An Evaluation of Hemoglobin A1c Monitoring at a Student-Run Free Clinic in Kansas City, Missouri

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Abstract

Background: The hemoglobin A1c is critical for monitoring and managing type II diabetes and providing clinicians with a framework for a treatment plan. Our study analyzes compliance to the American Diabetes Association (ADA) standards of appropriate A1c monitoring and encourages other clinics to monitor the same information within their own clinics.
Methods: A retrospective chart review was conducted on all patients who visited the Sojourner Health Clinic between January 2017 and November 2019. All patients who had met the criteria for A1c screening based on recommendations from the ADA were included in the study, as well as patients who were charted as diabetic or pre-diabetic. A total of 88 patients met the criteria for this study. Data collected included patient documentation as diabetic or pre-diabetic and patients' three most recent A1c values with corresponding dates. Based on this data, these patients were categorized as diabetic, pre-diabetic, or non-diabetic, and were evaluated on whether their A1c was monitored at appropriate intervals.
Results: A total of 21.6% of patients were monitored appropriately for their diabetic status determined by their A1c values. Only 18.2% of diabetic patients were accurately monitored. Patients with an unknown diabetic status had the lowest rate of appropriate monitoring.
Conclusions: Most patients at the Sojourner Health Clinic are not properly monitored for diabetes using the clinic's modified A1c monitoring guidelines. The clinic can make several improvements to strengthen adherence to these guidelines with the implementation of new protocols for better A1c monitoring. Further studies should be made to assess the efficacy of these changes.

Background

Diabetes is a chronic condition affecting more than 34 million Americans, with 90-95% of these individuals affected by type II diabetes.[1] Management of this condition is multifactorial, including physical, dietary, and pharmacologic intervention. However, detection of type II diabetes can be done through several laboratory tests, including hemoglobin A1c.[2,3] Clinicians use A1c to monitor diabetes and decide treatment plans.[4] Diabetic patients are at risk for microvascular complications including retinopathy, nephropathy, and neuropathy. Microvascular disease occurs in insulin-independent tissues including the retina, kidney, and vascular endothelium. The resulting glucotoxicity results in local tissue damage.[5] The prevalence of these complications within the United States adult diabetic population is significant—approximately 28.5% present with diabetic retinopathy, 25.0% with diabetic nephropathy, and 28.0% with diabetic neuropathy.[6,7,8] Early intervention for glycemic control in diabetic patients, especially lowering A1c to <7.0%, can reduce the development and progression of microvascular disease.[9,10] This is especially important in the context of the uninsured population as they are more likely to have undiagnosed or uncontrolled diabetes than insured patients.[11,12]

There are two studies conducted by student-run clinics related to A1c monitoring. However, both studies focused solely on A1c as a testing

metric to determine how well diabetes is managed.[13,14] Neither study explores adherence to A1c guidelines. Therefore, our study hopes to fill this gap in research by analyzing A1c monitoring rather than the actual management of diabetes using A1c. Thus, the primary objective of this study is to explore how effectively the clinic monitors A1c based on American Diabetes Association (ADA) guidelines and to encourage other clinics to analyze the same information.

Methods

The Sojourner Health Clinic is a free student-run clinic that provides primary health care to the uninsured population of downtown Kansas City, Missouri. The clinic treats over 300 patients annually, accomplished through more than 2,500 student volunteer hours.[15] The clinic runs all laboratory testing via the in-house student-run laboratory. Tests include basic metabolic panel, fasting lipid profile, A1c, point-of-care glucose, urine analysis, and HIV screening. These tests improve the quality of care provided to patients by allowing physicians to adjust their treatment course based on test results within the same encounter.[4]

This study is a retrospective analysis to determine how closely the Sojourner Health Clinic adheres to ADA guidelines for the monitoring and management of diabetes through A1c glycemic assessment. There are over 300 patients in the urban core of Kansas City who rely on the Sojourner Health Clinic for care: a survey collected in 2019 demonstrated that the average age of its patients is 55, 61.0% are homeless or living in a shelter, 80.5% are male, 47.0% identified as African American, and 37.0% identified as Caucasian.

The conduction of this quality improvement study was claimed as exempt by the institutional review board of the University of Missouri-Kansas City. All patients who visited the clinic from January 2017 to November 2019 were chart-reviewed. Patients selected for the study included those with a documented diagnosis of type II diabetes or pre-diabetes, an in-clinic A1c that met criteria for diabetes or pre-diabetes, and all patients who visited the clinic more than once who qualified for baseline A1c screening. New patients who visited the clinic only once were excluded from this study as baseline labs are generally not required

on the patient's first visit to the clinic to allocate clinic resources—this is intended to address the issue of patients coming to clinic for a singular visit with an acute concern without follow-up.

The following data were collected for each patient and manually documented on a Microsoft Excel (Version 15.30, Microsoft Corporation, Kansas City, MO) sheet: diabetic status, three most recent A1c values, and dates of when these A1c tests were run. Based on their A1c levels, patients were categorized as diabetic, pre-diabetic, or non-diabetic per ADA guidelines. The guidelines define an A1c less than 5.7% to be normal.[4] Pre-diabetes is defined by an A1c of 5.7%-6.4% and diabetes is defined by an A1c of 6.5% or greater.[4] One patient was determined to be previously pre-diabetic but is currently classified as a non-diabetic according to ADA guidelines for diabetes remission.[16] Patients were additionally classified as being appropriately monitored or not per ADA guidelines[4].

Several organizations offer guidelines for the management and monitoring of diabetes including fasting plasma glucose, 2-hour oral glucose tolerance test, and the A1c.[3] This study focused on ADA guidelines pertaining to A1c monitoring. This is due to difficulties associated with performing a fasting plasma glucose in the setting of a weekly free health clinic.[3] ADA guidelines recommend rechecking A1c values every 3 months in poorly controlled diabetics (A1c >7.0%), every 6 months in well-controlled diabetics (A1c <7.0%), and annually for pre-diabetics.[3] Additionally, the ADA recommends rescreening every 3 years for patients, with increased frequency of screening for patients with risk factors for the development of diabetes. These factors are listed in Table 1. It is difficult to consistently assess if patients are considered high risk per ADA guidelines due to the Sojourner Health Clinic's use of paper charting, barriers to our patients providing an accurate past medical history, and the fact that the clinic does not document body mass index (BMI). As a result, Sojourner Health Clinic monitoring criteria had to be adjusted to include annual A1c screening of high-risk non-diabetic patients in place of the ADA's recommendation for rescreening every three years. This is done to reduce the number of missed diagnoses of diabetes or pre-diabetes in the clinic in consideration of our patient population. The clinic also

Table 1. American Diabetes Association diabetes screening criteria[3].

1. Testing should be considering in all adults who are overweight (BMI ≥25 kg/m2*) and have additional risk factors:
    * Physical inactivity
    * First-degree relative with diabetes
    * High-risk race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander)
    * Women who delivered a baby weighing >9 lbs. or were diagnosed with GDM
        - Hypertension (≥140/90 mmHg or on therapy for hypertension)
    * HDL cholesterol level <35 mg/dL (0.90 mmol/L) and/or a triglyceride level >250 mg/dL (2.82 mmol/L)
        - Women with polycystic ovarian syndrome
        - A1c ≥5.7%, IGT, or IFG on previous testing
    * Other clinical conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans)
        - History of CVD
2. In the absence of the above criteria, testing should begin at age 45 years.
3. If results are normal, testing should be repeated at least at 3-year intervals, with consideration of more frequent testing depending on initial results (e.g., those with prediabetes should be tested yearly) and risk status.

At risk BMI may be lower in some ethnic groups
BMI: body mass index; GDM: gestational diabetes mellitus; HDL: high-density lipoprotein; IGT: impaired glucose tolerance; IFG: impaired fasting glucose; CVD: cardiovascular disease.

Table 2. Sojourner Health Clinic A1c monitoring criteria based on American Diabetes Association guidelines.

Diagnosis	A1c criteria for diagnosis	Monitoring frequency
Diabetic (uncontrolled)	>7.0%	Every 3 months
Diabetic (controlled)	<7.0%	Every 6 months
Pre-diabetic	5.7%-6.4% (and no previous diagnosis of diabetes)	Yearly

implemented baseline A1c testing for all patients visiting the clinic more than once. All other screening criteria remained in line with the ADA's guidelines. The final modified criteria used by Sojourner Health Clinic based on ADA guidelines is outlined in Table 2.

Results

A total of 88 patients met the criteria for this study. Table 3 offers a breakdown of how many met the clinic's A1c criteria for diabetes and how many were accurately monitored per the guidelines. A minority of patients were classified as diabetic (12.5%) in comparison to 26.1% of patients as prediabetic. A total of 21.6% of patients were monitored appropriately based on the diabetic status determined by their A1c values. Patients who qualified as nondiabetic had the highest rate of appropriate monitoring (60.0%). Patients with an unknown diabetic status (44.3%) had the lowest rate of appropriate monitoring; these patients had no A1c listed in their charts even though they should have received baseline testing.

Additionally, Table 4 offers a breakdown of patients who had no written diagnosis of diabetic status in their patient chart by what their diagnosis should be based on the A1c values reported in their charts. Of the clinic's patients with no charted documentation of their status, 50.7% ultimately had an unknown diagnosis per the chart review.

Table 3. Diagnosis of diabetes and appropriate monitoring of A1c at a student-run free clinic based on modified guidelines.

Diagnosis	N (%)	Number appropriately monitored (%)
Total	88 (100)	19 (21.6)
Unknown	39 (44.3)	0 (0.0)
Pre-diabetic	23 (26.1)	8 (34.8)

Table 4. Diagnosis based on modified guidelines for patients with no charted diagnosis of diabetes at a student-run free clinic.

Determined diagnosis	N (%)
Total	73 (100)
Unknown	37 (50.7)
Pre-diabetic	19 (26.0)

Out of patients that had no charted documentation of their status, 26.0% met ADA criteria for prediabetes. Similarly, two patients who had no documentation of diabetic status in their chart met ADA criteria for diabetes.

Finally, a third set of data offers a breakdown of what percentage of documented diabetic or pre-diabetic diagnoses in the patient charts were accurate based on A1c values (Table 5). Of the patients with a charted diagnosis of diabetes, 90.0% were accurately diagnosed in accordance with their A1c values—out of the ten that were charted as diabetic, one patient did not have an A1c value recorded to support this diagnosis. Of the patients with a charted diagnosis of pre-diabetes, 80.0% were accurately charted—out of the five that were charted as pre-diabetic, one patient did not have an A1c value recorded to support this diagnosis.

Discussion

Overall, the current efficacy of A1c monitoring at the Sojourner Health Clinic varies between subgroups with non-diabetics having the highest rate of proper monitoring and status unknown patients having the lowest rate. This is likely due to diabetic patients requiring more frequent monitoring: thus, follow-up is more likely missed in these patients. Notably, there are many patients who qualified for baseline labs who never received them—this can lead to missed diagnoses and can deter optimum condition management. Additionally, the high percentage of uncharted patients who met the criteria for pre-diabetes demonstrates the need for improved documentation. Throughout this study, we adhered strictly to ADA guidelines that we modified for our clinic. However, we recognize that patient-centered diabetes care requires flexibility when developing follow up and hemoglobin A1c goals for each patient.

There were some barriers to care in adequately monitoring A1c levels that created limitations within this study. The use of paper charts may have resulted in a failure to appropriately chart diagnoses based on A1c.[13] Of the patients that met the A1c criteria for pre-diabetes, 24.3% had no charted diagnosis of the condition. The clinic's transition from paper charts to electronic medical records (EMR) this year may better track these diagnoses as well as which patients have risk factors for the development of diabetes or are due for additional A1c testing. A1c testing was also not consistently available in the clinic due to an unexpected decline in supply or delayed ordering of testing supplies. In efforts to address this, laboratory directors can focus on ensuring timely restocking of tests. The A1c test itself yields some limitations due its inability to measure glycemic variability or hypoglycemia—patients with a severe insulin deficiency may be best evaluated with a combination of results from self-monitoring and the A1c.[3]

The lack of continuity of care due to different students and attending physicians present at the clinic each week presented another barrier to care. The standardized protocol for A1c monitoring may not be understood among all volunteers, leading to possible discrepancies in A1c monitoring guidelines. To address this, the clinic recently started implementing a brief chart review of all visiting patients at the start of clinic each week to determine if patients are due for A1c retesting. Volunteers can also focus on assessing the risk factors for diabetes outlines by the ADA such as measuring patients' BMI during clinic. Additionally, patients often did not follow up to the clinic at the intervals necessary for adequate A1c test-

Table 5. Charted diagnosis of diabetes or prediabetes accuracy based on A1c collected at a student-run free clinic.

Charted diagnosis	N (%)	Number accurately charted (%)
Total	15 (100)	13 (86.7)
Diabetic	10 (66.7)	9 (90.0)
Prediabetic	5 (33.3)	4 (80.0)

ing, and some patients declined labs to be conducted during their visits due to personal preference. Documentation of these incidences were inconsistent and therefore could not be factored into our results.

Previous studies by other student-run free health clinics focused on diabetic management health outcomes. A 2017 study determined that uninsured patients at Icahn School of Medicine at Mount Sinai's student-run clinic were able to maintain target A1c values just as well as insured patients.[14] A 2014 study that focused on diabetic patients at Shade Tree Clinic in Nashville determined that medical student health educator programs can help improve A1c values in type II diabetics.[15] However, these studies focused on A1c as a metric for diabetic management rather than the testing itself.

Similar studies conducted at other free health clinics found that while the rate at which patients were appropriately referred to A1c labs were appropriate, several patients were lost to follow up, possibly due to social needs.[17] This suggests that shortcomings in A1c monitoring at student-run clinics run beyond numerical thresholds and require a deeper understanding of social determinants of health.

Future interventions

We hope that other free clinics can use this information to improve their A1c monitoring by analyzing their current adherence to recommended guidelines and recognizing their clinic's barriers to more efficient monitoring. We recognize that the student-run clinics throughout the US may have different patient populations than Sojourner Health Clinic. However, they may face similar barriers to testing, and this study can serve as a blueprint for other clinics to reflect upon their own A1c monitoring. Data from vari-

ous free clinics can eventually be used to extrapolate results to determine if student-run free clinics are collectively meeting the standard of care required for diabetic patients.

Conclusions

Overall, this study provided an overview of how well Sojourner Health Clinic adheres to the modified ADA A1c monitoring guidelines. This retrospective chart review shows how a majority of the clinic's pre-diabetic patients are improperly monitored and highlights the need for proper documentation and A1c follow-up.

Student-run free health clinics can more accurately identify and monitor their diabetic patients by acknowledging and addressing barriers to appropriate A1c monitoring. These barriers may include the use of paper charts, a lack of follow-up from patients, and changes in volunteers and attending physicians. These concerns can be addressed with interventions such as chart reviews at the beginning of clinic or the introduction of an EMR. The success of these interventions should be assessed in a future study. Other clinics can use the results of this study as a guide to analyze their own adherence to ADA guidelines for A1c monitoring and recognize their clinic's barriers to more effective diabetic management.

Disclosures

The authors have no conflict of interest to disclose.

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