying and preventing potential drug interactions, enhancing medication adherence, and improving quality of life. The study concludes that comprehensive diabetes management incorporating appropriate pharmacotherapy, dietary regulation, lifestyle modification, and sustained adherence can substantially improve glycaemic control and therapeutic outcomes.

Keywords: Anti-diabetic drugs, Clinical pharmacy services, contemporary prescription pattern.

INTRODUCTION:

Diabetes mellitus is a group of metabolic disorders characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Persistent hyperglycemia is associated with long-term damage, dysfunction, and failure of various organs, particularly the eyes, kidneys, nerves, heart, and blood vessels [1]. According to the International Diabetes Federation (IDF), approximately 382 million people worldwide were living with diabetes in 2013, and this number is projected to increase to nearly 592 million by 2035. India bears a significant burden of diabetes, with an estimated 65.1 million adults affected in 2013, as reported by the IDF [2]. It is further anticipated that the prevalence of diabetes among the adult population in India will reach approximately 6% by the year 2025 [3].

Contemporary diabetes management emphasizes disease prevention, early identification of high-risk individuals, and intensive treatment of patients in the pre-diabetic stage. Current pharmacotherapeutic approaches to diabetes mellitus include insulin therapy and oral hypoglycemic agents. Oral hypoglycemic agents differ in their mechanisms of action, safety profiles, and efficacy. The major classes include insulin secretagogues such as sulfonylureas and rapid-acting secretagogues, agents that reduce hepatic glucose production such as biguanides, drugs that delay carbohydrate absorption in the gastrointestinal tract such as α-glucosidase inhibitors, insulin sensitizers including thiazolidinediones, and incretin-based therapies such as dipeptidyl peptidase-4 inhibitors [4–6].

According to the World Health Organization, drug utilization is defined as the marketing, distribution, prescription, and use of medicines in a society, with particular emphasis on the resulting medical, social, and economic consequences [7]. Numerous drug utilization studies focusing on antidiabetic agents have been conducted worldwide, including in India [8–19].

The primary aim of the present study is to evaluate the impact of clinical pharmacy activities on contemporary prescribing patterns of oral antidiabetic drugs and the associated complications in a tertiary care teaching hospital. The general objective of the study is to initiate and strengthen clinical pharmacy services for patients with diabetes mellitus and its associated comorbid conditions.

STUDY METHODOLOGY

Study design: prospective, observational, study.

Study location: Study was carried out in a tertiary care hospital. From July 2022 to September 2023.

Study setting: Study was based only on those patients who have type 2 diabetes and admitted in a tertiary care hospital.

Study criteria:

Inclusion criteria: Patients who were diagnosed with Type 2 Diabetes admitted in hospital**,** and Patients with comorbid diseases were included in the study.

Exclusion criteria: Diabetes patients admitted in other departments except general medicine and surgery.

Study Duration: The study was carried out for a over a period of (from july 2018 to September 2019)

Sources of data: The data for the study was taken from case sheets of patients who had type 2 diabetes, Treatment charts, Investigation reports, ADR notification form, Drug intervention and interaction forms. Personal interviews with patient/patient's attendant Personal interviews with reporting persons/clinicians Past history of medication use, which are generally obtained from-Past prescriptions, Reports of Medical and surgical interventions, Referral letters, discharge cards/Advice on discharge.

Study procedure: Ethical committee clearance and formal permission from medical superintendent (MS) of tertiary hospital were obtained prior to initiation of the study. The clinical pharmacist impact of clinical pharmacy services can improve the patient quality of life. All the clinical pharmacy services will be subjected for verification by consultation with the clinicalpharmacist in department of pharmacy practice

Data Collection and Pharmacist intervention: All these inpatients admitted to wards will be reviewed on daily basis. The medication details of all these patients were collected and documented in a data collection form. The patients' socio demographic data such as age, sex, weight, height, Disease specific information like past medical history, reason for admission, allergies, Medication history including drug administered, route of administration, dosage, drugs involved type of drug related problems, reason for intervention, suggestion made by clinical pharmacist**,** Dietary habits, life style and medication adherence of patients, Acceptance and significances of pharmacist interventions will be documented in a suitable- designed patients data collection form.

During the study period patient was reviewed on daily basis, if any change in medication orders or laboratory details were obtained and updated in the patient data collection form. All the collected patient data and medical data will be subjected for independently review by clinical pharmacists to identify the drug related problems.

Drug related problems suggestions: All identified drug related problems were provided at the earliest possible time to concerned health care professional for suitable actions. The suggestions of drug related problems will be categorized as any one of the following: Change in dosage form, change in drug dose, Addition of drug, Cessation of drug, Substitution of drug, change in route of administration, change in frequency of administration, Change in duration of therapy, Others.

Evidenced of Intervention consulted: The drug information resource consulted for each student pharmacist intervention were classified as follows

Primary sources: Scientific journals, literatures, abstracts. Secondary sources: Databases: Micromedex.

Tertiary sources: Textbooks such as Martindale, Stockley's drug interactions, AHFS guidelines, Goodman and Gillman of pharmacology and therapeutics, Pathophysiological approach by Dipiro.

American association of Diabetes guidelines, National kidney foundation-Sydney, JNC 8 guidelines

Patient counselling& medication adherence: Patient counselling was done by providing patient information leaflets which includes information about the Disease, Diet, Exercise and lifestyle modification Medication adherence was measured by asking relevant questionnaires **Analysis of the results**
All the data collected were analysed by descriptive analysis and represented as charts and tables.

RESULTS:

Age group and gender wise categorization of hypertensive patients

In present study patients were grouped gender wise into male and female and their respective percentage proportion was calculated. A total of 205 patients were found during the study. Among 205 patients, 123 (60%) were male and 82 (40%) were female patients. Majority 27(32.68 %) were 40-49 years followed by 20 (26.34%) were 50-59years, followed by 17 (23.90%) were 60-69years, followed by 12 (9.75%) 70-79years, followed by 5 (3.90%) were above 80 years age group patients. Results were summarized in figure 1 and 2

Age group and gender wise categorization of hypertensive patients

In present study patients were grouped gender wise into male and female and their respective percentage proportion is calculated. A total of 450 patients were found during the study. Among 450 patients, 265 (58.88%) were male and 185 (41.11%) were female patients. Majority 123(27.33%) were 70years &above age group, followed by 119 (26.44%) were 60-69years, followed by 102 (22.66%) 50-59years, followed by 80 (17.77%) were 40-49 years, followed by 24 (5.33%) 30-39years, followed by 2 (0.44%) were 20-29years age group patients.

Alcoholic and smoker patients:

This study reveals the social habits of the patients admitted in a hospital out of 205 patients' majority are non-alcoholic and nonsmokers 136(66.34%) were found,45(21.95%) were alcoholic,24(11.70%) were found. Results were summarized in figure 3

Complications of diabetes mellitus:

In the study out of 205 patients 91 (44.39%) were found majority with both macrovascular and microvascular complications,26(12.68%) was found microvascular complications, and 88(42.92%) were macrovascular complications. Results were summarized in figure4. majority of microvascular complications nephropathy 12(5.85%) and very less neuro and retinopathy 01(0.48%) were found. majority of macrovascular found with hypertension 38(18.53%) and very less PVD, ANGINA, IHD+LEFT VENTRICULAR DYSFUNCTION

each 1 prescription (0.48%) were found. Results were summarized in figure 5 and 6.

Pattern of drug regimen prescribed for diabetic patients:

Out of 205 patients insulin were prescribed more 167 (41.03%) in diabetic patients followed by OHAs combination drug regimen 145 (35.62%) and mono drug regimen were 95 (23.34%) prescriptions. Results Were summarized in figure 7

out of 95 mono drug regimen metformin were prescribed more 48 (23.41%) followed by glimepiride 26

(12.68%) and very less dapagliflozin, canagliflozin each 1(0.48%) were found results were summarized in figure 8

145 two drug regimens were prescribed. majority are metformin + glimepiride 112(77.24%) were found and very less are glyburide+metformin 06(2.9%). Results were summarized in figure 9.

167 prescriptions were prescribed with insulin majority are insulin regular 86(41.95%) were found. results were summarized in figure 10.

Assessment of DDI in anti-hypertensive prescriptions

During the study total 125 DDI's were found. Out of the 56(27.31%) were major, 69(33.65%) were moderate drug interactions, Out of these 56 major DDI's 24(11.70%) DDI's were of Glimiperide +Aspirin and 69 moderate interactions majority interactions 12(5.85%) DDI's were of Metformin + Metoprolol. Results were summarized in figure 11 and 12

Study of efficacy of hypoglycemic agents on diabetic patients

During the hospital stay the various types of hypoglycemic drugs were prescribed to patients to reduce RBS & FBS. Out of these Metformin significantly reduced FBS (p=0.216), Glimiperide reduced SBP significantly (p=0.0034) and there was significant reduction were found in RBS (P=0.0034) on discharge when compared with respective Random blood sugar on admission.

In combination therapy metformin + glymiperide showed significant reduction in RBS (p=0.034) and FBS (p=0.144) on discharge day when compared with RBS on admission respectively and other combinations like Metformin + sitagliptin show reduced RBS (p=0.6253) significantly as compared with RBS on admission. Remaining results were summarized in Table 1.

Comparison of efficacy between mono and combination therapy

Here we had chosen 1 drug and their combinations to compare the efficacy of drugs. mean reduction in RBS increased significantly (p=0.018) in patients prescribed. Metformin and Glimiperide combination when compared with mean reduction in RBS of only Metformin treated patients. Likewise Table 4 reveals mean reduction in RBS increased significantly (p=0.451) in Metformin and Sitagliptin received patients as compared with Metformin alone treated and there is significant increase in mean reduction in FBS in patients treated with combination of Metformin And Sitagliptin as compared with alone Metformin remaining combinations doesn't show any significant difference. Results were summarized in table 2.

Clinical Pharmacy Services in Diabetic Patientsat A Tertiary Care Hospital:

clinical pharmacy services provided in Diabetic Patients patients admitted in a tertiary care hospital out of 205 patients 125(60.97%) drug drug interactions (major+moderate), 156 (76%) patient counseling were provided,03(1.46%) adverse drug reactions were found, 12(5.85%) medication errors were found, and 53(25.85%). Accompanying major age groups having Type 2 diabetes mellitus is 40-49 years i.e. 32.68% and 50-59 years i.e.,26.34%. Results were summarized in figure 13.

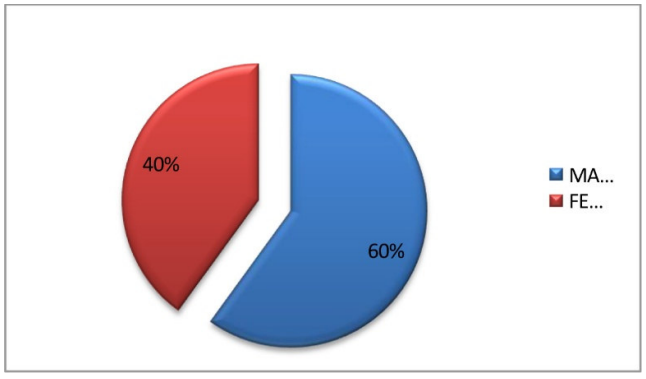

Figure 1: Male and female patients

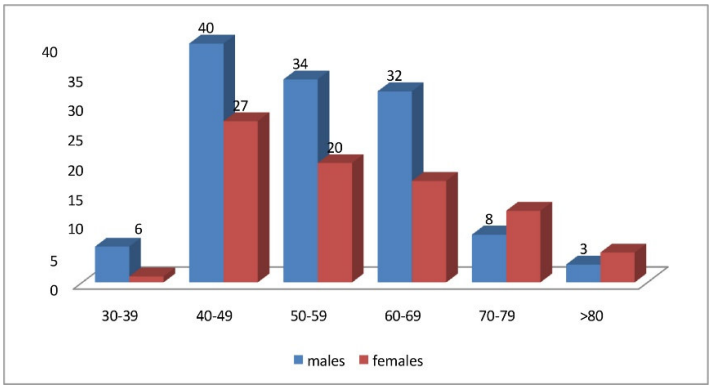

Figure 2: Age wise distribution of patients.

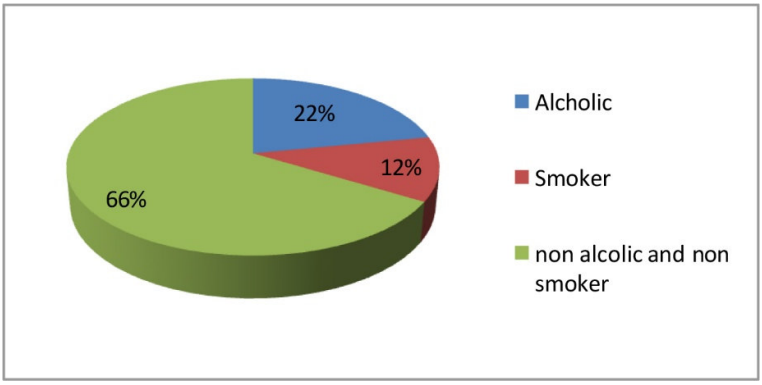

Figure 3: Alcoholic and smoker patients

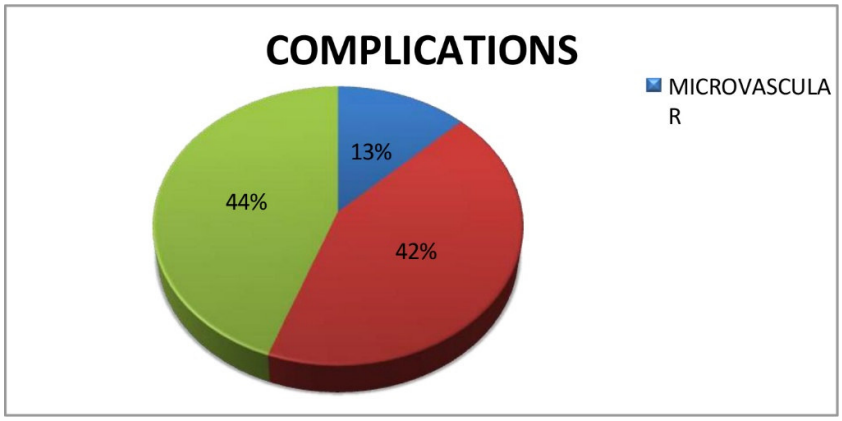

Figure 4: Graphical representation of frequency of complications in diabetes mellitus

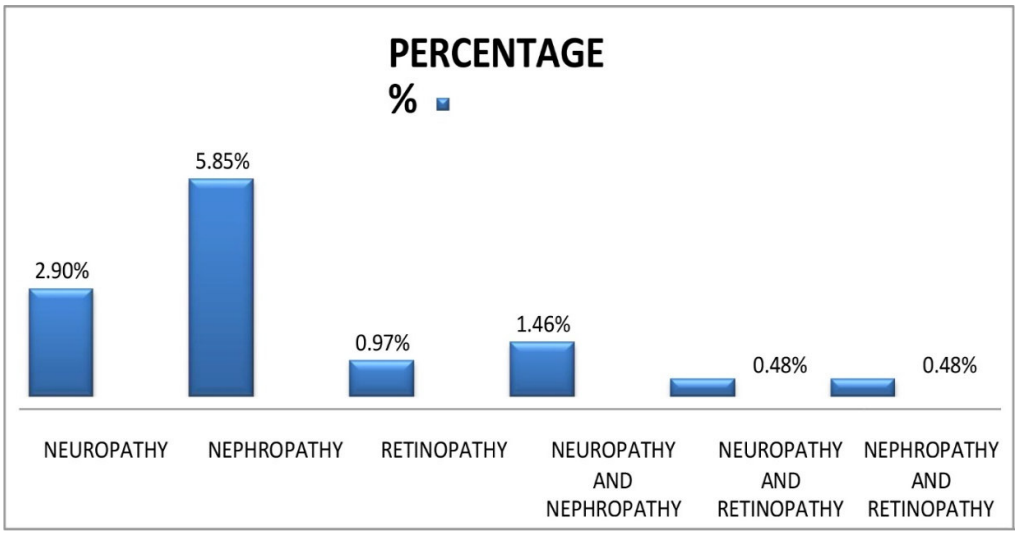

Figure 5: Graphical representation of frequency of microvascular complications

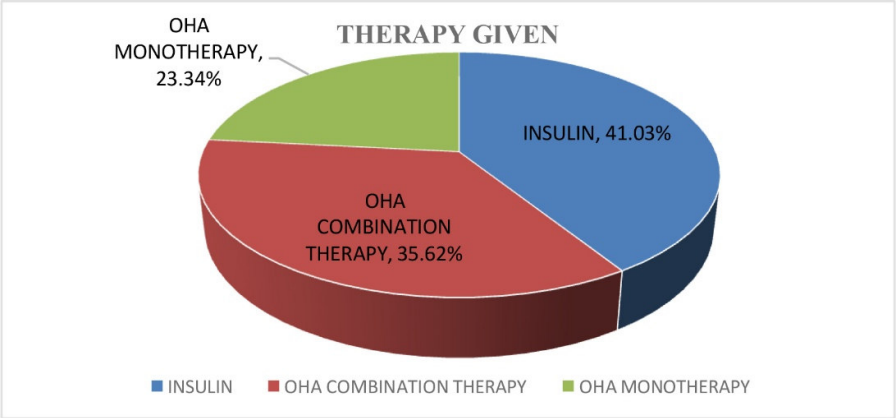

Figure 6: Drug therapy given to the patients

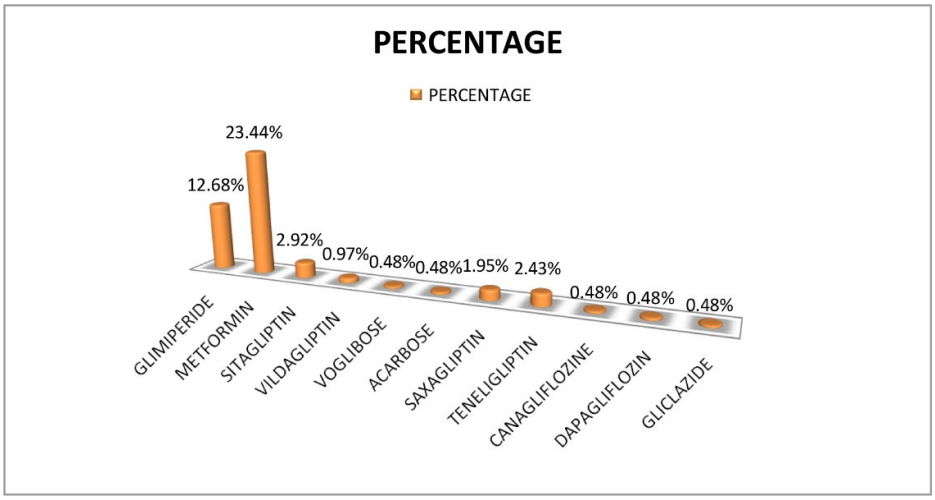

Figure 7: Monotherapy of OHA'S

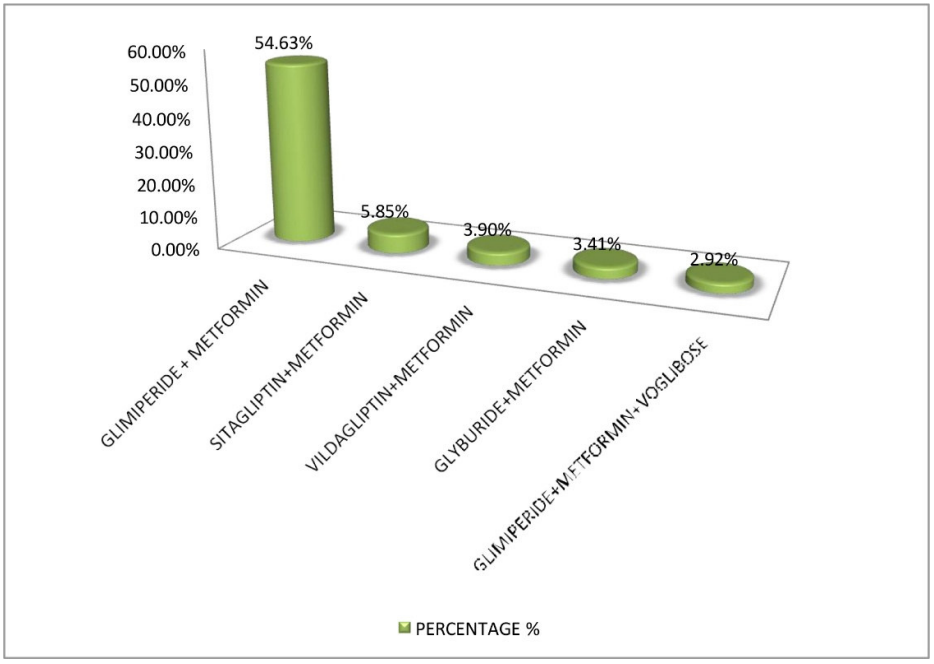

Figure 8: combination therapy of oral hypoglycemic agents

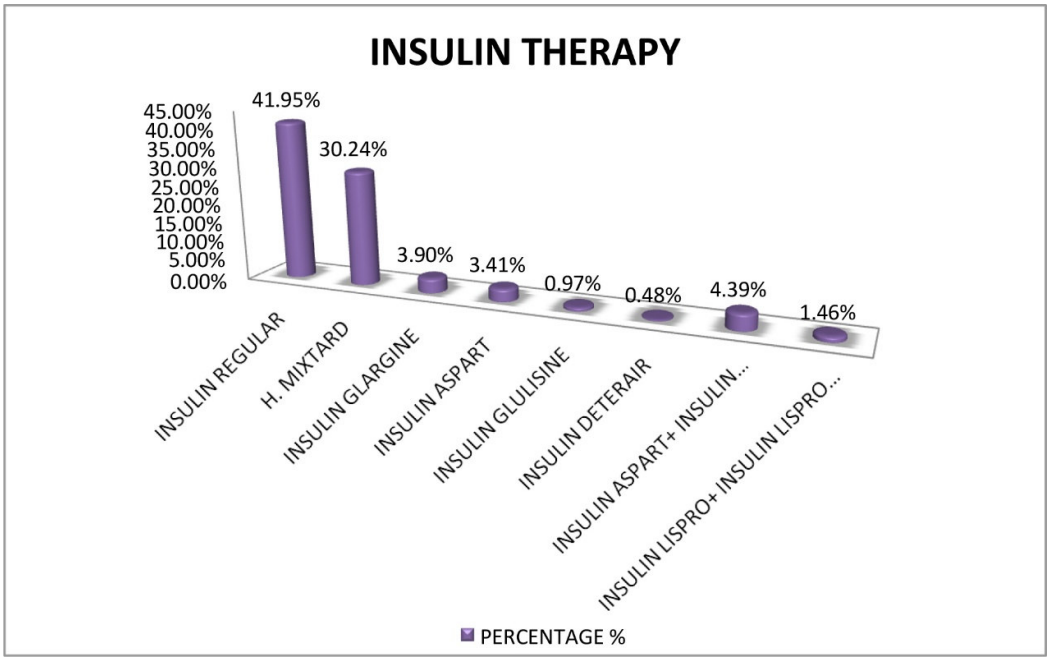

Figure 9: Insulin therapy

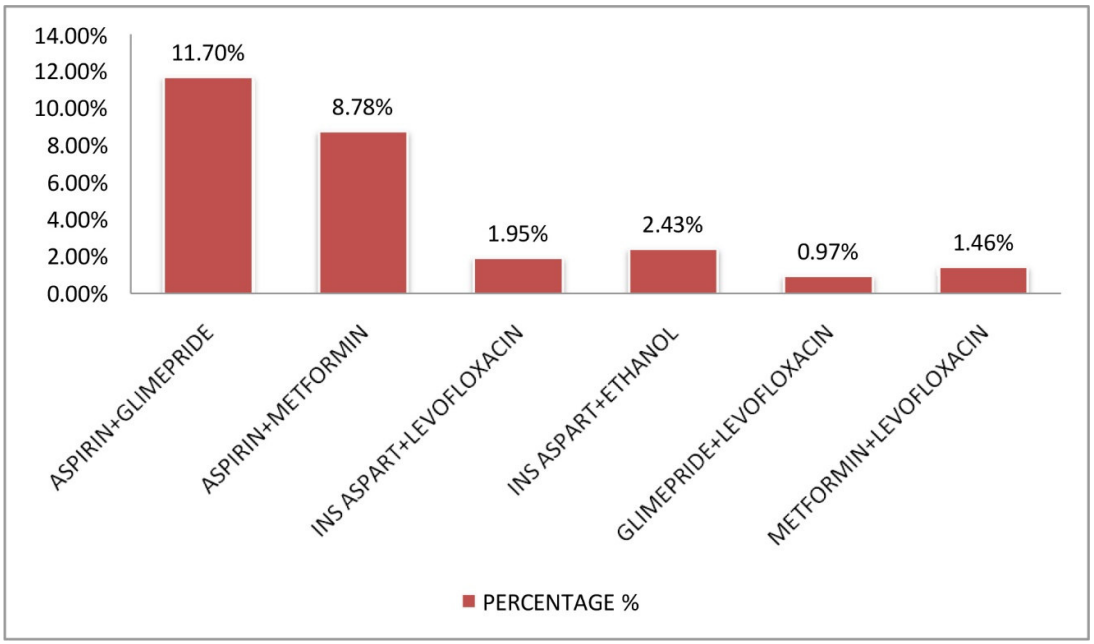

Figure 10: Graphical representation of major drug interactions found in 205 prescriptions

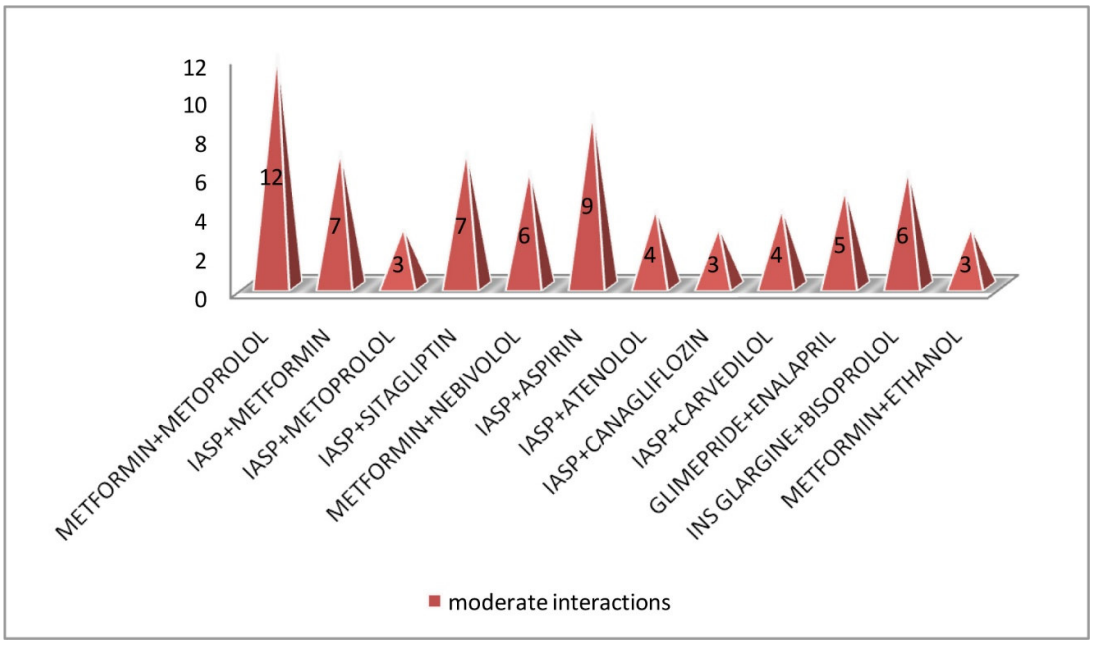

Figure 11: Graphical representation of moderate drug interactions were found in 205 prescriptions

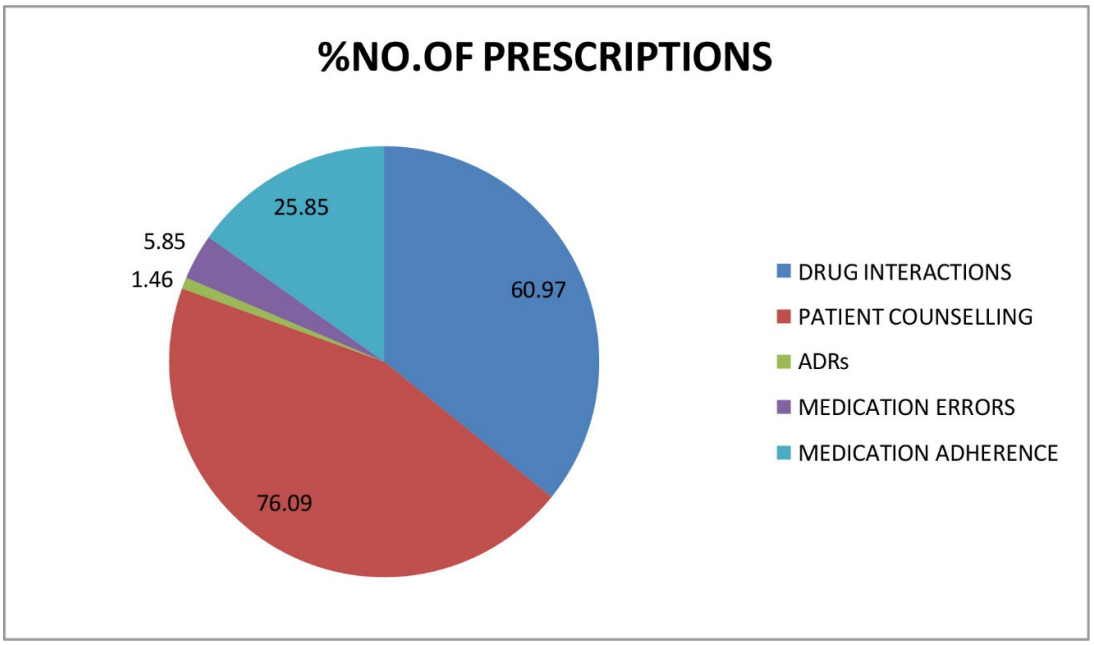

Figure 12: Clinical pharmacy services

Table 1: Efficacy of Monotherapy Oral Hypoglycaemic Drugs in Patients at a Tertiary Care Hospital

Drug	Parameter	On Admission (Mean ± SEM)	On Discharge (Mean ± SEM)	p-value	t-value
Metformin	RBS (mg/dL)	250 ± 6.27	130 ± 2.98	0.116	2.561
	FBS (mg/dL)	86.75 ± 5.13	80.26 ± 2.45	0.0138	2.135
Glimepiride	RBS (mg/dL)	234 ± 6.76	130.5 ± 2.59	0.0286	2.506
	FBS (mg/dL)	82.75 ± 5.13	76.25 ± 1.83	0.2522	1.194
Sitagliptin	RBS (mg/dL)	215.1 ± 13.22	128.4 ± 1.60	0.5253	0.6543
	FBS (mg/dL)	85.36 ± 12.22	82.29 ± 2.01	0.8561	0.4561

Notes:

- RBS = Random Blood Sugar
- FBS = Fasting Blood Sugar
- Values are expressed as Mean ± SEM
- p-values calculated using unpaired Student's t-test

Table 2: Comparison of efficacy between mono and combination therapy of Metformin

Therapy Group	N	Mean Reduction in RBS (mg/dL)	Mean Reduction in FBS (mg/dL)	p-value (RBS)	p-value (FBS)
Mono therapy (Metformin)	48	45.15 ± 8.26	12.50 ± 5.37	–	–
Combination 1 (Metformin + Glimepiride)	112	12.03 ± 18.33	4.51 ± 1.68	0.6639	0.6785
Combination 2 (Metformin + Sitagliptin)	12	43.50 ± 17.95	12.00 ± 12.29	–	–
Combination 3 (Saxagliptin-based)	–	234.60 ± 6.56	80.71 ± 3.23	0.0236	0.4493

Notes:

- RBS = Random Blood Sugar
- FBS = Fasting Blood Sugar

- Values are expressed as mean ± SEM
- p-values were calculated using the unpaired Student's t-test comparing mono versus combination therapies

DISCUSSION:

Diabetes mellitus (DM) is a chronic illness along with disturbance of carbohydrate, protein, and fat metabolism due to defects in insulin secretion and/or insulin response that requires life-long medical care and ongoing patient self-management and support to prevent acute complications and to reduce the risk of morbidity and mortality. It is a major public health service challenge worldwide with global prevalence estimated to increase from 2.8% in 2000 to 4.4% in 2030, an increase from 171 million people to 366 million people in 30 years. The most recent Global Burden of Disease study estimates the diabetes is the seventh leading cause of mortality with disability worldwide. Diabetes is associated with reduced quality of life and life expectancy.

In this study, an attempt has been made to evaluate the prescribing attitude of a physician along with the implementation of clinical pharmacy services on patients with type-2 DM with complications in the hospital. The present study was based on ADA guidelines. The study procedure used here includes prospective and cross-sectional studies using the data collection forms and hospital information system. The analysis of the prescribing pattern of a physician promotes the rational use of drugs, also increases the efficacy of treatment. This also increases the safety of patients by promoting the decrease in morbidity and mortality rates in patients.

A total of 205 subjects were included in this study, our study suggests that out of 205 patients who were treated with the anti-diabetic drugs all of the subjects were having type-2 DM with complications in which male patients (60 %) has more prevalence rate than female patients (40 %). Our results provide a direct evidence of an increasing burden of type-2 DM with complications especially among the middle aged population. Prevalance of type-2 DM with complications is mostly seen with in the age groups of 40-49 yrs (32.68%) and 50-59 yrs (26.34%).

Our study shows that 4% of the patients were obese who are leading an unhealthy lifestyle who have a major chance to be prone to diabetes at an young age along with the 11.70% of patients who were smokers and 21.95% were alcoholic, these results indicates the risk factors of type-2 DM with complications. Out of 205 subjects, only 12.68% were suffering from microvascular complications which are only seen in patients with type-2 DM, a majority of 42.92% were having macrovascular complications which are also seen in patients with cardiac disorders and 44.39 % of patients had both micro and macrovascular complications. in microvascular complications nephropathy (5.85%) was most commonly seen and in macrovascular complications (18.53%) of hypertension cases were seen.

During our study period we have assisted with the clinical pharmacy services provided to the patient. The services provided were : Identifying the Drug interactions and reporting them, Adverse drug reactions, Medication errors, Counselling the patients. Some drug interactions found in the prescriptions were: Glimepride+Aspirin(11.70%), Metformin+Aspirin (8.78%), Metformin+Metoprolol (5.85%), Insulin Aspart+Metformin (3.41%). Adverse Reactions Found Were 1.46%, Medication errors found and rectified were 5.85%. Total patient counsellings done were to 156 Patients.

Our study suggests that most of the patients needed insulin therapy (81.03%) to control their blood glucose levels. This suggests that insulin therapy was more commonly used than that of the OHAs. This suggests that subcutaneous route were the most desired routes of administration of drugs than oral route. This study on prescribing pattern suggests that insulin therapy along with OHAs is the choice of most physicians in the treatment of type-2 DM. Insulin Regular and Human Mixtard Were The Most Commonly Prescribed Insulins, Whereas In Oha's Biguanides (Metformin) Were The First Choice Followed By Sulfonylureas (Glimepride). The Use of Combination Therapy is to Achieve Better Glycemic Control.

In Monotherapy of Insulin, Insulin Regular (41.95%), Human Mixtard (25.36%), Insulin Glargine (3.90%), Insulin Aspart (3.41%), Insulin Glulisine (0.97%), Insulin Detemir (0.48%) Were The Major Choice. In Combination Therapy, Insulin Aspart+Insulin Aspart Protamine (4.39%), Insulin Lispro+Insulin Lispro Protamine (0.97%) were the most common choice.

In Monotherapy Of Oha's, Metformin (23.41%), Glimepiride (12.68%), Sitagliptin (2.92%), Voglibose (0.97%), Acarbose (0.48%), Saxagliptin (1.95%), Teneligliptin (2.43%), Canagliflozin (0.48%) Dapagliflozin (0.48%), Gliclazide (0.48%) Were Prescribed.In Fixed Combination Therapy Of Oha's, Metformin + Glimepiride (54.63%) Were Most Commonly Prescribed, Sitagliptin + Metformin (5.85%), Vidagliptin + Metformin (3.90%), Glyburide + Metformin (2.92%) Were Commonly Prescribed. In Triple Therapy Glimepiride + Metformin + Voglibose (3.41%) was mostly used.

In the analysis of the prescribing pattern, we found out that the drugs were prescribed based on the brand name instead of the generic name. This suggests the influence of pharmaceutical companies and the popularity of brands in the market. This study also suggests that in some hospitals still insulin based therapy is still dominant over the OHAs.

This study also suggests that monotherapy of insulin or OHAs was the most successful therapy and also shows success levels in the control of glycaemic levels in the subjects. This also makes a strong point that insulin therapy is most commonly used rather than OHAs.

The number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014. The global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014.The prevalence of diabetes has been seen increased in low- income countries. Diabetes has been seen increased in middle aged people. Diabetes is more prevalent in people who smokes and consume alcohol. Diabetes is the major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation. An estimated 3.4 million deaths were reported in 2015 due to diabetes. Almost half the deaths were seen in patients before 70 years. In an article, WHO mentioned that diabetes will be the 7th leading cause of death in 2030.Healthy diet, regular physical activity, etc are some of the ways to prevent the onset of type-2 DM. Diabetes and its complications can be prevented with diet, regular physical activity, medication, regular screening of blood glucose levels.

The analysis of our study has shown that a few guidelines in prescribing pattern had been deviated by preferring insulin therapy over OHAs as per AMERICAN DIABETES ASSOCIATION. In majority of cases, insulin therapy was used in combination with OHAs for the better control of diabetes in presence of alarming levels of glycaemic levels. INSULIN REGULAR was the first choice of insulin therapy and METFORMIN was the most prescribed OHAs. We also believe that patient education regarding lifestyle modification and diabetes is strongly advised to achieve the maximum control of glycaemic levels in patients. We also believe that implementation of clinical pharmacy services by proper involvement of a clinical pharmacist is very important and also a slight change in the prescribing pattern will enhance better results in patient safety.

CONCLUSION:

The findings of the present study indicate that among patients with type 2 diabetes mellitus and associated complications, insulin therapy was preferred over oral hypoglycemic agents. In the majority of cases, insulin was prescribed in combination with oral hypoglycemic agents to achieve better glycaemic control, particularly in patients presenting with markedly elevated blood glucose levels. Regular insulin was identified as the most commonly used insulin formulation, while metformin emerged as the most frequently prescribed oral hypoglycemic agent.

The study further highlights the importance of patient education on diabetes management and lifestyle modification as a key factor in achieving optimal glycaemic control. Implementation of clinical pharmacy services played a vital role in patient counseling, monitoring for potential drug–drug interactions, and ensuring appropriate follow-up, thereby contributing to an improved quality of life. The results suggest that comprehensive management of diabetic patients—including appropriate pharmacotherapy, dietary modifications, and lifestyle changes—can effectively control hyperglycemia.

Moreover, the effectiveness of antidiabetic therapy was found to be strongly influenced not only by the appropriate selection of medications but also by patients' adherence to prescribed dosing regimens.

Acknowledgement: The authors are greatful to BBR Multi Speciality Hosptial, Hyderabad for the collection of patient prescriptions and the technical support for the successful completion of the work.

REFERENCES:

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care 2012;35Suppl 1:64-71.
2. IDF Diabetes Atlas. 6th ed. International Diabetes Federation, 2013. Available from: http://www.idf.org. [Last accessed on 2014 Nov 17].
3. King H, Aubert RE, Herman WH. Global burden of diabetes, 1995-2025: prevalence, numerical estimates, and projections. Diabetes Care 1998;21(9):1414-31.
4. Unger J. Current strategies for evaluating, monitoring, and treating type 2 diabetes mellitus. Am J Med 2008;121(6 Suppl): S3-8.
5. Krentz AJ, Bailey CJ. Oral antidiabetic agents: current role in type 2 diabetes mellitus. Drugs 2005;65(3):385-411.
6. El-Kaissi S, Sherbeeni S. Pharmacological management of type 2 diabetes mellitus: An update. Curr Diabetes Rev 2011;7(6):392-405.
7. Lee D, Bergman U. Studies of drug utilization. In: Strom BL, editor. Pharmacoepidemiology. 4th ed. New York: John Wiley & Sons; 2005. p. 401.
8. Upadhyay DK, Palaian S, Ravi Shankar P, Mishra P, Sah AK. Prescribing pattern in diabetic outpatients in a tertiary care teaching hospital in Nepal. J ClinDiagn Res 2007; 3:248- 55.
9. Hassan Y, Mathialagan A, Awaisu A, Aziz NA, Yahaya R, Salhani A. Trend in the use of oral hypoglycemic agents in an outpatient pharmacy department of a tertiary hospital in Malaysia (2003-2006). Asian J Pharm Clin Res 2009;2: 40-6.
10. Jimoh AO, Sabir AA, Chika A, Sani Z. Pattern of antidiabetic drugs use in a diabetic outpatient clinic of a

tertiary health institution in Sokoto, North-western Nigeria. J Med Sci 2011;11:241-5.
11. John LJ, Arifulla M, Sreedharan J, Muttappallymyalil J, Das R, John J, et al. Age and gender-based utilisation pattern of antidiabetic drugs in Ajman, United Arab Emirates. Malay J Pharm Sci2012; 10:79-85.
12. Vengurlekar S, Shukla P, Patidar P, Bafna R, Jain S. Prescribing pattern of antidiabetic drugs in indore city hospital. Indian J Pharm Sci 2008;70(5):637-40.
13. Kannan, Arshad, Kumar S. A study on drug utilization of oral hypoglycemic agents in type-2 diabetic patients. Asian J Pharm Clin Res 2011; 4:60-4.
14. Shamna M, Karthikeyan M. Prescription pattern of antidiabetic drugs in the outpatient departments of hospitals in Malappuram district, Kerala. J Basic ClinPhysiolPharmacol 2011;22(4):141-3.
15. Dave DJ, Dikshit RK, Gandhi AM. Utilization of some newer oral antidiabetic agents in a tertiary care hospital. Natl J Physiol PharmPharmacol 2012;2(2):146-51.
16. Kumar KS, Sreeramya G, Krishna KM, Nalini K, Kiranmai N, Vasavi P.Drug use pattern study of antidiabetics in type 2 diabetes mellitus at atertiary care hospital in Tenali, Andhra Pradesh. Int J Inv Pharm Sci 2013; 1:162-6.
17. Patel B, Oza B, Patel KP, Malhotra SD, Patel VJ. Pattern of antidiabeticdrugs use in type 2 diabetic patients in a medicine outpatient clinicof a tertiary care teaching hospital. Int J Basic ClinPharmacol 2013; 2:485-91.
18. Sivasankari V, Manivannan E, Priyadarsini SP. Drug utilization patternof anti-diabetic drugs in a rural area of Tamil Nadu, South India – Aprospective, observational study. Int J Pharm Bio Sci 2013; 4:514-9.