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A STUDY ON IMPACT OF CLINICAL PHARMACIST PROVIDED EDUCATION IN PATIENTS WITH TYPE II DIABETES MELLITUS AT A TERTIARY CARE HOSPITAL

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Abstract

Background: Type II Diabetes Mellitus (T2DM) is a Chronic disorder often complicated by poor knowledge, low adherence ,and uncontrolled glycemia. Clinical pharmacists play a crucial role in educating and counseling patients to improve long-term outcomes. Aim: Study on impact of clinical pharmacist provided education in patients with type 2 diabetes mellitus at a tertiary care hospital. Objective: To assess the impact of pharmacist- provided education on knowledge, self care activities and health related quality of life and glycemic control in T2DMpatients at a tertiary care hospital. Methodology: A prospective observational study was conducted over 9 months among 305 T2DM patients. Structured Educational interventions focused on pharmacotherapy, lifestyle modification, and Self-monitoring. Pre and Post –intervention outcomes included HbA1c, FBS and PPBS, Medication Adherence and knowledge scores. Results : In a total of 305 patients,167(54.8%) were males and 138 (45.2%) were Females. A total of 227 patients (74.5%) achieved controlled glycemic levels following pharmacist interventions, whereas 78 (25.5%) remained uncontrolled despite therapy adjustments, emphasizing the importance of continuous follow-up and lifestyle modification.Drug utilization analysis revealed that 58.2% of patients were treated with monotherapy, 31.9% with combinations therapy , and 9.9% with Fixed Dose therapy. Among monotherapies, the most commonly prescribed drug was Gliclazide (14.4%), followed by Glimepiride (13.5%) and Metformin (12.05%), highlighting the predominance of sulfonylureas and biguanides as first-line agents.Most commonly prescribed insulin was Human Mixtard (19.3%).The mean HbA1c value,significant improvements in glycemic control were observed following clinical pharacist interventions. The main HbAlc level decreased from 8.6% at baseline to 7.0% at 9months, with an overall percentage reduction of approximately 19.4%which reflecting long-term glycemic control management. Similarly, Fasting blood sugar (FBS) lvels dropped from an average of 193.4mg/dL to 169.2mg/dL, Showing a mean percentage reduction of 8.13%. Postprandial blood sugar (PPBS) levels also improved significantly, reducting from 201.8mg/dL to 169.1mg/dL, indicating an average reduction of 4.24% over the study period. These findings clearly demostrated the positve impact of continuous pharmacist councelling, regular follow- up and patient education on glycemic outcomes. A total of 18 adverse drug reactions (ADRs) were identified.

Keywords: *Type 2 Diabetes Mellitus, Clinical Pharmacist, Patient Education, Glycemic Control, Medication Adherence, Self-Care Activities.*

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INTRODUCTION

The term "Diabetes Mellitus" (DM) refers to a group of chronic metabolic disorders characterized by hyperglycaemia due to insufficient insulin secretion (type I DM) or to an inadequate response of the body to the action of this hormone (type 2 DM) [1].

DM emerges from either insufficient insulin secretion, pancreatic β cell damage, or insulin resistance linked to insulin non utilisation [2]. The global prevalence of DM is 9.3% (463 million),which is expected to rise to 10.9% (700million) by 2045. 2 Type I DM (TIDM: prevalence: 0.55%) is caused due to decreased insulin secretion resulting from pancreatic β-cell destruction by immune-mediated or idiopathic causes, while insulin resistance results in type II DM (TIIDM: prevalence: 8.58%).3 Type III DM (prevalence: 0.31%) includes other specific types with established aetiologies such as mono genic disorders, genetic disorders, diseasedPancreas, Endo Crinopathies, infections, genetic syndromes and drugs. Type IV DM (prevalence: 1.3%) includes gestational DM (GDM) [3, 4].

Diabetes mellitus is a metabolic disease that directly affects well-being and poses a high morbidity risk. the long-term vascular complications associated with type II diabetes accounts for the majority belonging to morbidity and mortility in patients [5]. Several studies shown that lowering hemoglobin A1c is associated with reduced onset or progression of micre vascular complications [6]. treatment stratergies applied for type II diabetes arecomplex, requiring ongoing medical care, continuing patient education and support to prohibit acute complication and minimize the risk of chronic complications [7].

pharmacists can play crucial role in diabetes treatment by helping patients improve their chances of reaching the curative and lifestyle goals. As experts in frug selection, identifiction of drug releated problems and patient education pharmacsts can be excellent additions to multidisciplinary helath care team, contributing to better care for patients [8]. They can help in patients individually or with other health professionals in designing, implementing and monitoring therapeutic plans to achieve good disease outcomes by pharmacist interventions [9].

pharmaceutical care programs developed and executed by pharmacist have been found effective in improving the quality of care for patients suffering with various diseases such as hypertension, dyslipidemia, asthma, heart failure and tuberculosis. Pharmacist led care programs improve glycemic control and the quality of life in patients with diabetes [10]. some studies have demonstrated the clinical and economic benefits of various clinical pharmcy services in hospital settings [11].

Medication regimens of type II diabetic parients are often complex and appropriate use of medications is important for the success of diaebtes care which is associatted with great level of self- care behaviour and self- management [12]. Poor adherence to diabetes treatment is common among the patients and it can cause severe complication, increased mortality. Responsibilities of pharmacist include the optimization of medical treatment and adherence to medication. Pharmacist interventions have the potential for improving the adherence to medications for type II diabetes in such different settings as face-to-face meetings, group activity and telephone follow up [13].

The goal of this study to assess impact of pharmacist mediated education about diabetes mellitus, medication and quality of life of the patients with type II diabetes mellitus at a tertiary care hospital.

MATERIAL AND METHODS

Study Design: This Study was a Prospective Observational study with 305 patients at a Tertiary care hospital.

Study Site: This study was conducted at a tertiary care hospital.

Study Duration: The study was carried out for a period of 9 months.

Study Criteria: Type II diabetic patients visiting OPD and Patients admitted to hospital who fit into the following criteria.

Study Subjects:

Inclusion Criteria:

1. Type II Diabetic patients of either gender.
2. Type II diabetic patients with or wothout comorbidities.
3. Patients with laboratory investigations HbA1c value ≥(more than) 6.5% were selected.
4. Patients willing to participate in the study.

Exclusion Criteria:

1. Patients who are not willing to participate.
2. Patients with gestational diabetes are excluded from the study.
3. ICU diabetic patients and post-operative diabetic patients are excluded from the study.

Case study procedure

- The study was carried out after obtaining approval from the institutional Review Board (IRB).
- The study was initiated by enrolling the type II diabetic patients who fit the study criteria after obtaining their written consent.
- At baseline the data such as Demographic data, diabetic profile, and other relevant lab data along with prescribed medication will be collected in a well designed data collection form br referring to patients case sheets, OPD cards, personal case files,and also by one-to-one interactions.

Study Material

Preparation of patient data collection form: A data collection form is suitably designed to collect the required data for the study by using various resources.

Preparation of consent form: A written consent will be taken from the enrolled patient in a suitable designed consent form.

RESULTS

The demographic analysis revealed that the study was predominantly composed of middle age and older adults. A higher porportion of cases were observed among males compared to females across the majority of age groups.the concentration of patients in the 40-60year age bracket highilights age as a significant demographic factors in the prevalence of T2DM. The observed gender distribution suggests a modest male predominance, although both gender exhibited a comparable age-related increase in disease occurance.

Table 01: Gender and Age wise distribution of patients (N=305)

Age Group (years)	Male (n)	Female (n)	Total (n)	Percentage (%)
20-30	07	04	11	3.6%
30-40	30	23	53	17.4%
40-50	57	38	95	31.2%
50-60	33	45	78	25.9%
60-70	33	29	62	20.3%
70-80	00	06	06	2.09%
Total Patients	160	145	305	100%

Gender %	54.8%	45.2%	-	-

Most of the patients in the study received anti-diabetic treatment as Monotherapy, with 622 Prescriptions (58.2%) written for single agents. Monotherapy was dominated by sulfonylureas and metformin, with gliclazide (90 prescriptions, 14.4%), Glimepiride(84,13.5%) and metformin (75, 12.0%) being the most frequently used drugs, followed by newer agents such as Linagliptin (55, 8.8%) and sitgliptin (51,8.1%). Fixed-dose combinations accounted for 341 prescriptions(31.9%), in which metformin plus glimepiride(29 prescriptions, 27.2%)metformin + Sitagliptin (30, 28.5%)and Empagliflozin + linagliptin (36, 34.4% Were the leading combination regimed that target multiple pathophysiological defects. The remaining 105 prescriptions (9.9%) consisted of other combinations, reflecting more individualised regimens used for patients requiring intensification beyond standard monotherapy aor fixed dose combinations.s

Table 02: Distribution of Anti-Diabetic Prescriptions (Mono therapy, Fixed-Dose combinations and other combinations)

S.NO	Drug or FDC	Frequency	Percentage
I.	**Monotherapy-Total**	**622**	**58.2%**
1.	**Gliclazide**	**90**	**14.4%**
2.	**Glimepiride**	**84**	**13.5%**
3.	**Metformin**	**75**	**12.0%**
4.	**Linagliptin**	**55**	**8.8%**
5.	**Sitagliptin**	**51**	**8.1%**
6.	**Vildagliptin**	**46**	**7.3%**
7.	**Alogliptin**	**42**	**6.7%**
8.	**Trelagliptin**	**39**	**6.2%**
9.	**Voglibose**	**34**	**5.4%**
10.	**Dapagliflozin**	**28**	**4.5%**
11.	**Tenegliptin**	**24**	**3.8%**
12.	**Evogliptin**	**20**	**3.2%**
13.	**Pioglitazone**	**17**	**2.7%**
14.	**Empagliflozin**	**10**	**1.6%**
II.	**Fixed- Dose Combinations-TOTAL**	**105**	**9.9%**
1.	**Metformin+ Glipizide**	**10**	**9.5%**
2.	**Metformin+Glimepiride**	**29**	**27.7%**
3.	**Metformin+ Sitagliptin**	**30**	**28.5%**
4.	**Empagliflozin+ Linagliptin**	**36**	**34.3%**
III.	**Other Combinations (Non-FDC)**	**341**	**31.9%**
1.	**Glimepiride+metformin**	**60**	**17.5%**
2.	**Sitagliptin+ metformin**	**51**	**15%**
3.	**Dapagliflozin+sitagliptin**	**43**	**12.6%**
4.	**Dapagliflozin+metformin**	**39**	**11.4%**
5.	**Tenegliptin+ metformin**	**35**	**10.2%**
6.	**Dapagliflozin+vildagliptin**	**30**	**8.7%**
7.	**Empagliflozin+ Sitagliptin**	**29**	**8.5%**
8.	**Dapagliflozin+Linagliptin**	**24**	**7.0%**
9.	**Empagliflozin+Linagliptin**	**19**	**5.5%**
10.	**Vildagliptin+ metformin**	**11**	**3.2%**
IV.	**TOTAL (All Prescriptions)**	**1068**	**100%**

This table presents the distribution of insulin prescribing pattern and associated comborbid conditions among patients Type II DM. Human premix insulin formulations were the most frequently prescribed, with human mixtard accounting for the highest proportion (19.3%), followed by Humalog mix(16.7%) and inslulin degludec were comparatively less utilized(5.0%).

With respect to comorbid conditions, Hypertension was the most prevelant, affectiong 35.2% OF Patients, Followed By Other comorbidities (28.3%) and thyroid disorders (26.47%). Dyslipidemia was observed in 9.80% of the study population. These findings indicate a preference for premixed insulin regimens in routine clinical practice and hghlight the substantial burden of cardiovascular and endocrine comorbidities among patients with type 2 diabetes mellitus.

Table 03: Distribution of commonly prescribed insulin regimens and associated comorbid conditions in patients with type 2 diabetes mellitus.

Catageory	Variable	Frequency	Percentage
Insulin therapy	Human Mixtard	73	19.3%
	Humalog Mix	63	16.7%
	Insulin glargine	60	16.0%
	Eglucent mix	54	14.3%
	Human actrapid	46	12.2%
	Novo mix	32	8.4%
	Human insultard	30	8.0%
	Insulin degludec	19	5.0%
	T2DM with	36	35.29%

Comorbid Conditions	Hypertension		
	T2DM withThyroid illness	27	26.47%
	T2DM with Other conditions	29	28.43%
	T2DM with Dyslipidemia	10	9.80

A total of 305 patients with type 3 diabetes mellitus were included in the study. Among them, the prevalence of diabetic neuropathy was found to be 7.5%(n=23). Assessment of glycemic status xhowed that the majority of patients had controlled glycemia (74.52%,n=227), while 25.57%(n=78) exhibited uncontrolled t2dm based on FBS, PPBS, HbA1c values. Evaluation of microvascular complications further revealed that 6.5%(n=20) of the patients had diabetic retinopathy. Overall, the findings indicated that althoug most patients maintained adequate glycemic control, a connsiderable proportion continued to experince microvascular complications such as neuropathy and retinopaty, emphasizing the need for continuous monitoring and early preventive interventions in T2DM Management.

Table 04: Summary of complications and glycemic status among T2DM Patients (N=305)

Parameter	Catergory	Frequency (n)	Percentage%
Neuropathy	T2DM patients	305	100%
	T2DM with neuropathy	23	7.5%
Retinopathy	T2DM Patients	305	100%
	T2DM with Retinopathy	20	6.5%
Glucemic Control	Controlled T2DM	227	74.52%
	Uncontrolled T2DM	78	25.57%

The longitudinal changes in glycemic parameter and the incident of adverse drug reactions are summarized in table 5. A progressive reduction reduction in fasting blood sugar levels was observed from baseline (193.4%mg/dL) to 9 months (169.2%mg/dL), corresponding to an overall mean percentage reduction of 8.13%. similarly post-prandial blood sugar levels demonstrated a consistent decline from 201.8%mg/dL at baseline to 169.1mg/dL at 9 months, with an average reduction of 4.24%.

Glycated hemoglobin (HbA1c) levels also showed a clinically meaningful improvement over the study period, decreasing from 8.69% at baseline to 7.00% at 9 months, with an average reduction of 0.55%. The observed reductions in FBS, PPBS, and HbA1c indicate improved glycemic control over time and were statistically significant on repeated – measures analysis.

With respect to safety outcomes, a total of 18 adverse drug reactions were reported durig the study period. Gastrointenstinal disturbances and hypglycemic episodes were the most frequently observed ADRs. Most managed conservatively, with no treatment discontinuations reported. Overall, the findings suggest effective glycemc control with an acceptable safety profile.

Table 05: Glycemic Outcomes and Adverse drug reactions in patients with Type 2 diabetes mellitus

Parameter	Baseline	3 months	6months	9 months	Overall Change/ Frequency
FBS(mg/dL)	193.4	189.3	180.2	169.2	8.13%
% Change (FBS)	-	4.1%	9.1%	11.2 %	
PPBS(mg/dL)	201.8 %	193.6	184.3	169.1	4.24%
% Change (PPBS)	-	8.2%	9.3%	12.2 %	
HbA1c(%)	8.69%	8.04 %	7.70%	7.0%	0.55%
% changed (HbA1c)	-	0.65 %	0.34%	0.69 %	
ADR(Adverse Drug Reactions)	-	-	-	-	18ADRs Reported

DISCUSSION

The presenent study was conducated at Basaveshwar Teaching and General Hospital which is a tertiary care multi-speciality hospital. This prospective study aimed to evaluate the impact of clinical pharmacist –provided education on mediction adherence and glycemic control in patients with type 2 diabetes mellitus. This study demonstrates that clinical pharmacist-led educational interventions significantly enhance knowledge, attitude, adherence and self- management practices among patients with type 2 diabetes mellitus . in corporating clinical pharmacists into routine healthcare delivery can serve as a sustainable, cost-effective approach to improve outcomes and prevent long- term complications in diabetic patients.

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and progressive β-cell dysfunction, resulting in hyperglycemia and multiple long-term complications. In recent years, the role of the clinical pharmacist has

gained significant importance in diabetes management, especially in patient education, medication adherence, lifestyle modification, and prevention of complications. The findings of this study highlight the impact of structured pharmacist-led educational interventions on patient outcomes.

A Study was done in the In-patient department and Out-patient Department. Based on the Inclusion and Exclusion Criteria a total 305 prescriptions were collected for the evaluation.

A Total of 305 cases were reviewed from August 2024- August 2025, The Male criteria (54.8%) and Female Criteria (45.2%) More Patients were between age of (41-50 years 31.2%), and followed by 51-60 years (25.9%), 61-70 years (20.3%), 31-40 years(17.4%), 20-30 years(3.6%), and 71-80years (2%) were the least age groups.

Data analysis of gender distribution in present study showed that there was a male predominance in this study.Out of 305 cases analyzed there were 167(54.8%) were male and 138(45.2%) were Females. Similar male predominance was shown in studies carried out by Manjusha .S et al [14] were male are 57.14%than female are 42.86%In this study more number of patients belongs to age groups 20-30(3.6%) and few % were observed in the age group 70-80. In this study maximum number of patients belonged to Out-Patient department (52.45%). In our study, it was found that out of 305 prescriptions 58.2% were prescribed as monotherapy and 31.9% were prescribed as combination therapy and 9.9% were prescribed as Fixed dose therapy this findings are close to the study conducted by Manjusha .S et al 1458.01% are monotherapy 4.76% are fixed therapy.

In total 305 cases were 227(74.52%) cases controlled T2DM were 78(25.57%) cases are uncontrolled T2DM similar study conducted by Ankala Hemanth Reddy et al [15].

In this study among T2DM with other comorbid comditions are t2DM with Thyroid illness(26.4%) followed by T2DM with Hypertension were(35.29%) , T2DM with Dyslipidemia (9.9%) and T2DM with Other (28.4%).

In our Study among the all groups of anti diabetics glicazide is most commonly prescribed followed by Metformin. Least prescribed drug pioglitazone and Empagliflozin 17(2.7%). Most commonly prescribed insulin Inj. Human Mixtard 73(19.3%), least prescribed insulin Inj. Degludec 19(5.0%).

CONCLUSION

The main finding of the study relvealed that the pharmacist interventions have a positive effect on glycemic control as well as medication adherence. The pharmacist interventions can provide a caare to the patients with type II diabetes by reducing HbA1c, FBS,PPBS,improves the quality of life and self care activitires. In this study pharmacist who was a qualified educator used experties to help the patients by providing the knowledge about disease management, encouraging them to reach heir therapeutic outcomes and supporting them in adherence of the medications. The results of this study showed the therapeutic beneficiary of the many people with type 2 diabetes mellitus.

The findings of this study highlight the pivotal role of clinical pharmacists in improving the management of patients with type 2 diabetes mellitus (T2DM) through structured education and counseling. Diabetes is a lifelong condition that requires not only pharmacological intervention but also strong patient engagement in self-care, lifestyle modification, and adherence to prescribed regimens. Despite the availability of effective therapies, many patients fail to achieve optimal glycemic control due to inadequate knowledge, misconceptions about the disease, poor adherence, and limited awareness of lifestyle measures. This study clearly demonstrates that clinical pharmacist–driven educational interventions can address these challenges effectively. One of the most significant observations of this study was the improvement in patients' knowledge about diabetes, its complications, and its management strategies. Prior to intervention, many patients had only a partial understanding of their condition and were unaware of the long-term risks such as retinopathy, nephropathy, neuropathy, cardiovascular disease, and amputations. After receiving systematic education from clinical pharmacists, patients exhibited improved awareness about disease progression and the importance of maintaining target blood glucose levels. This increased awareness not only. Through repeated counseling, simplified explanations of drug regimens, reinforcement of dosing schedules, and discussion of side effects, clinical pharmacists were able to reduce medication-related concerns and improve compliance. Improved adherence translated into better glycemic outcomes in many patients, as reflected in clinical indicators such as fasting blood sugar and HbA1c reductions observed in similar studies.

previous international and Indian studies have consistently demonstrated the benefits of pharmacist interventions in diabetes care. A meta-analysis indicated that pharmacist involvement results in an average reduction of 0.5–1% in HbA1c levels. Another study conducted in a tertiary care hospital in India revealed significant improvement in patients' quality of life and medication adherence after structured pharmacist counseling.

The results of our study are comparable, indicating that pharmacist-provided education is a reproducible and cost-effective strategy for diabetes management in different healthcare settings.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

INFORMED CONSENT
Not Applicable.

ETHICAL STATEMENT
No human or animal studies were performed.

AUTHOR CONTRIBUTION
Both Authors contributed equally.

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