My Diabetes Care: A Pragmatic, Parallel-design, Randomized Controlled Trial

NCT05451914

Protocol and Statistical Analysis Plan

June 12, 2024

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1.0 Background

Diabetes is a leading cause of cardiovascular disease, renal failure, vision loss and non-traumatic lower limb amputations. Diabetes self-management can prevent or delay diabetes-related complications, yet patients struggle to consistently engage in recommended self-care behaviors. Patients with diabetes may lack the understanding and motivation necessary to successfully manage their disease. Among patients with diabetes, studies have found that higher patient activation (i.e., knowledge, skills and confidence to manage their own health and care) is associated with healthy eating, blood sugars monitoring, eye exams and immunizations. Many of these findings were reported in diverse and disadvantaged populations.

Patient portals offer a vehicle for interventions aimed at increasing patient activation, improving understanding, and promoting self-management, while overcoming the limitations of costly and difficult to scale face-to-face programs. We recently applied user-centered design sprint methodology and key strategies for patient engagement to develop a multi-faceted patient portal intervention, My Diabetes Care (MDC), designed to help patients better understand their diabetes health data as well as support self-management. MDC was embedded within an established patient portal on Epic's MyChart platform. MDC uses infographics to visualize and summarize patients' diabetes health data and provides literacy-level appropriate educational and self-management resources. MDC is grounded in a well-established Chronic Care Model (CCM) adapted for eHealth (i.e., healthcare practices supported by electronic processes and communication). By leveraging elements within the Model's five domains (self-management support, delivery system design, decision support, clinical information systems, and eHealth education), MDC has the potential to create more informed and activated patients leading to improved outcomes.

2.0 Rationale and Specific Aims

Vanderbilt University Medical Center (VUMC) in Nashville and Brigham and Women's Hospital (BWH) in Boston have similar patient portals. The patient portal at Vanderbilt is called My Health at Vanderbilt. The patient portal at BWH is called Patient Gateway.

The purpose of the study is to determine satisfaction with two versions of the patient portal. In addition, we will determine their effect on blood sugar control and knowledge and experience about diabetes. One version will be the currently available version of the patient portal at each site. The second version will be the currently available version of the patient portal at each site with a new feature added.

The new feature is called My Diabetes Care. My Diabetes Care displays patients' diabetes health data using graphics and easy to understand description. In addition, MDC provides diabetes self-care resources and supports diabetes self-care.

The study will involve using the patient portal (My Health at Vanderbilt at VUMC or Patient Gateway at BWH), completing study questionnaires, and using mail-in home hemoglobin A1c test kits.

In this study, we aim to evaluate the effect of MDC on glycemic control and secondary intermediate outcomes (e.g., diabetes self-efficacy). We hypothesize that a pragmatic randomized controlled trial will demonstrate MDC significantly improves HgbA1C and secondary clinical and behavioral outcomes among a racially and

ethnically diverse group of patients with type 2 diabetes (T2D) over a 6-month period and sustains improved outcomes at 12-month follow-up.

3.0 Inclusion/Exclusion Criteria

Participants will be eligible for the study if:

- Have type 2 diabetes
- Currently be taking at least one medication for diabetes
- Be between the ages of 18 and 75
- Be able to speak and read in English or Spanish
- Hemoglobin A1c at enrollment equal to or above 7.5 (most recent A1C within the last 12 months)
- Be a patient at Vanderbilt University Medical Center (VUMC) or Brigham and Women's Hospital (BWH)
- Have an existing patient portal account (Patient Gateway at BWH or My Health at Vanderbilt at VUMC)
- Able to use and have reliable access to a smartphone, tablet, or computer with internet access
- Be willing to complete an at-home A1c test kit at 4 timepoints throughout the study

We will exclude patients on dialysis, pregnant or planning to become pregnant for the next year, or living in a long-term care facility.

4.0 Enrollment/Randomization

Participants will be able to complete an electronic consent form and enroll online via Research Electronic Data Capture (REDCap™) version 5.0.8. Randomization will be performed within permuted blocks stratified by baseline A1c, study site, racial/ethnic category, and preferred language. Participants randomized to the intervention arm will be provided access to a version of their site's patient portal embedded with MDC. Participants randomized to the control arm will have access to the standard version of their site's patient portal, both sites use Epic's MyChart platform. The standard MyChart-based patient portal at both sites contains diabetes patient education materials and the ability to review pertinent health data in English and Spanish.

5.0 Study Procedures

Design. This study will be a pragmatic, parallel-design, 2-arm randomized controlled trial (RCT) of the effects of MDC on diabetes-related outcomes. Participants will be randomized 1:1 into one of two arms: (1) usual care and (2) the intervention (MDC). Participants in both arms will be told the purpose of the study is to determine patients' satisfaction with the patient portal among patients with diabetes.

Setting. The study will be conducted at two sites: (1) the VUMC Primary Care (including Shade Tree Clinic) and Diabetes clinics located throughout the greater Nashville, TN area, and (2) the BWH Primary Care clinics located throughout the greater Boston, MA area. At both sites, an electronic health record (EHR) from Epic Systems Corp. stores all clinical data and patients receive access to their clinical data via an integrated patient web portal that is accessible on desktops and via a native mobile app for iOS and Android mobile operating systems.

Participants and Recruitment. Patients will be recruited from both study sites. At VUMC, potential participants will be identified automatically using a Custom eStar Reporting Workbench Report (described below) to identify established adult patients with type 2 diabetes who receive care at participating clinics. These patients are the target population for study (i.e., Vanderbilt primary care patients with diabetes) and as such these patients are potentially eligible to participate in the study. At BWH, potential participants will be identified using a similar EHR-based recruitment strategy. The BWH EHR will be queried to identify patients that meet the eligibility criteria.

With permission of the clinic leadership at both sites, potentially eligible patients, will be mailed a recruitment letter describing the study and providing contact information for IRB approved study personnel. At BWH, an electronic version of the recruitment letter will also be available to send through the patient portal (i.e., Patient Gateway). If after receiving the letter, a patient is interested in the study, the patient may contact study personnel to learn more and consider participating in the study. The recruitment letter will include a QR code and/or URL link to the eligibility screener in REDCap. After reviewing the study eligibility criteria on the REDCap pre-screener, interested patients who believe they are eligible can advance to the REDCap Informed Consent Document (ICD). Participants will complete a self-administered electronic consent form and enroll online via REDCap. Study staff will be available to answer questions of potential participants during the consent process and will also review the ICD and study participation with all patients who enroll. Patients who do not respond to the recruitment letter or patient portal messages may be contacted by phone by study staff from either site to ensure they received the letter/message and offer them information about the study. Patients who do not respond to the initial recruitment letter may also be resent the letter one additional time.

In addition, we will distribute study flyers to participating clinic sites. As with the recruitment letter, the study flyer will include the QR code and URL link to the eligibility pre-screener in REDCap where interested patients can review eligibility criteria, review the consent form, and enroll. If a patient is interested in the study, they may contact study personnel to learn more and consider participating in the study. Contact information (study phone number and e-mail address) will be included on the study flyer and throughout the REDCap process. In accordance with best practices and to reflect a range of patient experience with diabetes, we will use oversampling and purposive sampling with the aim of achieving a study sample that is approximately 40% racial and ethnic minorities.

eStar Reporting Workbench at VUMC

Reporting Workbench Reports are available/viewable in eStar, our local EHR. These reports are developed using real-time data and can be customized to meet study-specific inclusion/exclusion criteria that are computable in the EHR. The reports often include additional variables to help the study team determine which type of outreach may be appropriate, such as Research OK to Contact status, MHAV account status, and patient portal message status. While the report displays certain variables/data, it provides easy access to a patient's record for additional screening and confirmation of eligibility. Research team members with appropriate eStar access can view/run the reports as frequently as needed. The report results will then be used to send recruitment requests through MHAV (managed centrally by the Vanderbilt Institute for Clinical and Translational Research (VICTR)) to only those with the status of Research OK to Contact. We will not be utilizing “EMR Recruitment - Existing provider relationship”.

eStar My Health at Vanderbilt Recruitment Requests

My Health at Vanderbilt (MHAV) is VUMC's patient portal where the patient may sign up and participate in managing his/her health care. MHAV can also be used for sending recruitment requests (managed centrally by VICTR) to a predefined cohort of patients who meet certain study-specific inclusion/exclusion criteria, have explicitly said OK to Contact for research, and have an active MHAV account. The messages are sent by a central team that is managed by the VICTR/Health Information Technology (IT) teams, meaning they send the messages on behalf of the study team.

Potential participants who have an explicit OK to Contact documented in eStar will receive a research invitation. The notification preferences for the research invitations can be managed by the patients in MHAV. If the patient has chosen not to receive notifications, the study will just be listed on their research studies page in MHAV.

Once the patient gets to the Research Studies page, the new study will be listed under the heading - Studies you may be able to join.

If a patient clicks I'm Interested, an automated In Basket message is sent to the study team notifying them that the patient expressed interest in the study.

If a patient clicks No, Thank You, the study will fall off their research studies page in MHAV and their eStar record will be marked as not interested.

The study personnel will be able to run a report to generate a list of all patients who clicked I'm Interested and then send a bulk direct-to-patient follow-up message through MHAV's patient clinical communication. The follow-up message will also include a URL link to a REDCap site where interested patients can review the eligibility for study, review the consent form, and enroll similar to the above recruitment methods. If a patient is interested in the study, they may contact study personnel via phone or e-mail at any time to learn more and consider participating in the study. The study contact information is included in the MHAV follow-up message.

In-person Recruitment

To supplement the above recruitment methods and support meeting our recruitment goals at both study sites, a research assistant (RA) may meet patients after appointments with their providers or set an appointment to meet with the patient at the site's research offices. Patients who express interest in the study in response to other recruitment methods (i.e., letters, portal messages, phone calls, and flyers) may be offered an optional in-person meeting to learn more about the study and have their questions answered. In-person meetings may be preferable for some patients who would like assistance navigating to the online REDCap pre-screener and ICD. In addition, study staff will use Epic reports to identify patients who meet the eligibility criteria and have upcoming appointments at participating clinics. With the approval of primary care physician, an RA may approach potentially-eligible patients after their clinic appointment to describe the study and answer any questions they might have. Meetings will take place in a private area away from other patients to ensure privacy. If a patient is interested in participating, the research assistant will assist the patient in

navigating to the online REDCap eligibility pre-screener using a computer, laptop, or mobile device. If the patient believes they are eligible, they can navigate to and complete the online REDCap ICD and enroll the study. The RA will remain available to assist and answer questions.

Data Collection and Outcome Measures. Study participants will complete questionnaires electronically via email using REDCap™ at four time points: baseline (T0), 3-month follow-up (T1), 6-month follow-up (T2), and 12-month follow-up (T3). Participants will complete a baseline questionnaire including items about socioeconomic status, race/ethnicity, marital status, education level, insurance status, diabetes duration, and technology access and use as well as validated measures of health literacy, numeracy, and eHealth literacy.

Table 1 shows the primary and secondary outcomes and related measures with associated time points for data collection. The primary outcome measure will be change in HbA1c at 6-months (T2), and sustained change at 12-month (T4) as a secondary outcome. At all timepoints, we will send participants a mail-in home HbA1c test kit. Each kit is deidentified and linked to a unique barcode. The kits instructions will be available in English and Spanish. BioQuintex Laboratories, Inc. a specialty reference laboratory accredited by the College of American Pathologists, will provide kits, analyze the samples, and sends us the results. Mail-in Home A1C test kits will not substitute for recommended HbA1c lab monitoring through patients' healthcare system and participants will be advised to continue to lab monitoring and follow-up with their healthcare team as usual. The participants will be compensated $35 for each questionnaire and $25 for completing the A1c kit.

Table 1. Outcome Measures

Primary Outcomes	**Measures**	**Time Points**
Hemoglobin A1c ($\Delta T_0 - T_2$)	Mail-in home HbA1c test kit or abstracted from the EHR	$T_0 - T_2$
Secondary Outcomes	**Measures**	**Time Points**
Hemoglobin A1c ($\Delta T_0 - T_3$)	Mail-in home HbA1c test kit or abstracted from the EHR	$T_0 - T_3$
BMI	Value abstracted from EHR	$T_0 - T_3$
Bodyweight	Value abstracted from EHR	$T_0 - T_3$
LDL cholesterol	Result abstracted from EHR	$T_0 - T_3$
Urine albumin-to-creatinine ratio	Result abstracted from EHR	$T_0 - T_3$
Blood pressure (systolic and diastolic)	Value abstracted from EHR	$T_0 - T_3$
Diet adherence	Summary of Diabetes Self-Care Activities (SDSCA) – Diet Subscale	$T_0 - T_3$
Exercise adherence	SDSCA – Exercise Subscale	$T_0 - T_3$
Medication adherence	Adherence to Refills and Medications Scale	$T_0 - T_3$
Glucose self-monitoring adherence	SDSCA – Self-monitoring of Blood Glucose Subscale	$T_0 - T_3$
Satisfaction with patient portal or MDC	System Usability Scale	$T_0 - T_3$

Secondary clinical outcomes include change in body mass index (BMI), low-density lipoprotein (LDL), urine albumin-to-creatinine ratio, blood pressure, and flu vaccination status. Additional secondary behavioral outcomes include adherence to diet, exercise, medications, and glucose self-monitoring. We will also evaluate

the following hypothesized mediators of the intervention's effects: diabetes self-efficacy, readiness to change, and diabetes knowledge.

6.0 Statistical and Qualitative Analysis Considerations

Statistical Analysis. We will generate descriptive statistics comparing the pre-intervention characteristics for intervention versus control group. For the primary analysis of change in HbA1c at 6 months, the secondary analysis of change in HbA1c at 12 months and the secondary analyses of continuous other clinical and behavioral outcomes, we will use two-sided independent two sample t-tests. For categorical variables, a chi-squared test will be performed. We will perform a secondary analysis on HbA1c using mixed effects regression models to estimate the effects of the intervention using additional timepoints, while adjusting for the baseline measure of the outcome. Nonlinear associations will be modeled with regression splines. When there are deviations from normality for any of the continuous primary or secondary outcomes, the non-parametric Wilcoxon-Mann-Whitney test will be used. An appropriate transformation will be used on the outcome variable for the mixed effects regression when the normality assumption is violated. Appropriate statistical methods, such as multiple imputation, will be used where missing data are present. The analysis with multiple imputation assumes Missing-at-Random (i.e., the model properly handles missing data by including covariates associated with reasons for dropout). Characteristics of participants who do not complete the study will be compared to those that complete it.

We will perform causal mediation analyses to explore whether the effect of MDC on the four behavioral outcomes (adherence to diet, exercise, medications, and/or home glucose monitoring) is mediated by changes in patient activation, diabetes knowledge, and/or readiness for change attributable to the intervention. Each outcome will be examined in a separate model. For each of the behavioral outcomes, the causal mediation models will include MDC, the outcome of interest at 6 months, and the posited four mediators. We will use structural equation modeling (SEM) to estimate the indirect effects of the mediators and the direct effect of MDC.

Power Analysis. In the context of the primary outcome, change in A1c at 6 months, we assume a dropout rate of 20%, a difference in the change in A1c of at least 0.5 (minimally important clinical difference) between treatment groups and 80% power. Assuming a standard deviation of 1.75 for the change in A1c based on prior studies, the sample size to detect a significant difference in improvement of A1c between the treatment groups using a two-sample t-test is 242 per sample and 484 total.