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# Effect of follow-up by a hospital diabetes care team on diabetes control at one year after discharge from the hospital

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ABSTRACT

*Aim:* This study was conducted to evaluate the effect of continued follow-up by a hospital diabetes team on HbA1c at 1-year after discharge.

*Methods:* Adults with HbA1c ≥8% (64 mmol/mol), undergoing an elective surgery, were treated in the perioperative period and randomized to continued care (CC) or the usual care (UC) after discharge. Patients in the CC group received weekly to monthly phone calls from a diabetes specialist nurse practitioner (NP) to review their home blood glucose values, diet, exercise, and medications. Patients in the UC group followed with their diabetes care providers.

*Results:* Out of 151 patients, 77 were randomized to the CC group and 74 to the UC group. HbA1c (%) at 1-year was 8.2 ± 1.4 in the CC group and 8.5 ± 1.5 in the UC group (p = NS). Change in HbA1c from baseline was similar between the groups; −0.7 ± 1.4 in the CC versus −0.7 ± 1.5 in the UC group (p = NS). A higher number of calls was not associated with lower HbA1c or reduction in HbA1c. There were 41 insulin-treated patients in the CC group and 53 in the UC group and among them, HbA1c reduction was 0.5 ± 1.5 and 0.6 ± 1.3 respectively (p = NS).

*Conclusions:* Optimal perioperative treatment of diabetes is associated with an improvement in HbA1c but continued follow-up by a hospital diabetes team after discharge does not have an additional impact on long-term glycemic control.

ClinicalTrials.gov identifier NCT02065050.



## 1. Introduction

Diabetes mellitus is a major public health problem. Despite advances in treatment, a large number of patients with diabetes remain poorly controlled, with above-target HbA1c levels [1]. Patients with diabetes are admitted to a hospital 2–3 times more often than those without diabetes [2]. Moreover, patients with worse glycemic control are more likely to

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get admitted than those with good glycemic control [3]. While the majority of hospital admissions are unrelated to diabetes, poor glycemic control contributes to poor clinical outcomes in many acute illnesses [4,5]. Therefore, most of the large US hospitals have established inpatient diabetes management teams. Typically, patients are managed by these teams during the hospital stay and given instructions for diabetes management at the time of discharge. Patients are often referred back to their primary care providers after discharge. Most studies show a temporary improvement, followed by worsening of glycemic control after discharge from the hospital [6,7].

Hospitalization may be an opportunity to identify patients with poorly controlled diabetes and intensify treatment to improve their long-term glycemic control [8,9]. Previous attempts have been made at improving long-term glycemic control by providing more diabetes education in the hospital, improving discharge instructions and arranging follow-up appointments after discharge [10,11]. Results of these studies are mixed; some showing no improvement and others showing a temporary improvement followed by worsening of HbA1c. One potential explanation for the failure to achieve long term glycemic control may be the lack of regular contact between the patient and the diabetes care provider. In the past, regular telephonic contact has been successfully used to improve HbA1c in patients with diabetes [12,13]. We hypothesized that optimal inpatient diabetes treatment followed by frequent contact between the patient and the hospital diabetes care team will improve HbA1c at one year. To test this hypothesis, we conducted a randomized controlled trial in patients with poorly controlled diabetes admitted to hospital for an elective surgery.

## 2. Subjects and methods

This was a single center, randomized controlled trial to evaluate the effect of continued care (CC) by a hospital diabetes team versus usual care (UC) on HbA1c at 1-year after discharge from the hospital (ClinicalTrials.gov identifier NCT02065050). The study protocol was approved by the Partners Health Human Research Committee and all enrolled subjects provided a written informed consent.

Adults (≥18 years old) with HbA1c ≥8% (64 mmol/mol) at admission or within the last three months, and undergoing an elective surgery at the Brigham and Women's Hospital (BWH) were eligible for the study. Patients discharged on the day of surgery were excluded. Patients with diabetes were identified from the pre-operative evaluation center at BWH. Diabetes management team contacted them before admission and prepared them for elective surgery. All patients were followed by the inpatient diabetes care team after surgery, throughout their hospitals stay. All patients received basal-bolus insulin therapy during the hospital stay and received instructions for an individualized diabetes management plan at the time of discharge.

Patients who agreed to participate in the study were asked to sign an informed consent during their hospital stay and randomized to either the UC group or CC group at the time of discharge. We excluded patients undergoing bariatric surgery or surgery for a condition that may limit their life expectancy, e.g. advanced cancer or organ transplant. Patients requiring multiple surgeries or unable to provide an informed consent were also excluded. All patients included in this study were eating regular meals and were eligible for a target HbA1c <8% at the time of discharge. The outpatient diabetes care providers of all enrolled patients were informed about their patients' participation in the study. They were also informed when the study ended for their patients.

Patients randomized to the UC group were advised to follow with their prior diabetes care providers without any interference from the study team. Patients randomized to the CC group were co-managed by the study team in collaboration with their outpatient diabetes care providers. The CC group received weekly to monthly phone calls from a diabetes specialist nurse practitioner (NP) who worked in collaboration with an endocrinologist. During these calls, the NP reviewed patients' home monitored blood glucose values, counseled about diet and exercise and discussed their medications. The NP also communicated with patients' established diabetes care providers and coordinated their follow up visits and laboratory tests. Medication changes, if felt necessary by the study team, were first discussed with the patients' providers and implemented in collaboration with them. However, insulin dose adjustments were made by the study NP independently after initial approval of the provider and the providers were informed about these changes. The role of the study team was to ensure that patients received optimal care either through their own providers or through the study team.

Baseline data were obtained from hospital records at the time of admission. HbA1c was recorded at baseline, at 3-months after discharge and at 1-year after discharge in both groups. Other collected data included weight, BMI and blood pressure at baseline and 1-year after discharge; re-hospitalization at 1-month; lipid levels, serum creatinine, eGFR and urine albumin at 1-year. Three month HbA1c data were obtained from records of patients' visits with their providers. For 1-year evaluation, patients were either seen in the clinical research center at BWH, or data were obtained from records of their visits with their diabetes care providers.

### 2.1. *Statistical analysis*

The primary outcome for this study was the change in HbA1c at 1-year after discharge. We assumed that our intervention group would have an HbA1c reduction of 1.5 ± 2.5% and the control group will have a minimal reduction in HbA1c (0.5 ± 1.5%) at 1-year. Using these assumptions, 136 patients with complete data would have provided 80% power to demonstrate the difference for a two-sided analysis at an alpha value of 0.05. Based on previous experience, we expected a higher drop-out rate in this study and thus, decided to enroll 220 patients. Other major outcomes included BMI, blood pressure, lipid levels, renal function and urine albumin at 1-year. Sample characteristics were presented as mean ± standard deviation for continuous variables and number with percent for categorical variables. Demographic and baseline comparisons were analyzed using Wilcoxon-Mann-Whitney test for continuous variables or Fisher's exact test for categorical variables. Bivariate associations were tested by Spearman