Efficacy of Various Interventions for Achieving Target HbA1C Levels for Patients with Type II Diabetes Mellitus and on Exogenous Insulin

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INTRODUCTION

With a prevalence of 12% among US adults 18 years or older, Diabetes, predominantly Type II, is one of the most common medical illnesses we face today[1]. This number is only set to grow, with a prevalence of 14% in the US forecasted for 2060[2]. A chronic metabolic disorder characterized by persistent hyperglycemia, the disease can lead to hypertension, coronary artery disease, peripheral diabetic neuropathy, and may progress to high risk of myocardial infarction or stroke[3,4]. Thus, there is a large and growing need for effective medical control of the condition and its symptoms. In this study we compared the effectiveness of various interventions in controlling Diabetes in Type II Diabetics currently on insulin.

NATIONAL GUIDELINES

The American Association of Clinical Endocrinology (AACE) Type II Diabetes Management Algorithm breaks recommended treatment down into three areas: weight loss, treatment of atherocardiovascular risk factors, and control of hyperglycemia[5]. Recommended treatment for hyperglycemia initially includes administration of metformin, with the addition of a Glucagon Like Peptide 1 Receptor Antagonist (GLP1RA) and a Sodium Glucose Co-transporter 2 Inhibitor (SGLT2I) as needed. If this combination proves insufficient or if a patient presents with severely high Hemoglobin A1C, insulin is added to the regimen.

PURPOSE

This research is intended to determine the rates at which patients at UT Family Medicine – St. Francis (UTFM–SF) are prescribed the AACE recommended medications for Type II Diabetes Mellitus (T2DM), and whether the prescription of these medications is associated with a patient's level of glycemic control.

RESEARCH QUESTIONS

1. How many patients with T2DM and on insulin are prescribed metformin, SGLT2 inhibitors, and/or GLP1R agonists?
2. What is the frequency of prescription of these medications for those at different hemoglobin A1C benchmarks (below the clinical standard as set out by the ADA of 7.0%, above 7.0% but below the Center for Medicare & Medicaid Services benchmark of 9.0%, and above 9.0%)?

METHODS

A retrospective chart review was conducted, using the records of patients seen within the previous four years at UT Family Medicine who had visits labeled with ICD 10 codes for Type 2 Diabetes Mellitus (E11) and long-term current use of insulin (Z79.4). Only those between the ages of 18 and 65 were considered for analysis.

Of the 272 record numbers meeting this criteria, 8 were for fictional patients, 5 belonged to patients with no chart history of insulin use, 4 were no longer linked to a patient record, and 1 belonged to a patient with type 1 diabetes. An additional 16 patients' records were excluded because they did not contain an HbA1C measurement, and 4 were excluded because their most recent HbA1C value was more than 4 years old.

Data was manually abstracted from the remaining 234 patient records on the NextGen electronic medical record system and transferred to SPSS 28 for storage and analysis. 26 patients within this pool were no longer prescribed insulin, so this study only utilized data that had been recorded by the date on which their prescription was discontinued.

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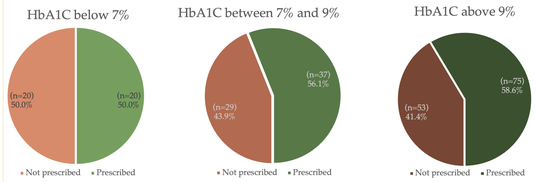
RESULTS

DEMOGRAPHICS

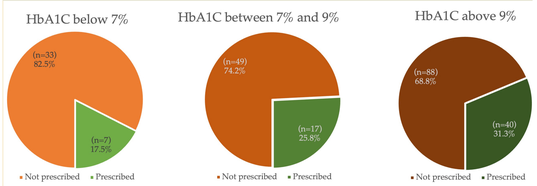
HbA1C Range	< 7% (n=40)	> 7%, < 9% (n=66)	> 9% (n=128)	Overall (n=234)
Mean Age	49.62	50.17	46.59	**48.12**
Race				
Black/African American	95%	78.8%	86.7%	**85.9%** (n=201)
White/Caucasian	5%	19.7%	11.7%	**12.8%** (n=30)
Asian	-	-	0.8%	**0.4%**(n=1)
Native American	-	1.5%	-	**0.4%**(n=1)
Ethnicity				
Hispanic/Latino	-	3%	-	**0.9%** (n=2)
Gender				
Male	25%	24.2%	20.3%	**22.2%** (n=52)
Female	75%	75.8%	79.7%	**77.8%** (n=182)

Table 1: Demographics of patients at UTFM–SF with T2DM on long-term insulin, broken down by level of glycemic control. Patients' three most recent HbA1C values were averaged in order to assign them to the HbA1C range categories.

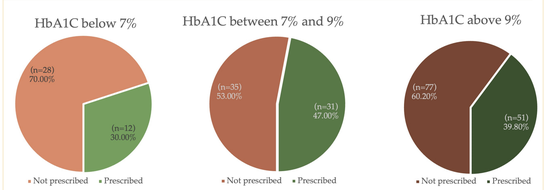
a) Frequency of Prescription of Metformin



b) Frequency of Prescription of SGLT2 Inhibitors



c) Frequency of Prescription of GLP1 Receptor Agonists



Figures 1a-c: Frequency at which patients at UTFM–SF are prescribed three main classes of medication for the treatment of T2DM, stratified by level of glycemic control.

Frequency with which Medication Classes are Combined

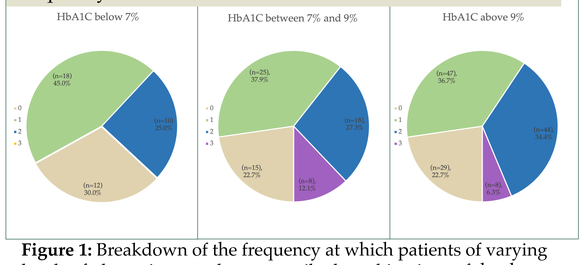


Figure 1: Breakdown of the frequency at which patients of varying levels of glycemic control are prescribed combinations of the three antidiabetic medication classes studied: metformin, SGLT2 inhibitors, and/or GLP1-receptor agonists.

Metformin Prescription Trends

HbA1C Range	< 7% (n=40)	> 7%, < 9% (n=66)	> 9% (n=128)
Metformin previously prescribed, then discontinued	**25%** (n=10)	**27.3%** (n=18)	**25%** (n=32)
Percent of above population that trialed extended-release metformin before discontinuation	50% (n=5)	38.9% (n=7)	37.5% (n=12)
Never prescribed metformin	**25%** (n=10)	**21.2%** (n=14)	**18.8%** (n=24)
Most common starting dose	**1000 mg/day** (n=13)	**1000 mg/day** (n=24)	**1000 mg/day** (n=500)

Table 3: Further analysis of trends in metformin prescription and discontinuation.

Frequency of HbA1C Checks

HbA1C Range	< 7% (n=40)	> 7%, < 9% (n=66)	> 9% (n=128)
Mean number of days between each HbA1C check	**270.5**	**197.4**	**251.4**
Standard deviation	330.3	129.3	271.2
Median number of days between each HbA1C check	**161**	**159**	**170.5**

Distribution of HbA1C Check Frequency

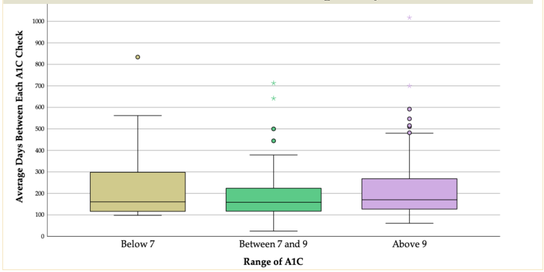


Table 2 and Figure 3: Distribution of the frequency with which patients of varying levels of glycemic control had their HbA1C checked. Box-and-whiskers chart displays median, quartiles, and outliers (defined as removed from the first or third quartile by greater than 1.5 times the interquartile range)

DISCUSSION

The analysis conducted was most notable for revealing that there are limited differences between patients of varying levels of glycemic control with regards to the classes and number of antidiabetic medications prescribed. There was a difference between the <7% and the >9% groups of less than 15% with regards to percent prescribed metformin, SGLT2 inhibitors, GLP1 receptor agonists. A similar proportion of each group were also not currently taking any medications of the classes.

Additionally, the data do not reflect an increase in the intensity of treatment or monitoring for patients with higher HbA1C results. A higher proportion of patients in the >7%,<9% group was on a combination of all three medication classes than with patients in the >9% group, and the median number of days between HbA1C checks was very similar between all three groups.

Within all three groups, over 40% of patients were not currently prescribed metformin, and around 20% in each group had no chart history of a metformin prescription—alarming considering that the ADA considers metformin to be part of the first-line treatment for T2DM.[6] The data reveal increased trialing of the extended-release formulation as a potential recourse, as 62.5% of those in the highest A1C group who stopped taking metformin had not trialed this format.

LIMITATIONS

- The reason for patient discontinuation of a drug was not able to be considered in this study, as a reason was usually not supplied in the charts reviewed. Additionally, the presence of chronic kidney disease was not considered. Metformin is contraindicated for CKD stage 4 patients, and therapy modificattions are dconsidered for stage 3b, thus this could account for some of the low prescription rates.
- Only patient history from their time at UT Family Medicine was reviewed, as it was the only data accessible to researchers. It is possible that some patients may have been trialed on metformin, SGLT2 inhibitors, and/or GLP1R agonists before starting care with

RECOMMENDATIONS

CURRENT STUDY

The following recommendations are given for maximizing reduction of patient HbA1C in Type II Diabetics on insulin:

- All eligible patients with elevated HbA1C levels should be trialed on concurrent use of metformin, an SGLT2 inhibitor, and a GLP1R agonist, and their new HbA1C levels monitored. Currently, only 12.1% in the HbA1C >7%,<9% group and just 6.3% in the >9% group are on all three medication classes.
- Patient HbA1C should be checked quarterly, in line with with the American Diabetes Association recommendations.[7]
- When beginning a patient on metformin, choosing a low dose and an extended-release option before slowly increasing dosages.
- Patients should be appropriately counselled on potential side effects of medications on initial prescription and at follow up appointment.

FUTURE STUDIES ON EFFICACY OF T2DM TREATMENTS

Suggested next steps include:

- Comparison of different drugs in each class (for example, different SGLT2 inhibitors), to see if there is a statistically significant difference between which drugs are more likely to be discontinued by the patient; comparison of starting dosages of metformin and their correlation to patient intolerance/discontinuation; and inquiry into which combination of the three classes leads to the most significant drop in HbA1C in patients.

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