OPEN ACCESS

Research Article

Impact Of Pharmacist Intervention In Educating Type 2 Diabetes Mellitus Patients Having Lower Medication Adherence To Attain Higher Medication Adherence And Improved Quality Of Life: A Community Based Prospective Interventional Study

K. Vineetha[1], Abhirami Jayaram*, A. R. Shabaraya[2]

[1] Department of Pharmaceutics, Srinivas College of Pharmacy, Mangalore, Karnataka, INDIA.
[2] Department of Pharmacy Practice, Srinivas College of Pharmacy, Mangalore, Karnataka, INDIA.

ABSTRACT

Diabetes mellitus (DM) is a worldwide health concern that necessitates efficient management to mitigate complications. Despite the critical role of medication adherence, non-compliance persists, especially among Type 2 DM patients. This prospective interventional study in Dakshina Kannada, India, aimed to assess and improve medication adherence in 100 Type 2 DM patients through pharmacist interventions over six months (January to June 2022). Collected data included demographics, social and medical history. The Morisky Medication Adherence Scale (MMAS-8) assessed adherence, with pharmacist interventions comprising education, counseling, and patient information leaflets. Pre-intervention, 56% exhibited low adherence, correlated with age, gender, education, employment, and treatment duration. Post-intervention, high adherence rose from 16% to 35%, medium adherence from 28% to 54%, and low adherence decreased to 11%. Influential factors included age, gender, education, employment, and treatment duration. Pharmacist interventions significantly improved adherence, underscoring the pivotal role of education and counseling. This study provides insights for managing chronic conditions and underscores the importance of tailored interventions for diverse patient profiles.

INTRODUCTION

A metabolic condition characterized by abnormally high blood glucose levels is diabetes mellitus (DM). There are various types of diabetes mellitus (DM), such as type 1, type 2, gestational diabetes, neonatal diabetes, maturity-onset diabetes of the young (MODY), and secondary causes resulting from endocrinopathies, steroid

---

*Corresponding Author: Abhirami Jayaram
Address: *Department of Pharmacy Practice, Srinivas College of Pharmacy, Valachil, Farangipete, Mangalore-574143, Karnataka, INDIA.*
Email ✉ : abhiramijay102@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

use, etc. Type 1 diabetes mellitus (T1DM) and Type 2 diabetes mellitus (T2DM) are the two main subtypes of diabetes mellitus (DM). T1DM and T2DM are primarily caused by faulty insulin production and/or action, respectively. While T2DM is expected to affect middle-aged and older adults who have chronic hyperglycemia as a result of poor dietary and lifestyle choices, T1DM is thought to manifest in children or teenagers.1 Diabetes has a complex physiology and treatment plan that require multiple therapies to effectively manage the condition. Patient participation and diabetes education are essential to the management of diabetes. Patients with better outcomes include those who can exercise regularly, self-monitor their blood sugar, and control their diet (carbohydrate and total calorie restriction). 2 According to the World Health Organization, medication adherence is "the degree to which the person's behavior corresponds with the agreed recommendations from a health care provider".3 A key component of the successful use of pharmaceutical and non-pharmacological treatments, as well as the efficient management of chronic conditions, is adherence. However, medication non-adherence is an ongoing concern for people with chronic illnesses. 4 Good adherence is attributed to decreased mortality, less burden on finances, and lower chance of complications from diabetes. But a significant percentage of individuals with type 2 diabetes do not take their medications as advised; only roughly 60% of insulin doses and 67–85% of oral medicine doses are taken.5 Patient adherence is a crucial factor in drug effectiveness that is rarely addressed up front. This is particularly crucial in the case of diabetes because patient adherence to therapy is generally low.6 The five factors that the WHO has identified as having an impact on adherence are therapy-related, patient-related, socioeconomic, condition-related, and health system-related. Diabetes mellitus treatment non-compliance can lead to worsening of the condition, decreased functionality, a low quality of life, and an increased need for healthcare services such as admissions, hospital stays, and nursing homes. Assessing barriers to medication adherence and promoting it successfully require a good set of communication skills. Important first stages include gathering information, establishing a cooperative relationship, using open-ended inquiries, promoting education, and removing barriers.7 In India, the percentage of people with diabetes surged from 7.1% in 2009 to 8.9% in 2019. Studies show that Type 2 diabetes affects Indians living in urban areas with a prevalence of about 12.1%. It is six times more common in urban than rural areas. 8 Medication adherence is vital for the management of type 2 diabetes. Diabetes is an intricate medical disorder that is difficult to understand and treat by nature. In order to effectively manage their diabetes, the majority of patients must adhere to food, exercise, and complex medication regimens, which can lead to issues with medication adherence.9 Medication adherence is reported by only 60% of patients with type 2 diabetes who take insulin; one in three patients report missing at least one dosage of oral hypoglycemic medication per month. All things considered, the best possible pharmacological choices and adherence to prescribed dosages should be part of the treatment of type 2 diabetes, taking into account individual data from patients.10 Clinical pharmacist can approach adherence conversations strategically and the responsibilities include optimization of medical treatment to improve adherence to medication and by provide counseling.11 According to a systematic review, pharmacist interventions may help patients with type 2 diabetes adhere to their medication regimens in a variety of contexts, including in-person discussions, group activities, and phone follow-ups. Adherence to oral hypoglycemic medications has been shown to rise from 36% to 93%, while adherence to insulin is at 63 %.12

MATERIALS AND METHODS
Study design:
Prospective interventional study
Study site:

The study was conducted in Dakshina Kannada district, Karnataka, India.

Study duration:

The study was conducted for a duration of 6 months from January 2022 to June 2022

Sample size:

The study was limited to a sample of 100 based on the time schedule allotted for the project including other circumstances.

Ethical clearance:

The study protocol was approved by the Institutional Ethics Committee (IEC) of Srinivas Institute of Medical Science, Mukka, Mangaluru.

Study criteria:

Inclusion criteria:

Patients of either gender already diagnosed with Type 2 DM.

Patients' ≥ 18 years

Diabetic patients that are only on oral antidiabetic medications

Exclusion criteria:

Patients who were not willing to or unable to give consent to participate.

Patients that are terminally ill and/or having visual and hearing impairments.

Source of data:

Data was collected through a research constructed pre-validated questionnaire form and Medication adherence among diabetic patients was assessed by using Morisky Medication Adherence Scale (MMAS-8).

Study method:

Preparation of Inform Consent Form: Inform consent form was prepared in Kannada and English and same were used. Before selection of subjects the consent form was orally explained to the participants before filling it and nonverbally by taking help of caregiver and staffs who are well known of the subjects at the hospital and made them understood. In the study only the participants willed to fill ICF were included. Patient categorization: Total MMAS-8 scores can range from 0 to 8 and have been categorized into three levels of adherence: high adherence (score = 8), medium adherence (score of 6 to < 8), and low adherence (score< 6). Providing intervention: After categorizing patients, Patient information leaflets (PILs) was provided for diabetic patients that belonged to medium adherence group, whereas for patients in low adherence group the patient information leaflets (PILs) was provided along with patient counselling using teach back method. Post educational intervention assessment: Diabetic patients who scored low and medium from MMAS, has been further considered for the study. The study design was divided into pre and post educational intervention, where the post educational intervention assessment was done after 1 month using the same study questionnaire and MMAS-8.

Data analysis:

Data was analyzed using Social Science Statistics software. Association of gender with adherence was done using student t-test. Karl Pearson correlation was used to observe association of age with adherence. Education level, employment status and duration of treatment was associated with adherence using one way ANOVA test.

RESULTS

Socio-Demographic Details

The study was conducted in 100 patients, containing equal number of male (50%) and female (50%) participants. Out of 100 participants, 13 were belonged to the age group of 30-44 years, 54 belonged to the age group of 45-60 years and 33 were above 60 years of age. Majority of the participants (53%) had completed college level of education, 23 (23%) participants had secondary level of education, 12 (12%) had completed primary level of education and 12 (12%) were illiterate. 62 (62%) of the participants were employed, (23%) were unemployed and 15 (15%) were retired. (Table 1)

Table 1: Demographic details of the patients

Demographic characteristics	Frequency (%) (N=100)
Gender	
Male	50 (50%)
Female	50 (50%)
Age Group	
30-44	13 (13%)
45-60	54 (54%)
60 and above	33 (33%)
Employment Status	
Employed Unemployed	62 (62%)
Retired	23 (23%)
	15 (15%)
Level of Education	
Illiterate	12 (12%)
Primary	12 (12%)
Secondary	23 (23%)
College Level	53 (53%)

Figure 1: Social history

Figure 2: Duration of treatment

Social and Medical History

Out of 100 participants, 20 participants had history of alcohol consumption only, 9 participants had history of smoking and 8 had both. In the study group, 40 participants (40%) have been on medication for more than 5 years; meanwhile 37 participants (37%) had treatment history of 1-5 years and 23 (23%) were on medication for less than one year. The social history and duration of treatment of the participants are depicted in Figure 1 and Figure 2 respectively.
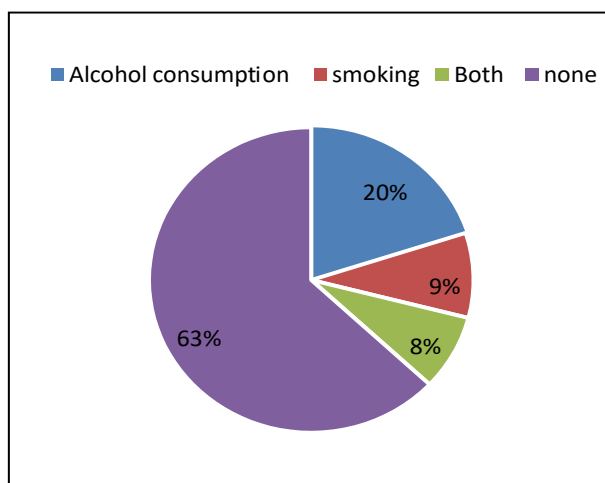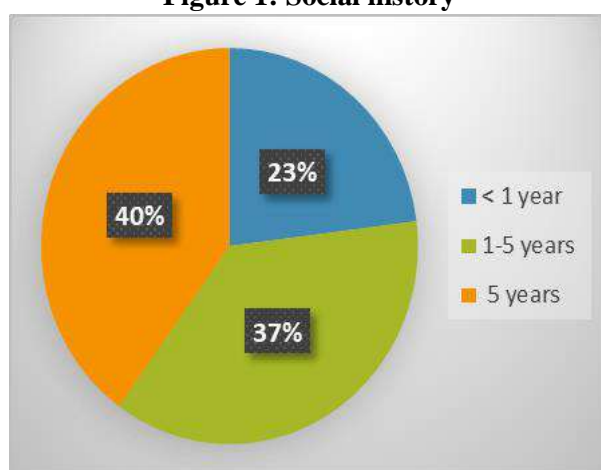
Questions	PRE		POST	
	Yes	No	Yes	No
Do you sometimes forget to take the medication?	72(72%)	28(28%)	44(44%)	56(56%)
People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take the medications?	52(52%)	48(48%)	7(7%)	93(93%)
Have you ever cut back or stopped taking the medications without telling the doctor, because you felt worse when you took it?	38(38%)	62(62%)	3(3%)	97(97%)
When you leave/travel home, do you sometimes forget to take the medication?	53(53%)	47(47%)	16(16%)	84(84%)
Did you take the medicine yesterday?	90(90%)	10(10%)	94(94%)	6(6%)
When you feel like the health condition is under control, do you sometimes stop taking you medications?	66(66%)	34(34%)	16(16%)	84(84%)
Taking tablets every day is really unconvincing for some people; Do you ever feel hassled about sticking to the treatment plan?	56(56%)	44(44%)	18(18%)	82(82%)
How often do you have difficulty remembering to take medicine? All the time	2(2%)		1(1%)	

Usually	15(15%)	1(1%)
Sometimes	29(29%)	15(15%)
Once in a while	26(26%)	27(27%)
Rarely/Never	28(28%)	56(56%)

Adherence pattern (pre intervention)

From the study population, mean score of MMAS-8 was found to be 4.69 before the intervention. Majority of participants were found to have low adherence (56%). The study revealed that 16 (16%) participants had high adherence and 28 (28%) had medium adherence. The average adherence score for females was 3.855 whereas for males it was 5.53.

Adherence pattern (post intervention) After the intervention, 35 subjects were classified into highly adherence group, 54 subjects into medium adherence group and 11 subjects in low adherence group respectively. (Figure 3).
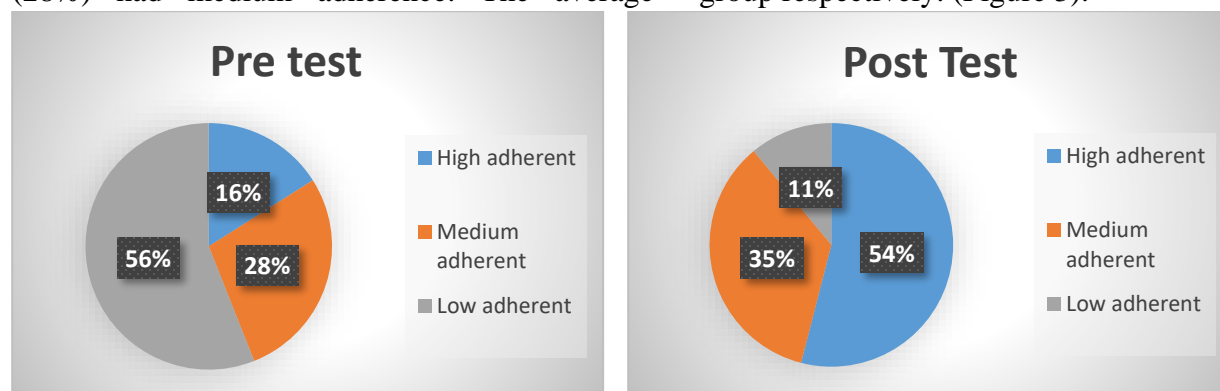

Figure 3: Assessment of medication adherence using Morisky scale pre and post test

**Table 3: Association of level of medication adherence with demographic details (pre)**

Level of Medication Adherence N=100		High(N=16)	Medium (N=28)	Low(N=56)	P value
Age	30-44 Years	3(8±0)	8(6.84±0.29)	2(4.25±1.41)	**<0.01**
	45-60 YEARS	11(8±0)	16(6.76	27(3.20±1.77)	
	>60 YEARS	2(8±0)	±0.23)	27(2.12±1.50)	
Gender	Male	11(8±0)	20(6.77±0.30)	19(2.80±1.57)	<0.01
	Female	5(8±0)	8(6.71±0.31)	37(2.67±1.81)	
Education	Illiterate	0	0	12(1.625±1.44)	<0.01
	Primary	**0**	1(7±0)	11(1.65±0.76)	
	Secondary	**0**	7(6.92±0.12)	16(3.28±1.72)	
	College	16(8±0)	20(6.68±0.32)	17(3.64±1.65)	
Employment Status	Employed	15(8±0)	21(6.78±0.26)	20(3.83±1.61)	**<0.01**
	Unemployed	0	3(6.91±0.14)	26(2.09±1.62)	
	Retired	1(8±0)	4(6.5±0.45)	10(2.1±1.00)	
Duration of treatment	< 1 Year	7(8±0)	12(6.79±0.29)	4(3.5±1.65)	**<0.01**
	1-5 Years	5(8±0)	9(6.86±0.13)	23(2.84±1.72)	
	> 5 Years	4(8±0)	7(6.57±0.40)	29(2.50±1.75)	

It was observed that the level of the adherence of patients was significantly associated with the age, gender, education, employment status and duration of treatment (Table 3).

Table 4: Distribution of respondents on the basis of MMAS-8 Score

Category	Pre-test	Pre-test %	Post-test	Post-test %
High adherence (=8)	16	16%	35	35%
Medium adherence (6-<8)	28	28%	54	54%
Low adherence (<6)	56	56%	11	11%
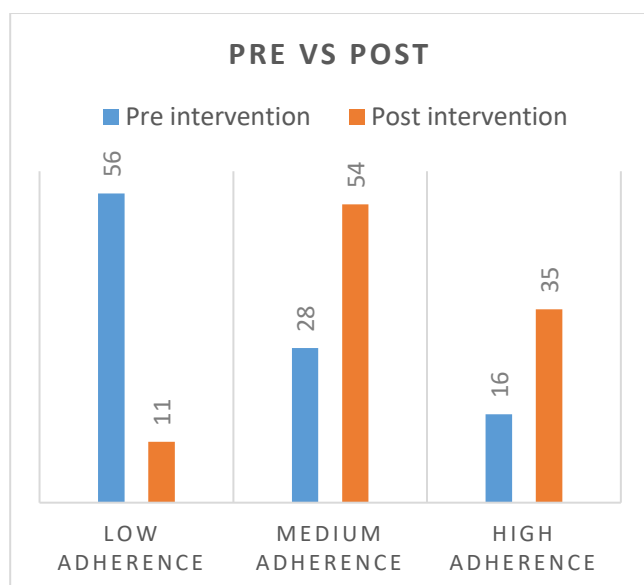
Figure 4: Proportion of participants according to their adherence (pre vs post)

DISCUSSION

The purpose of the preliminary study was to evaluate the patients' sociodemographic profile and adherence to their prescribed medication regimen. PILs were used to educate the medium adherence group, whereas PILs, pill cards, SMS alerts, medication adherence apps (Medication reminder and tracker) and patient counseling were used to educate the low adherence group. The aim was to assess the impact of pharmacist intervention on their medication adherence. According to this study, females were associated with low adherence which could be attributed to the fact that women in Dakshina Kannada were engaged in household work. There was significant association between education level and adherence (p<0.01). This association was brought about by the fact that education level has a beneficial impact on the amount of information patients will have, which will ultimately result in greater medication adherence. In a study conducted by Gebre Teklemariam Demoz et al., it was observed that or adherence was seen in females and participants with no formal education. 13 Non-adherence to medication has been the problem in the management of chronic illness like DM. Adherence to medication is the prior factor for the management of DM. With increasing need for long-term adherence to treatment, a reliable and valid measure of patient adherence that can be easily administered is needed. When appropriate, tailored interventions can be implemented, such as education of the patient regarding DM care, correcting misunderstandings and incorrect beliefs regarding DM treatment, reducing stress and improving coping skills among patients, or establishing a treatment regimen to foster medication adherence. In the study, MMAS-8 was used to assess the medication adherence of the subjects. A pre-test was conducted to assess the Medication adherence in diabetic patients using MMAS-8 and the results revealed that more than half of the subjects had low adherence. The relationship of medication adherence with age was determined by the Pearson correlation coefficient which was calculated to be -0.467 with $p < 0.001$ which tells us that there is a negative correlation between age and adherence. As age increases the adherence to medication decreases which can be owed to decrease in cognitive function as well as memory problems. A recent study conducted by Ishtiakul Islam Khan et al., stated that, participants aged 60 years or more had 3.83 times (95% CI:1.35-10.85; p=0.012) higher odds of noncompliance than the other participants.14 Although multifaceted interventions were found to be more effective than single-strategy approaches, and as noted in one recent review, interventions targeting medication side effects may be of particular value, a closer look at the wide variety

of intervention contents revealed no single form of intervention to be consistently effective for improving adherence. The combined intervention strategy involving educational and behavioral interventions was the most popular strategy used by the pharmacist, followed by the educational intervention strategy. This finding is also supported by the fact that education is the most common method used by pharmacists to enhance medication adherence. This study showed that education was usually integrated into each intervention strategy and is seen as a cornerstone to improve medication adherence by involving the health care professional and the patient. This finding is in line with results of prior systematic reviews, which is conducted by Bobby Presley et al., especially about the individual type of intervention.15

CONCLUSION

This prospective interventional study focused on medication adherence in patients with Type 2 diabetes mellitus (DM). The study, conducted in Dakshina Kannada district, India, involved 100 participants and utilized the Morisky Medication Adherence Scale (MMAS-8). Results indicated a concerning level of low adherence (56%) among participants pre-intervention. Following pharmacist interventions, including education and counseling, post-intervention assessments revealed significant improvements. High adherence increased from 16% to 35%, medium adherence from 28% to 54%, and low adherence decreased from 56% to 11%. Factors influencing adherence included age, gender, education, employment status, and duration of treatment. The study underscores the critical role of pharmacist interventions in enhancing medication adherence among Type 2 DM patients, offering valuable insights for clinical management and potential application to other chronic condition

SUMMARY

The present study was a prospective interventional study with the aim to evaluate the impact of pharmacist intervention for improving medication adherence in patients with type 2 DM by assessing medication adherence using questionnaire and Morisky scale. The study was conducted for 6 months which included a total of 100 type 2 DM patients, with or without co-morbidities. The study population included subjects who were enrolled from different areas of Dakshina Kannada district in which participants of males and females were 50% each. The highest percentage of age group was 45-60 years (54%) followed by >60 years (33%). Among the 100 subjects with type 2 DM whose adherence was analyzed using MMAS-8 scale, it was found that 16 of them showed high adherence, 28 were medium adherent and 56 were low adherent to their medications. Once the study subjects were classified into high adherent, medium adherent and low adherent groups, they were educated and provided with patient information leaflets which included disease related and diet related information on type 2 DM as well as different ways to adhere to the treatment regimen was provided. The subjects were followed-up after 1 month and their knowledge and awareness on type 2 DM and adherence to therapy was rechecked using the same questionnaire and adherence scale used for the initial assessment. This helped in assessing the improvement in adherence to medications and we achieved considerably good results. Results are clinically important in several ways. Firstly, they show the various factors contributing to non-adherence. These results also emphasize the importance of correctly identifying whether the mode of non-adherence is poor execution or non-persistence because the necessary intervention will differ substantially. These findings have implications for practical clinical management of treatment of type 2 DM, which are possibly also applicable to other long term drug treatments.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

ABBREVIATION

DM: Diabetes mellitus; MA: Medication adherence; WHO: World Health Organization; T2DM: Type 2 Diabetes Mellitus; MMAS: Morisky Medication Adherence Scale; RCT: Randomized controlled trial; SIMS&RC: Srinivas Institute of Medical Science and Research Centre; PIL: Patient Information Leaflets

REFERENCES

1. Amit S, Priyanka B. Diabetes Mellitus. StatPearls Publishing. 2022; 39(6): 243-56.

2. A Ramachandran. Know the signs and symptoms of diabetes. Indian J Med Res.2014; 140(5): 579–81.

3. Brown MT, Bussell JK. Medication adherence: WHO cares? In Mayo clinic proceedings. 2011; 86(4):304-14.

4. Abdul M, Muhammad Rehman, Iltaf H, Imran, Saleem MU, Saeed H. The Impact of Treatment Adherence on Quality of Life Among Type 2 Diabetes Mellitus Patients – Findings from a Cross-Sectional Study. Patient Prefer Adherence. 2021; 15: 475–81.

5. McGovern A, Tippu Z, Hinton W, Munro N, Whyte M, De Lusignan S. Systematic review of adherence rates by medication class in type 2 diabetes: a study protocol. BMJ Open. 2016 ;6(2)

6. Currie CJ, Peyrot M, Morgan CL, Poole CD, Jenkins-Jones S, Rubin RR, Burton CM, Evans M. The impact of treatment non-compliance on mortality in people with type 1 diabetes. Journal of Diabetes and its Complications. 2013 May 1;27(3):219-23.

7. Burkhart PV, Sabaté E. Adherence to long-term therapies: evidence for action. J Nurs Scholarsh. 2003;35(3):207-11

8. Pradeepa R, Mohan V. Epidemiology of type 2 diabetes in India. Indian J Ophthalmol. 2021; 69(11):232-38.

9. SR Mehta, AS Kashyap, S Das. Diabetes Mellitus in India: The Modern Scourge. Med J Armed Forces India. 2009;65(1):50-4

10. Polonsky WH, Henry RR. Poor medication adherence in type 2 diabetes: recognizing the scope of the problem and its key contributors. Patient preference and adherence. 2016 Jul 22:1299-307.

11. Besemah NA, Sartika RAD, Sauriasari R. Effect of Pharmacist Intervention on Medication Adherence and Clinical Outcomes of Type 2 Diabetes Mellitus Outpatients in Primary Healthcare in Indonesia. J Res Pharm Pract.;9(4):186-195

12. Sapkota S, Brien JA, Greenfield J, Aslani P. A systematic review of interventions addressing adherence to anti-diabetic medications in patients with type 2 diabetes—impact on adherence. PloS one. 10(2):e0118296.

13. Demoz GT, Wahdey S, Bahrey D, Kahsay H, Woldu G, Niriayo YL et al., Predictors of poor adherence to antidiabetic therapy in patients with type 2 diabetes: a cross-sectional study insight from Ethiopia. Diabetol Metab Syndr. 2020;.

14. Khan II, Pulock OS, Pinky SD, Barua B, Dola TA, Chowdhury P, Seal T, Salekin S, Quader TU, Mitra A, Chowdhury MH. Treatment noncompliance level among patients with type 2 diabetes mellitus: A hospital based cross-sectional study in Bangladesh. Plos one. 2022;17(9).

15. Presley B, Groot W, Pavlova M. Pharmacy-led interventions to improve medication adherence among adults with diabetes: a systematic review and meta-analysis. Research in Social and Administrative Pharmacy. 2019 Sep 1;15(9):1057-67