

Using Reminder Letters to Improve Adherence to Routine Hemoglobin A1C Testing in Adults with Diabetes

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Abstract

The American Diabetes Association (ADA) recommends hemoglobin A1C (A1C) goals of <7% for most non-pregnant adults and <8% for adult patients with extensive or life-limiting comorbidities. A1C testing is indicated every 3-months for patients not meeting goals to assess glycemic control, adjust medications, suggest lifestyle changes, and offer counseling. However, many patients do not adhere to routine testing. A clinic-wide quality improvement (QI) pilot project was implemented using mailed reminder letters to improve patient adherence to routine A1C testing in patients with hemoglobin A1C \geq 8%. Sixty-eight patients were identified for this letter intervention. Of these, 14 patients (20%) were historically adherent to 3-month interval testing, 31 patients (46%) were historically non-adherent, and 23 (34%) had historical A1C test intervals of less than 3-months because of provider orders. The primary outcome was improvement in A1C testing adherence rates of those who were previously non-adherent. There was a 58% increase overall and a 103% increase in testing rates among women. Statistical significance was not observed at the $P = .05$ level. However, improvement in adherence rates among women reached the $P = .10$ significance level. Mailed reminder letters may be useful in improving adherence to routine A1C testing in patients with diabetes. Further study of this intervention in larger groups is needed to provide timely data for the management of diabetes care.

Abbreviations

A1C = hemoglobin A1C
ADA = American Diabetes Association
CDC = Centers for Disease Control and Prevention
IMC = Tripler Army Medical Center Internal Medicine Clinic
QI = quality improvement
T2DM = type 2 diabetes mellitus
TAMC = Tripler Army Medical Center

Keywords

Type II Diabetes Mellitus, Mailed Letter Intervention, Quality Improvement, Military Medicine

Introduction

In the United States, type 2 diabetes mellitus (T2DM) is a common disease associated with significant morbidity and mortality. The Centers for Disease Control and Prevention (CDC) estimates that 26.9 million Americans of all ages have diabetes, with 1.5 million new cases of T2DM diagnosed yearly.¹ The 2020 National Diabetes Statistics Report published by the CDC lists diabetes as the seventh leading cause of death in the United States in 2017, with 83 564 death certificates having been issued with diabetes as the underlying cause of death.¹ In

Hawai'i, the prevalence of T2DM is 9.5% population-wide, with racial/ethnic minority populations being disproportionately affected.² An estimated 12.8% of the Native Hawaiian, 14.9% Other Pacific Islander, and 13.6% Japanese populations of Hawai'i were diagnosed with diabetes, compared to 5% of White residents.³ T2DM is known to cause multiple chronic health complications such as diabetic kidney disease, retinopathy, neuropathy, and cardiovascular disease.⁴ These complications are driven by elevated blood glucose levels that cause a variety of adaptive cellular and structural changes resulting in organ dysfunction.⁵ Therefore, control of blood glucose levels, also called glycemic control, is essential for reduction in diabetes related complications.

The American Diabetes Association (ADA) recommends using the hemoglobin A1C (A1C) test as a measure of glycemic control and predictor of diabetic complications in patients with T2DM.⁴ In widespread clinical use since the 1980s, the A1C test measures the proportion of glycated hemoglobin A in a blood sample at a single point in time to extrapolate average blood glucose levels during the preceding 3-month period. Glycohemoglobin A is formed by a non-enzymatic reaction between a hemoglobin A and glucose in the blood.⁶ Higher sustained blood glucose levels are directly proportional to levels of glycohemoglobin A level and A1C test results. Given the average 106- to 117-day lifespan of an erythrocyte, 90-120 days between consecutive A1C tests are needed to obtain >90% distinct samples of glycosylation.⁶

A1C testing at regular, defined intervals is essential for high quality care of patients with diabetes. The ADA recommends A1C testing every 3 months for patients not meeting glycemic goals or whose therapy has changed. Although a goal of A1C <7% is reasonable for most non-pregnant adults, the ADA recommends that almost all patients, even those with extensive comorbid medical conditions or limited life expectancy, target an A1C of <8%. Providers use routine 3-month A1C testing to evaluate effectiveness of patients' medication regimen, lifestyle habits, and administer disease appropriate counseling.⁴ An A1C test at intervals longer than 3 months may cause an unnecessary delay in medication titration and delayed improvement in glycemic control.⁷ Delays in treatment escalation are reported to not only cause long (>12 months) periods of hyperglycemia, but also diminish the chance of success once therapy is eventually intensified.⁷ Encouraging adherence to an indicated 3-month testing regimen is an opportunity to improve the quality of care to patients with diabetes.

A key component in improving the quality of care provided to patients with diabetes is the promotion of patient engagement and activation. The ADA highlights the importance of patient centered care, with emphasis on being “responsive to patient preferences, needs, values.”⁸ Thus, interventions to encourage adherence to routine A1C testing must take patients’ technology literacy, computer access, and time availability into account. Notably, cross sectional data of internal medicine patients by Bailey et al has showed that only 35% of patients age 18 to 80 years old reported using the internet to communicate of healthcare providers.⁹ In contrast, print-based mailed reminder letters have been shown to significantly improve adherence to scheduled appointments.¹⁰

A 3-month, Internal Medicine Clinic-wide prospective quality improvement (QI) pilot project was conducted to improve adherence to 3-month A1C testing in patients with T2DM. Print-based mail communication was used to notify patients that they were due for their routine 3-month A1C testing and to invite patients to the hospital to obtain repeat testing.

Methods

The project was conducted at the Tripler Army Medical Center (TAMC) Internal Medicine Clinic (IMC), in Honolulu, Hawai‘i. TAMC is a medium-sized military treatment facility that serves a diverse beneficiary population of nearly 500 000 people. The IMC serves active duty military members, dependents, and retirees ages 18 and older. In the IMC, all patients with diabetes are enrolled in the Diabetes Honor Program. This program mails patients 1 diabetes preventive care reminder letter per year, and automatically makes A1C testing available every 90 days at the phlebotomy lab for the entirety of the calendar year. The aim of the current project was to augment the efforts of the Diabetes Honors Program in providing quality patient care.

All protocols in this project were reviewed by the TAMC Clinical Investigation Review Board (review number #11227254) This project did not meet the criteria of research under 32 Code of Federal Regulation 219.012 and Department of Defense Instruction 3216.02 and was determined to lead to quality improvement at TAMC with the assistance of the Standards for Quality Improvement Reporting Excellence (SQUIRE) guidelines.¹¹

All adult patients with T2DM who obtain their primary care at the TAMC IMC were eligible for health record review. Patient data were queried 1 week before the start of November 2020, December 2020, and January 2021. In each month’s search query, patients who had an A1C test result $\geq 8\%$ 3 calendar months earlier (henceforth referred to as “baseline A1C”) were considered for intervention. Patients who did not have at least 1 A1C test prior to the baseline A1C test were excluded from intervention.

Patients were separated into 3 intervention cohorts by intervention month, namely November, December, and January. Patients who met inclusion criteria for the pilot project intervention were sent a standardized invitation letter on the first day of each cohort month to return to the hospital phlebotomy lab for A1C testing in the next 30 days. Letters were templated and automatically generated with the assistance of a diabetes management database and a population health nurse. After the last days of November 2020, December 2020, and January 2021, A1C testing attendance and test results were reviewed for each monthly cohort, respectively.

Data were pooled and statistical analyses were conducted at the conclusion of the intervention period. For analysis, all patients who received the intervention were separated into 3 groups by historical A1C test adherence. Group 1 consisted of patients who had obtained an A1C test 3 calendar months before the baseline A1C and were therefore deemed “pre-intervention adherent.” Group 2 consisted of patients whose pre-baseline A1C test was greater than 3 months before the baseline test date and were therefore deemed pre-intervention non-adherent. Group 3 patients had 1 or more repeat A1C tests between the baseline A1C testing date and the study intervention date due to a medical provider’s order. Because these patients received the intervention, they are described here, but were ultimately excluded from primary and secondary outcome analysis, as their status was driven by providers’ orders rather than independent patient behavior.

Descriptive statistics were used to summarize A1C test results pre and post intervention, as well as the difference in A1C between time points. Statistical analyses were conducted using SAS statistical software version 9.4 (SAS Institute Inc., Cary NC). To examine improvement in adherence rates among patients in Group 1 and Group 2, paired analyses using McNemar’s test were performed, with the level of significance set at $P < .05$. Statistical testing for association with age and gender were performed with Chi-squared testing, and Fisher’s exact test, respectively. Hemoglobin A1C comparisons by adherence were performed with the unpaired T-test.

Results

A total of 68 patients met inclusion criteria in this project. Of these 68 patients, 3 patient groups were identified, according to their pre-baseline A1C adherence. Group 1 consisted of 14 patients, or 21% of the population. Group 2 patients consisted of 31 patients, or 46% of the population. Group 3 patients consisted of 23 patients, or 34% of the intervention pool. **Table 1** describes demographics of pre-and post-intervention groups. No pre-existing statistical association between adherence to testing and age or gender was detected.

Table 2 describes the primary outcome, adherence rates to regular 3-month A1C testing, among the sample. Results showed a 58% increase in overall A1C test adherence after the intervention, although there was no statistical significance observed with the sample. Furthermore, most of the improvement was due to the increase in testing in women, with a 103% adherence increase in women after letter intervention, whereas there was a 12% increase in adherence for men after letter intervention.

Notably, there was an improvement of women's adherence at the $P = .10$ significance level.

Table 3 presents the secondary outcome analyses. Historically adherent patients had lower A1C levels at baseline, significant at the $P = .05$ significance level, compared to their historically non-adherent counterparts. Overall, however, the intervention was not significantly associated with difference in A1C results.

Table 1. Demographics of Patients Before and After Mailed Letter Intervention									
	Pre-intervention			P value ^b	Post-intervention			P value	
	All Patients	Adherent Pre-intervention ^a			All Patients	Adherent Post-intervention			
		n	%			n	%		
Age									
25-49	5	2	40	.44	25-49	5	2	.72	
50-59	10	1	10		50-59	10	4		40
60-69	17	6	35		60-69	17	8		47
70-89	13	5	38		70-89	13	8		62
Sex				.99				.14	
Female	23	7	30		Female	23	14		61
Male	22	7	32		Male	22	8		36

^a Adherence is defined as having received 2 consecutive A1C tests 3 calendar months apart.

^b Comparisons of adherence were made using the Chi-square test for four category age, and the Fisher's exact test for dichotomous age and gender.

Table 2. Patient Adherence to Routine A1C Testing Before and After Mailed Letter Intervention				
	Total Eligible	N ^a	%	P value
All Patients				.15
Adherent Pre-intervention ^b	45	14	31	
Adherent Post-intervention	45	22	49	
Female				.09
Adherent Pre-intervention	23	7	30	
Adherent Post-intervention	23	14	61	
Male				.99
Adherent Pre-intervention	22	7	32	
Adherent Post-intervention	22	8	36	

^a N= number of patients by adherence status. ^b Adherence is defined as having received 2 consecutive A1C tests 3 calendar months apart.

Comparisons of adherence were made using McNemar's test.

Table 3. Hemoglobin A1C Test Results of Patients Before and After Mailed Letter Intervention															
Variable	Pre-intervention Phase							Post-intervention Phase							
	Adherent ^a			Non-adherent				P value	Adherent			Non-adherent			
	N ^b	Mean	SD ^c	N	Mean	SD	N		Mean	SD	N	Mean	SD	P value	
A1C															
A1C at Baseline	31	9.2	1.2	14	8.6	.50	.03	23	8.9	1.0	22	9.0	1.2	.72	
Difference Between Baseline A1C and Post-intervention A1C	19	-1.18	1.52	10	-1.19	1.89	.10	7	-1.44	1.38	22	-.65	1.76	.29	

^a Adherence is defined as having received 2 consecutive A1C tests 3 calendar months apart. ^b N= number of patients. ^c SD=standard deviation.

Comparisons of adherence were made using the unpaired t test.

Discussion

This pilot project improved adherence rates to 3-month A1C testing in patients with diabetes via mailed reminder letters. There have been few published QI projects that use mailed letters to primarily improve hemoglobin A1C testing adherence. A systematic review by Nuti and colleagues identified only 3 studies that used letter reminders to achieve a primary outcome of increased frequency of A1C tests.¹² However, all were performed more than a decade ago in the continental US and addressed 6- or 12-month instead of 3-month interval testing in patients with A1C >8%. Within these studies, none combined sending a non-financially incentivized letter to patients specifically with A1C ≥8% who had not had their indicated A1C test in the last 3 months. The current study aligns with the ADA recommendations that patients with diabetes with A1C ≥8%, even with significant comorbidities, have their A1C test repeated every 3 months.

The primary outcome of this project was to increase adherence to routine 3-month A1C testing through sending mailed reminder letters. The project found an overall 58% increase in patients' return to A1C testing after the clinic mailed letters to their documented home address. Despite absolute increase in A1C adherence, there was no statistical significance observed. The improvement in adherence rates was driven primarily by women, with a 103% increase seen in adherence of women after intervention when compared to pre-intervention. This improvement was significant at $P = .10$. Meanwhile, male sex and age were not significantly associated with adherence rates. This disparity, with women being more adherent to maintenance care, has been previously described in literature. Women with T2DM have been shown to present to more diagnostic services, primary care, and specialty care appointments than men, although the etiology behind the gender disparity is unclear.^{13,14} The secondary goal of this project was to examine whether there was an improvement in hemoglobin A1C values with mailed reminder letters. There was a significantly higher A1C value at baseline for historically non-adherent patients than adherent (Table 3). This may be a result of past missed opportunities for closer follow up and titration of diabetes medications in the non-adherent group. However, further study of the association between adherence to A1C testing and A1C levels is needed.

Thirty-four percent of patients in this project received A1C tests sooner than the 3-month interval (Group 3). These patients returned in the short interval because they were advised to obtain a short-interval A1C by their medical provider. Thus, this population represents a "gray zone" in the adherence-non-adherence dichotomy of Groups 1 and 2. While the A1C

test is unnecessary, as a test with less than a 90-day interval is unlikely to yield clinically significant information, there is neither contraindication nor endorsement for more frequent A1C testing per ADA guidelines.^{4,5} These patients may have returned for increased testing due to one-time provider orders, not necessarily due to patient behavioral non-adherence. As such, this patient population may be of interest for further quality improvement study to quantify and reduce the number of unnecessary provider driven A1C lab tests.

This project had several limitations. The study was not a randomized controlled trial. The sample population available in the IMC clinic was relatively small. Patients were included over a course of 3-months instead of a longer period in order to avoid re-capturing patients who already received the intervention. Finally, there were many factors, such as actual date of mail delivery, household handling of received postal mail, and patients' English literacy that could have affected the outcomes but were not captured here.

This report describes a successful implementation of a pilot project using mailed letters to improve adherence to A1C testing in a medium sized military treatment facility. Encouragingly, the results showed an improvement in adherence, particularly in women, after the intervention. Further research using mailed letters to increase adherence to A1C testing in Hawai'i may yield promising results for the improvement of diabetic care. Future efforts should be directed towards expanding this intervention to larger or multiple clinics as well as further investigation of methods to improve the health of patients with diabetes in Hawai'i.

The views expressed in this abstract/manuscript are those of the author(s) and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the US Government.

Conflict of Interest

None of the authors identify a conflict of interest.

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