

The Impact of Visit Frequency and Treatment Intensification on Glycemic Control in Patients with Type 2 Diabetes Mellitus: A Two-Year Retrospective Cohort Study from a Private Clinic

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Abstract

Background: Diabetes mellitus is a chronic illness that needs ongoing care to prevent complications from developing and to treat them when they do. Blood glucose levels should ideally be kept close to normal (HbA1c <7%). The ADA's Standards of Care in Diabetes—2025 supports less stringent HbA1c targets for older adults. One of the most prevalent non-communicable diseases in our area is diabetes. Due to easier access to doctors, drugs, and lab testing, the majority of people seek care in private clinics or hospitals. This puts financial strain on patients, decreasing their adherence to clinic appointments and limiting their capacity to pay for more intensive treatment, which also poses a problem for doctors. **Objectives:** This study aims to find the association between clinic visit frequency, treatment intensification, and glycemic outcomes in private clinic settings. **Materials and Methods:** This is a retrospective cohort study conducted in our private clinic, Slemani, Kurdistan Region, Iraq, between 01 January 2023 to 01 January 2025. Treatment intensification is defined as when the addition of a new antidiabetic drug class starts for better HbA1c control. Visit frequency is defined as "adequate" when follow-up was at least 4 visits / 2 years. **Results:** A total of 617 patients were screened who attended the clinic during the period of the study between 01 January 2023 to 01 January 2025. Out of this, only 221 patients fulfilled the inclusion criteria. During follow-up, 194 patients (87.7%) underwent treatment intensification. Treatment intensification was significantly associated with final HbA1c ($p < 0.001$), demonstrating that it is an important predictor of glycemic outcomes in this cohort. In contrast, visit frequency was not statistically significant ($p = 0.803$), indicating that the number of visits alone did not significantly influence final HbA1c levels. **Conclusion:** In this cohort, the frequency of clinic visits during the follow-up period was not significantly associated with achieving the target HbA1c level. This may suggest that the number of visits alone is insufficient to improve glycemic control without effective therapeutic interventions or patient engagement. In contrast, treatment intensification showed a significant association with achieving HbA1c targets.

Keyword: Type 2 Diabetes, Glycemic control, Clinic visit frequency, Treatment intensification.

Introduction

Hyperglycemia is a hallmark of type 2 diabetes mellitus (T2DM), which is caused by a combination of insufficient insulin production and resistance to insulin action [1]. Diabetes mellitus is a chronic condition that necessitates ongoing medical care to prevent and treat its debilitating effects [2]. According to the 10th edition of the International Diabetes Federation

Diabetes Atlas, which was released in December 2021, 10% of adults worldwide suffer from diabetes. While gains are anticipated globally, the most significant expansion is anticipated in Africa, the Middle East, and Southeast Asia [3]. Blood glucose levels should ideally be kept close to normal (HbA1c levels <7%). For older persons with diabetes, less strict HbA1c targets are supported by the American Diabetes Association

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Standards of Care in Diabetes-2025 [4]. In our area, diabetes is regarded as one of the most prevalent chronic and non-communicable diseases [5]. Regular attendance at diabetes care clinics is associated with improved management of diabetic mellitus (DM) [6]. Many individuals with type 2 diabetes mellitus do not obtain timely treatment intensification and do not attain glycaemic control as soon as they are diagnosed. This might be partially caused by clinical inertia, which is the inability of medical professionals to start or step up treatment when necessary [7]. Since private clinics and/or hospitals offer greater access to specialists, better quality and quantity of pharmaceuticals, and laboratory testing, the majority of people in our area go there [8]. Patients experience financial strain as a result, making it difficult for them to maintain consistent clinic appointments and to pay for more intensive therapy. This is also a barrier on the part of the physician [9]. In this study, our aim is to find the association between clinic visit frequency, treatment intensification, and glycaemic outcomes in private clinic settings.

Materials and Methods

This is a retrospective cohort study conducted in our private clinic, Sulaymaniyah, Kurdistan Region, Iraq between 01 January 2023 to 01 January 2025. The reason for selecting this period is the fact that our clinic started to open in 2020. This was the time of The Coronavirus Pandemic and majority of chronic disease patients were unable to attend outpatient clinics up to 2023 when the pandemic started to decline.

Inclusion Criteria

- Age ≥ 18 years
- Diagnosed T2DM
- At least two HbA1c measurement

Additional Criteria for Time to Intensification Analysis

- At least one HbA1c $> 7\%$
- At least one follow-up visits

Exclusion Criteria

- Type 1 diabetes
- Gestational diabetes
- Incomplete medication or visit records

HbA1c chosen as the main follow up parameter for diabetes control. Laboratory machine used was Roche (Cobas C501). A marker of HbA1c $< 7.5\%$ was selected as the control of diabetes instead of the internationally- agreed $< 7\%$ in order to avoid confusion regarding patients with hypoglycemic risk that needed less stringent HbA1c level.

Treatment Intensification defined as when addition of new antidiabetic drug class started for better HbA1c control.

Visit Frequency defined as “Adequate” when follow-up was at least 4 visits / 2 years. This was decided because it is customarily that diabetic patients need the minimum of 2 visits per a year as a follow up. The total number of clinic visits during the 2-year study period was recorded for each patient. Patients with fewer than four visits were classified as having inadequate follow-up. Data collected from our clinic’s electronic system of patient registry and included: Age, Sex, Diabetes duration, BMI, Baseline HbA1c, Baseline insulin use, Number of antidiabetic medications, Structured diabetes education, Visit frequency category, Time to treatment intensification, Final HbA1c that is the last clinic visit during the study period, Time to treatment intensification, Education given to the patient regarding diabetes, Number of medications

Statistical analysis

Data were analyzed using SPSS version 31. Continuous variables were expressed as mean $\pm$

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SD and categorical variables as frequencies and percentages. Independent and paired t-tests, chi-square test, and multiple linear regression were applied as appropriate. A p-value <0.05 was considered statistically significant.

Ethical Considerations

Ethical Considerations: Ethical approval was obtained from the Department of Health, Sulaymaniyah on 4 February 2026. As this study involved a retrospective review of medical records, no direct patient contact was required. All data were anonymized prior to analysis, and patient confidentiality was strictly maintained throughout the study.

Results:

Total patients screened were 617 that attended the clinic during the period of the study between 01 January 2023 to 01 January 2025. Out of this, only 221 patients fulfilled the inclusion criteria. Of the 617 patients screened, 396 were excluded (Figure 1), primarily due to pregnancy, gestational, Type 1 diabetes or insufficient follow-up. Those with adequate visits, defines as at least 4/ 2 years were 46 patients (20.8%).

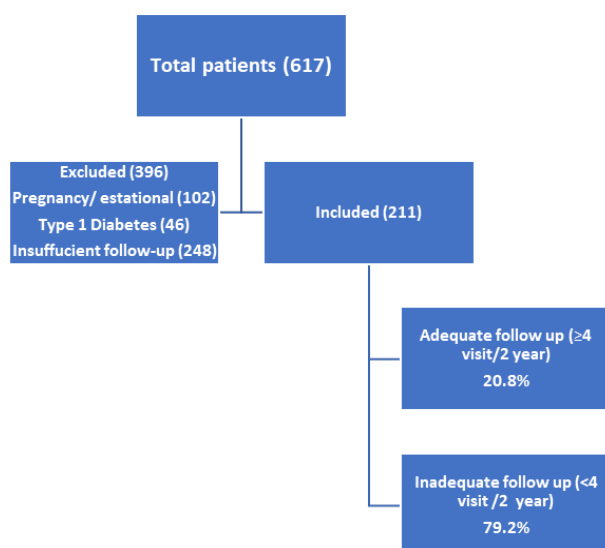


Figure 1: The flow diagram of patients visited the clinic during the study period.

A total of 166 patients from the 221 had baseline HbA1c value above 7, Figure 2.

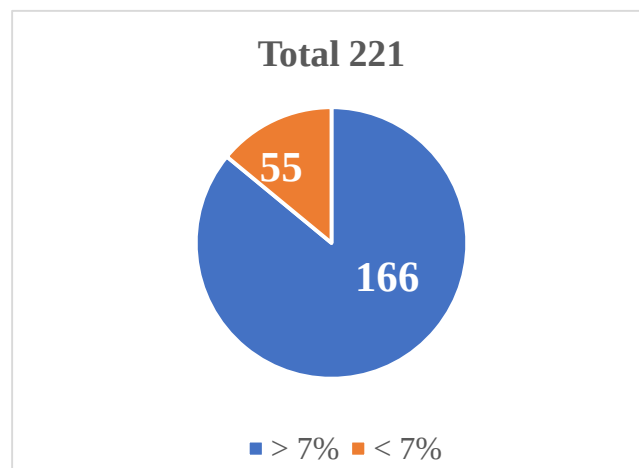


Figure 2: Baseline HbA1c value of the 221 included patients divided according to the number above and below 7% as a marker of uncontrolled diabetes that required treatment intensification.

Table 1 shows baseline characteristics of the 221 included patients. As it is showing less patients made adequate visits to the clinic which was set as ≥ 4 visits / 2 year

Table1: Baseline characteristics of the included patients.

Baseline characteristics	Value
Age (mean $\pm$ SD)	56.08 $\pm$ 11.09
Sex %	Male = 66 (29.8%), Female = 155 (70.1%)
BMI (mean $\pm$ SD)	30.19 $\pm$ 5.965
Diabetes duration in years (mean $\pm$ SD)	7.281 $\pm$ 6.636
Insulin use as a baseline (%)	34 (15.38%)
Residency	City = 124 (56.11%), Area = 97 (43.89%)
Visit frequency category	% adequate = 20.8% % inadequate = 79.2%

The results of the multiple linear regression analysis indicate that Treatment Intensification has a statistically significant impact on Final HbA1c, whereas Visit (Table 2 and 3). Treat-

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ment Intensification was significantly associated with Final HbA1c ($B = 1.220$, $\beta = 0.315$, $t = 3.891$, $p < 0.001$), demonstrating that it is an important predictor of glycemic outcomes in this cohort. In contrast, Visit Frequency was not statistically significant ($B = 0.032$, $\beta = 0.129$, $t = 0.250$, $p = 0.803$), indicating that the number of visits alone did not significantly influence Final HbA1c levels. Although the overall regression model was statistically significant ($F(2,218) = 7.680$, $p = 0.001$), it explained a relatively small proportion of the variance in glycemic control ($R^2 = 0.066$; Adjusted $R^2 = 0.057$). We tried to estimate for the effect of residency of the patients on the visit frequency as being outside of the city where the clinic is based may make a barrier for adequate visits for follow up.

Table (2): Summary of Multiple Regression Analysis.

Variable	B	Standardized β	t	p-value
Constant	6.642	0.443	14.99	<0.001
Visit Frequency	0.032	0.129	0.250	0.803
Treatment Intensification	1.226	0.315	3.891	<0.001*

During follow-up, 194 patients (87.7%) underwent treatment intensification.

Table 3: Model Summary for Multiple Linear Regressions Predicting Final HbA1c

Statistic	Value
R	0.257
R ²	0.066
Adjusted R ²	0.057
F (2,218)	7.680
p-value	0.001*

*Statistically significant at $p < 0.05$. Dependent Variable: Final HbA1c.

Table 4 shows that out of the total 221 patients included in the study, 124 patients (56.1%) were

residents of the city, while 97 patients (43.9%) were from surrounding areas. The mean value for residence coding was 1.44 ± 0.497 , indicating that the majority of the study population were city residents.

Table 4: Distribution of Study Participants by Residency

Residence	Frequency	Percent	Mean $\pm$ SD
Valid			
City	124	56.1	0.497 ± 1.44
Area	97	43.9	
Total	221	100	

The results of the independent samples t-test indicate a statistically significant difference in visit frequency between participants living in the city and those living in the Area (Table 5). Participants from the City ($N = 221$, $M = 7.8$, $SD = 1.57$) reported a substantially higher visit frequency compared to participants from the Area ($N = 221$, $M = 1.44$, $SD = 0.497$). The mean difference between the two groups was 6.366. This difference was statistically significant, $t(440) = 57.217$, $p < 0.001$, indicating that the variation in visit frequency is not due to chance.

Table 5: Comparison of Visit Frequency by Residency (City vs. Area).

Group	N	Mean $\pm$ SD	Mean Difference	F	t	df	p-value	Cohen's d
1	221	7.8 ± 1.57	6.366	135.14	57.21	440	<0.001	-1.79
2	221	1.4 ± 0.49	6.366					

A paired-samples t-test revealed a statistically significant reduction in HbA1c levels following treatment intensification, from baseline ($M = 9.39\%$, $SD = 2.24$) to final follow-up ($M = 7.81\%$, $SD = 1.58$), with a mean decrease of 1.59% (95% CI: 1.29–1.88), $t(220) = 10.564$, p

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$p < 0.001$ (Table 6). A significant positive correlation was found between baseline and final HbA1c ($r = 0.356$, $p < 0.001$). The effect size was moderate-to-large (Cohen's $d = 0.71$), indicating that treatment intensification had a clinically meaningful impact on improving glycemic control. These findings show that just over half of the patients attained the desired glycemic target, while a substantial proportion nearly half continued to have poor glycemic control despite treatment intensification. A significant positive correlation was found between baseline and final HbA1c ($r = 0.356$, $p < 0.001$). The effect size was moderate-to-large (Cohen's $d = 0.71$), indicating that treatment intensification had a clinically meaningful impact on improving glycemic control.

Table 6: Paired Samples t-Test Comparing Baseline and Final HbA1c Levels.

Measurement	Mean (%)	SD	Mean Difference	95% CI	Correlation	p-value (Correlation)	t	Df	p-value (t-test)	Cohen's d
Baseline HbA1c	9.39	2.24	1.59	1.29 - 1.88	0.356	<0.001	10.564	220	<0.001	0.71
Final HbA1c	7.81	1.58								

Of the 221 patients included in the study, 116 patients (52.5%) achieved the target HbA1c of $< 7.5\%$, indicating adequate glycemic control by the end of the follow-up period. In contrast, 105 patients (47.5%) remained above the target, with a mean HbA1c of 9.21% (SD = 1.47) (Table 7). These findings show that just over half of the patients attained the desired glycemic target, while a substantial proportion nearly half continued to have poor glycemic control despite treatment intensification.

Table 7: Comparison of Final HbA1c against Target ($< 7.5\%$).

Category	N (%)	Mean $\pm$ SD HbA1c	Median	Range
Achieved Target ($< 7.5\%$)	116 (52.5%)	6.78 $\pm$ 0.62	6.8	5.02 - 7.49
Did Not Achieve ($\geq 7.5\%$)	105 (47.5%)	9.21 $\pm$ 1.47	8.9	7.50 - 15.15
Total	221 (100%)	7.9 $\pm$ 1.65	7.6	5.02 - 15.15

Discussion

Diabetes mellitus is a chronic illness that necessitates ongoing medical care to prevent and treat its debilitating complications when they do arise [2]. In our study we tried to assess a crucial part of diabetes mellitus that is the medical follow up. Blood glucose levels should ideally be kept close to normal (HbA1c levels $< 7\%$). For older persons with diabetes, less strict HbA1c targets are supported by the American Diabetes Association's Standards of Care in Diabetes—2025 [4]. A HbA1c of less than 7.5% was considered glycaemic control. Clinical recommendations emphasise customised glycaemic objectives depending on patient factors, such as age, comorbidities, and risk of hypoglycemia, even though a HbA1c target of less than 7% is frequently advised for many persons with type 2 diabetes. For certain individuals, less demanding goals could be suitable in standard therapeutic practice. In order to give a practical definition of satisfactory glycaemic control within this diverse outpatient group, a threshold of 7.5% was employed [10]. Yet, we ensured this doesn't affect the optimal management of each patient on an individual bases during our day to day care of the patient. Regular attendance at diabetes care clinics is associated with improved management of diabetic mellitus (DM) [6]. Acknowledging this fact, we conducted this research to assess the adherence of the patients to the minimum

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number of follow up visits to doctor clinics which is 2 visits per a year. Our study found that only 20.8% of the patients made the adequate visits compared to a large number (79.2% of the patients) that did inadequate frequency of visits. Other studies also found that “defaulters” form diabetic clinics is a real health issue [11]. Studies have shown that after a year of therapy, those who attended more interim appointments had lower HbA1c readings [12]. Yet, our study found the effect of visit frequency on the final HbA1c level deemed to be controlled was not statistically significant (p value was 0.803). Multiple explanations exist for this finding among them is the effect of adherence to lifestyle interventions, medications and the overall management plan [13, 14]. We were not able to assess for adherence of each patient to the management plan due to lack of resources and the fact that the visit frequency was already inadequate. The finding of inadequate clinic visits prompted us to think of the most obvious barrier of attending the clinic regularly that is the residency of the patient. Our study found this effect to be statistically significant (p value was <0.001). This is in line with other studies like [15]. The second aim of the study was the effect of on time treatment intensification on the final HbA1c target for diabetes control. This was statistically significant (p value <0.001). This is in line with many published studies [16-18]. It seems obvious, but ‘clinical inertia’ is a significant barrier for achieving diabetes control [7]. This is even more an issue for our regional doctors to start treatment intensifications [9]. Of the 221 patients included in the study, 116 patients (52.5%) achieved the target HbA1c of < 7.5%, indicating adequate glycemic control by the end of the follow-up period. In contrast, 105 patients (47.5%) remained above the target, with a mean HbA1c of 9.21% (SD = 1.47). This is reflected in a study [19] that the overall

percentage of patients reaching HbA1c $\leq 7\%$ was 36.6 (34.1–39.1%) % out of 169 patient groups in RCTs with findings available for analysis.

Limitations of study

The limitations observed in our study were the lack of resources to account for the factors that may influence the results like the patient’s adherence to the treatment plan and the inability to measure the effect of the different types of the medications used in the treatment intensification.

Conclusion

In this cohort, the frequency of clinic visits during the follow-up period was not significantly associated with achieving the target HbA1c level. This may suggest that the number of visits alone is insufficient to improve glycemic control without effective therapeutic interventions or patient engagement. In contrast, treatment intensification showed a significant association with achieving HbA1c targets, highlighting the importance of active therapeutic management in improving glycemic outcomes.

Conflict of Interest Statement

The authors declare no conflicts of interest related to this manuscript.

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