

Association between Medication Adherence, Glycated Hemoglobin (HbA1c) Levels, and Glycemic Control in Patients with Type 2 Diabetes Mellitus in a Tertiary Care Teaching Hospital

Anil Kulshrestha¹, Anand Jitendrakumar Someshvar²

¹Assistant Professor, Department of General Medicine, SAL Institute of Medical Sciences, Ahmedabad, Gujarat, India

²Assistant Professor, Department of Biochemistry, Dr. M.K. Shah Medical College and Research Centre, Ahmedabad, Gujarat, India

Received: 25-04-2023 / Revised: 23-05-2023 / Accepted: 26-06-2023

Corresponding Author: Dr. Anil Kulshrestha

Conflict of interest: Nil

Abstract:

Introduction: Medication adherence is the extent to which a patient's medication-taking behaviour coincides with intention of the physician. This study aims at the impact of medication adherence on glycated haemoglobin (HbA1C) levels in type -2 diabetes mellitus patients in tertiary care teaching hospitals. The main objective of the study is to assess medication adherence by a Morisky questionnaire and identify factors linked with poor adherence in patients with type 2 DM. To improve the clinical outcomes in diabetes patients who are visiting the hospital by patient medication counselling.

Methods: 110 diabetic individuals participated in a 6-month prospective observational research to evaluate medication adherence. An eight-item Morisky Medication Adherence Questionnaire with eight questions was used to measure adherence. From patient medical records, additional information was gathered, including patient demographics, family history, length of diabetes mellitus, smoking and alcohol use, comorbidities, complications, and therapy.

Results: 10 of the 110 individuals who were enrolled in the trial do not regularly attend follow-up appointments. They were assessed for their adherence rate in Follow up. Nine patients in the study were poor adherent, whereas 17 patients had high adherence levels, and about 74 patients in the study had medium adherence in follow-up.

Conclusion: Adherence to medication in T2DM patients in the tertiary care hospital was found to be medium. The major barriers identified in our study like forgetfulness, inadequate knowledge regarding drug therapy, the nature of a busy schedule, lack of knowledge about the disease can be overcome by continuous follow-up and patient education by the pharmacist. Pharmacist-patient participation has significantly improved adherence and glycaemic control.

Keywords: Type 2 diabetes mellitus, adherence, and glycemic control.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The World Health Organization defines medication adherence as "the extent to which an individual's behavior aligns with the established guidelines from a healthcare provider." Only by following the entire suggested regimen will medications and lifestyle modifications to control type 2 diabetes and related illnesses be effective. According to data from the World Health Organization (WHO), only about 50% of people in affluent nations stick to long-term treatment for chronic illnesses.

Because adherence declines most quickly during the first six months of therapy, patients with chronic disorders often have lower adherence rates than those with acute conditions. This is related to the long-term nature of chronic diseases. In addition to

having a negative effect on health outcomes, such low adherence also significantly raises healthcare expenses. Therefore, adherence and the use of the right drugs should be part of the entire therapy of type 2 diabetes. Five sets of factors—referred to as "dimensions" by the WHO—interact to determine adherence, which is a multifaceted phenomenon. Social and economic, educational, interaction with health care providers, disease condition, therapy, and patient-related factors are some of these characteristics.

The prevalence of diabetes has increased more quickly in low- and middle-income nations over the last ten years than in high-income nations. [2]. By 2030, there will be 438 million adults between the

ages of 20 and 70, up from 285 million in 2010. Although type 2 diabetes is extremely costly for all countries, developing nations are most affected, with middle- and low-income countries accounting for 80% of cases.

All Asian countries have high prevalence estimates of diabetes and impaired glucose tolerance (IGT), and these rates are predicted to rise over the next 20 years. [3]. Up to 79.4 million people in India are expected to have diabetes mellitus by 2030. India's future is currently uncertain due to the possible strain that diabetes could place on the nation. [4].

Aim of the study: To evaluate the impact of medication adherence on Glycated haemoglobin (HbA1c) levels in type-2 diabetes mellitus patients.

Objectives of the study

The key objectives of the study include:

- To determine the variables associated with poor adherence in type 2 diabetic patients.
- To enhance clinical results by providing medication counseling to hospitalized diabetic patients.

Methodology

Study period: Study was conducted for a period of six months.

Source of Data:

- Demographic characteristics of the patients from the case sheets.
- Data would be collected from treatment charts, prescriptions and case sheets, questioner forms, participants included in the study

Sample Size: All the patients were recruited from the Outpatient department of general medicine diagnosed with type 2 diabetes and the sample size is 100 patients.

Inclusion Criteria: The study includes if the subjects satisfy the following criteria:

1. Patients of age >18 years of both sexes were included in the study.
2. Patients who are attending their regular follow-ups.
3. Patients who are willing to give their informed consent.

Exclusion Criteria:

1. Pregnant women, lactating women, and paediatrics
2. Patients who are with iron deficiency anaemia and using drugs like glucocorticoids.
3. Patients with recent blood loss, sickle cell anaemia, thalassemia.
4. Patients were not willing to participate in the study

Statistical Analysis: Results were summarized using EXCEL form and data analysis was carried out by differentiating based on age, gender, duration of diabetes, the habit of smoking & alcohol, educational status, diabetes with comorbidities & complications and calculating the adherence rate and glycaemic control. Data were expressed in percentage. Chi-square test was applied to find the level of significance, $P < 0.005$ was fixed as statistically significant. Graph pad prism 7.05 was used to assess the level of significance

Results

The total sample size of the present study for six months was 110. The total no of patients willing to participate was 100 and 10 patients are not attended for their regular follow up

Percentage Distribution Based on Gender and age: Most of the 100 patients were in the 48–57 age range, with 40 percent of them being male (21), female (nineteen). Subsequently, the age group of 58-67 is 24 (24%), with 11 men and 24 females. The other age groups are 28–37 is 2 (2%), >67 is 16 (16%), and 38–47 is 18 (18%). In the 100-patient sample, men made up the bulk of the patients (55%) compared to women (45%). (As seen in image 1)

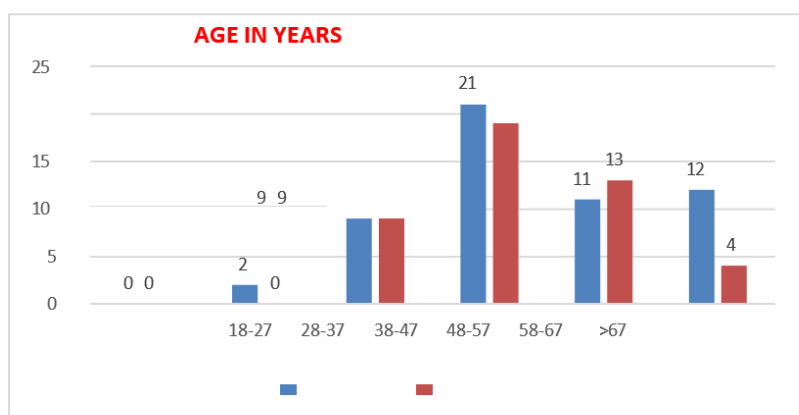


Figure: 1: Graphical representation of percentage distribution based on gender and age

Distribution of Gender-Based on Education: Illiterate (65%) are more when compared to the literates (35%).

Table 1: Distribution based on Education

S. No.	Educational status	No. of Patients	Percentage
1	Literate	35	35%
2	Illiterate	65	65%

Patients based on social history: The no of patients who are associated with Alcohol and smoking (both) are 17(17%). Among the total sample, alcoholic patients are 15(15%), Smoking 1(1%).

Table 2: Percentage distribution of patients based on social history

S. No.	Social history	No. of Patients	Percentage
1	Smoking	1	1%
2	Alcohol	15	15%
3	Both	17	17%
4	None	67	67%
	Total no. of patients	100	100%

Percentage Distribution Based on Co-Morbidities: When compared to the other comorbidities, the majority of the 100 patients in the sample have hypertension (50 percent), followed by hypertension and dyslipidemia (11 percent), hypertension and cerebrovascular accident (eight percent), hypertension + CVA + dyslipidemia (4 percent), and hypertension + CVA + CKD (2 percent).

COPD, alcoholic liver disease, CHF, and CAD are among the additional comorbidities, which total 7 percent.

Table 3: Percentage distribution based on co-morbidities

S. No.	Comorbidities	No. of Patients	Percentage
1	Hypertension	50	50%
2	Hypertension+ Dyslipidemia	11	11%
3	Hypertension +CVA	8	8%
4	Hypertension+ CVA+ Dyslipidemia	4	4%
5	Hypertension+CVA+ CKD	2	2%
6	Others	7	7%
7	None	18	18%
	Total no of patients	100	100%

Percentage Distribution based on the duration of diabetes: The participants were differentiated into groups depending on the number of years they had been suffering from diabetes. The majority of the study sample had been diagnosed with diabetes for the past 5-10 years is 49(49%) with the second-highest representation being in the 1-5 years is 33(33%) category, remaining no of patients are categorized under the duration of >10 years is 18 (18%). (Shown in figure 2)

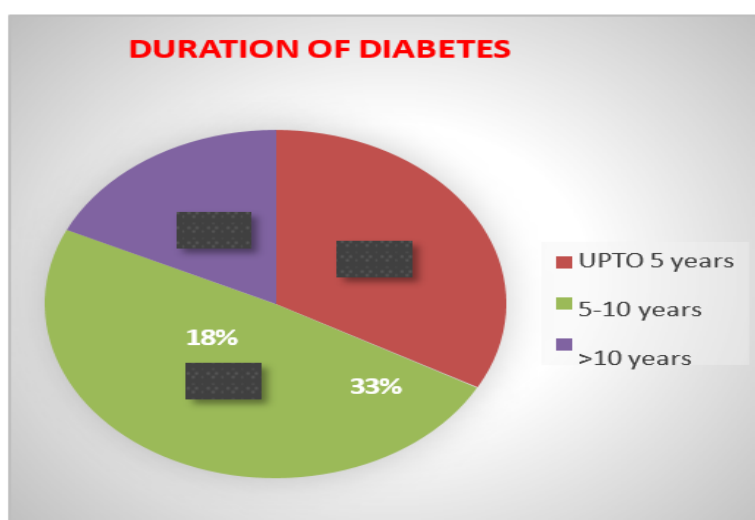


Figure 2: Graphical representation of percentage distribution based on the duration of diabetes

Distribution of Patients Based on Medication regimen: Among the total 100 sample size, the majority of the patients are treated with the medications such as oral hypoglycemic agents are 86(86%), which are followed by the patients who are using the insulin are 8(8%), patients who are having both (insulin and OHA agents) is 6(6%).

Distribution of patients based on glycaemic control: By calculating the patients' glycated hemoglobin levels (HbA1C), blood glucose levels can be determined. After the follow-up, 81

individuals had control of their HbA1C levels compared to the baseline, with the majority of the 100 patients in the sample size falling into the Mild category (6.5%–7.0%). After the follow-up, 18 patients in the moderate group (7.0%–7.5%) had control of their HbA1C levels, whereas 1 patient in the severe group (>7.5%) had control of their HbA1C levels.

According to table 4, the p-value, which is 0.0027 for patients having baseline and follow-up HbA1c readings, is considered significant.

Table 4: Distribution of patients based on Glycaemic Control

S. No.	HBA1C	Baseline	1 ST Follow Up	P-value
1	Mild (6.5%-7.0%)	59	81	Significant: YES P-value:<0.0027
2	Moderate (7.1%-7.5%)	37	18	
3	Severe (>7.5%)	4	1	
	Total no. of patients	100	100	

Distribution of Patients Based on Medication Adherence: Our study results show that the majority of patients are in the medium adherence by providing medication counselling to those patients adherence level increased from baseline (42 patients) to follow up (74 patients). Higher adherence patients are increased from baseline (7 patients) to follow up (17 patients). In the low adherence number of patients are decreased from baseline (51 patients) to follow up (9 patients). The p-value is said to be significant for the patients with baseline and follow up of the medication adherence, where the value is 0.0001.

Discussion

After receiving follow-up counselling regarding medication management, the majority of patients in this study had medium adherence (74%), followed by those with better adherence (17%), and patients with lower adherence (9%). The findings of our study were compared to those of Divya S. et al. Illiteracy can somewhat impede comprehension of illness and medicine. Research indicates that individuals who lack understanding about their ailment and are unable to comprehend drug therapy have poor adherence rates. [7]. Forty percent of the patients in this study were in the 48–57 age range, followed by the twenty-four percent in the 58–67 age group. Males make up 56% of them, compared to 44% of females. The findings of our investigation were comparable to those of D. Sunanda et al. T2DM patients with comorbidities typically take more medications from various pharmacological classes, including antiplatelet, lipid-lowering, and hypertensive medications. One of the possible contributing factors to non-adherence may be this intricate treatment plan. [8] Our study results were compared V. Karthikeyan et.al Treatment of comorbid diseases is really a challenging factor in the therapeutic management of type-2DM diabetes. Among the study population, 20.00 % of patients were having hypertension along with diabetes

(DM+HTN) then followed by DM +HTN+ CAD (12.17 %). The majority of patients (291 patients; 84.34%) were prescribed with OHA alone followed by 33 patients (9.56%) with (insulin + OHA) and 21 patients (6.08%) were prescribed with only insulin. Among patient-related barriers, forgetfulness was reported by 36.52% of patients followed by low literacy (19.13%), Stopped medications on being well (6.95%), clinical waiting for longer periods (5.12%) and frequent travelling by 2.60% of patients. [9] In our study most of the patients are having hypertension along with diabetes is (50%) when compared with other comorbidities and the majority of the patients are treated with the oral hypoglycaemic agents are (86%) and insulin using patients are (8%) and both are (6%). most of the patients have forgetfulness (46%), lack of knowledge regarding disease along with the forgetfulness (21%), nature or busy schedule of work along with travel a lot (19%), forgetfulness with the inadequate knowledge regarding therapy (16%), no of medications along with the frequency of dosing (12%), decision to omit is (10%), these are the major factors are identified in the diabetic patients for non-adherence.

The findings of our investigation were comparable to those of Phei Ching Lim et al. According to the UKPDS study, there is a 21% risk reduction for any diabetes-related endpoint and a 37% risk reduction for microvascular complications for every 1% decrease in mean HbA1c. The mean HbA1c reduction among patients in the additional DMTAC program was 0.9%, which is indirectly linked to a 19% risk reduction for any diabetes-related endpoint and a 33% risk reduction for microvascular sequelae such as retinopathy and nephropathy. Consequently, this has indirectly enhanced patients' quality of life. [10].

Conclusion

In our study, the results showed that control of glycosylated haemoglobin levels from baseline to the follow-up. In the mild group, more no of patients having controlled hba1c levels from baseline (59 patients) to follow up (81 patients) likely in the moderate and severe groups. The p-value is said to be significant (value is <0.0027) from the baseline to the follow up of hba1c values for the type 2 diabetic patients. There was a significant relationship between the adherence level of the patients from baseline to the follow up (whereas the p-value is <0.0001). More patients are recorded in the low adherence before the baseline (51 patients). More number of patients are in the medium adherence level after the follow up (74 patients). This indicates that patients who strictly adhere to medication therapy and awareness of their disease condition have satisfactory adherence levels.

References

1. Medication Adherence: A Literature Review. Charlotte A. Kenreigh, PharmD, and Linda Timm Wagner, PharmD. www.medscape.com, 2005.
2. Luis-Emilio García-Pérez, María Álvarez, Tatiana Dilla. Adherence to Therapies in Patients with Type 2 Diabetes. *Diabetes Ther.* 2013 Dec; 4(2): 175–194.
3. Antonia Kalogianni. Factors effecting patient adherence to medication regimen. *Health science journal*, 2011;5(3):157- 158.
4. American Diabetes Association. *Diabetes Care.* 2014; 37: S81- S90.
5. World Health Organization. Global report on diabetes. http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257_eng.pdf (accessed 2017 Jan 27).
6. Ramachandran A, Snehalatha C, Shetty AS, Nandita A. Trends in prevalence of diabetes in Asian countries. *World Journal of Diabetes.* 2012; 3(6):110-117. doi:10.4239/wjd.v3.i6.110.
7. Divya S, Pratibhanadig. Factors contributing to non-adherence to medication among type 2 diabetes mellitus in patients attending tertiary care hospital in south India. *Asian J Pharm Clin Res*, 2015;8(2):274-276.
8. D. Sunanda, K. Sindhuja. Evaluation of Medication Adherence in Diabetes Mellitus Patients by Using 8- Item Morisky Scale. *JMSCR* 2015;03(04):5439-5454.
9. V. Karthikeyan, S. Madhu Sudhan. Intervention to improve adherence to Type 2 Diabetes mellitus subjects in rural teaching hospital. *Der Pharmacia Lettre*, 2016;8 (1):361-367.
10. Phei Ching Lim, Kelvin Lim, Zubaidah Che Embee. Study investigating the impact of pharmacist involvement on the outcomes of diabetes medication therapy adherence program Malaysia. *Pak. J. Pharm. Sci.* 2016;29(2):595-601.