Study Title: Integration of Blood Glucose Monitoring into Electronic Health Records

NCT number: Not Yet Assigned

Date of Document: 5-25-2018

Contents

Administrative Information

1-Descriptive Title

Integration of Blood Glucose Monitoring into Electronic Health Records: a multi-center, randomized, 6-month study to evaluate the impacts of facilitating physician and patient use of electronic blood glucose tracking flowsheets.

2-Trial registration: World Health Organization Trial Registration Data Set

1. **Primary Registry and Trial Identifying Number**
   The study will be registered under ClinicalTrials.gov Protocol Registration and Results System (PRS). The NCT ID has not yet been assigned
2. **Date of Registration in Primary Registry**
   April 27, 2018
3. **Secondary Identifying Numbers**
   Sponsor (Inova Health Care Services) IRB Protocol Number: 17-2642
   Office of Evaluation Sciences Project ID number: 1729
4. **Source(s) of Monetary or Material Support**
   Travel/Project development grant of $4970 from Abdul Latif Jameel Poverty Action Lab to Allyson Root
5. **Primary Sponsor**
   Inova Health Care Services
6. **Secondary Sponsor(s)**
   N/A
7. **Contact for Public Queries**
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9. **Public Title**
   Integration of Blood Glucose Monitoring into Electronic Health Records
10. **Scientific Title**
    Integration of Blood Glucose Monitoring into Electronic Health Records
11. **Countries of Recruitment**
    United States
12. **Health Condition(s) or Problem(s) Studied**
    Diabetes Mellitus
13. **Intervention(s)**
    The study consists of a total of 5 arms: 1, 2a, 2b, 2c, and 2d.
    Arm 1: Control
    Half of primary care practices in the study sample at Inova Health Care Services will not receive any intervention and patients/physicians located at these practices will continue with business as usual.
    Arm 2: Practice Orientation for Use of Electronic Blood Glucose Flowsheets
    In the other half of primary care practices in the study sample at Inova Health Care Services Providers selected for Arm 2, practices will be encouraged to batch order blood glucose flowsheets for all patients with diabetes with active MyChart accounts. This will allow diabetic patients at these practices to enter any self-monitored glucose measurements. The research team will contact physicians and practice managers with an explanation of the initiative and instructions for completing batch orders and viewing entries through the system. Additionally, providers will be given a template for a secure smart-text message to send to all patients receiving the flowsheets, instructing them to enter data for the study period. The secure message will also provide them with information on how to enter data, and on the benefits of tracking blood glucose.
    Arm 2a: No additional reminder messaging
    25% of individuals at practices assigned to Arm 2 will receive no additional reminder messaging to enter glucose measurements in the electronic flowsheets
    Arm 2b: Standard secure message reminder
    25% of individuals at practices assigned to Arm 2 will receive generic biweekly reminders, addressed from Inova Medical Group, to enter glucose measurements in the electronic flowsheets
    Arm 2c: Secure message reminder with chance to receive gift card

25% of individuals at practices assigned to Arm 2 will receive generic biweekly reminders, addressed from Inova Medical Group, to enter glucose measurements in the electronic flowsheets. In these reminders, they will also be notified that that they will be entered to win a $50 gift card for each day entering data.

Arm 2d: Secure message reminder, addressed from primary care doctor

25% of individuals at practices assigned to Arm 2 will receive biweekly reminders, addressed from their physician, encouraging them to enter glucose measurements in the electronic flowsheets

14. **Key Inclusion and Exclusion Criteria**

Non-pregnant adult patients of Inova physicians at primary care sites other than Ashburn II Primary Care, Lake Ridge Primary Care and Springfield Primary Care with a current diabetes mellitus diagnosis and active MyChart account at time of treatment administration will be included in the study. There will be no gender, age, racial or ethnic exclusions of adult patients, and study population is expected to match the distribution of diabetic patient characteristics in Inova health system. Patients will not be formally recruited for participation in the study. The intervention involves practice-level promotion of an existing feature of Inova's MyChart: electronic blood glucose flowsheets. Promotion of this feature will not be formally mandated by the study design. All communications and interactions included in the study will take place electronically through MyChart. Physicians will exclude from initial bulk flow sheet orders any individual patients whom they identify as having contraindications for tracking of blood glucose.

15. **Study Type**

Type of study: Interventional

Method of allocation: Randomized- Provider-side treatments will be cluster randomized at the practice level. Randomization will stratify across practices by number of diabetic patients (cluster size) and will be conducted using a random number generator (via the statistical package R) at the outset of the study. Reminder messaging treatments will be assigned alphabetically by first two letters of patient last name, as it is logistically infeasible to do individual level patient messaging without sorting on an existing field in the patient's EHR

Masking: None

Assignment: Factorial

Phase (if applicable): N/A

16. **Date of First Enrollment**

May 1, 2018

17. **Sample Size**

Planned Enrollment: 7860

Enrollment to date: N/A

18. **Recruitment Status**

Pending: participants are not yet being recruited or enrolled at any site

19. **Primary Outcome(s)**
    Outcome: Flowsheet use, Extensive
    Metric: Whether patient enter data to an electronic glucose flowsheet during the measurement period (binary)
    Timepoint: (0-14) weeks after initial practice orientation meeting

    Outcome: Patient HbA1c
    Metric: Most recent patient A1c test value
    Timepoint: 26 weeks after initial practice orientation meeting

    See table in section 12 for further details.

20. **Key Secondary Outcomes**
    See table in section 12.

21. **Ethics Review**
    Status: Approved
    Date of approval: 07/06/2017
    Name and contact details of Ethics committee(s):
    Approval Number: 17-2642
    Board Name: Inova Human Research Protection Program (IRB00001101)
    Board Affiliation: Inova Fairfax Hospital
    Phone: 703-776-2182 Email: irb@inova.org
    Address:
    Inova Office of Research (IOR)
    3300 Gallows Road
    Falls Church, VA 22042

22. **Completion date**
    Expected November 2018
23. **Summary Results**
    TBD
24. **IPD sharing statement**
    No current plan to share deidentified individual clinical trial participant-level data (IPD) (Undecided).

3-Protocol Version

Date: 5/25/2018, Version: 2

4-Funding

Travel and Research Development Grant ($4980), Abdul Latif Jameel Poverty Action Lab, Allyson Root

5-Roles and responsibilities

Names, affiliations, and roles of protocol contributors

Allyson Root, MS; Affiliation: GSA, UC Berkeley
Season Majors MSN, RN; Affiliation: Inova Health Care Services
Christopher Connolly, MD; Affiliation: Inova Health Care Services
Mary Ann Friesen PhD, RN, CPHQ; Affiliation: Inova Health Care Services
Hassan Ahmed; Affiliation: Inova Health Care Services

Authors' contributions:

Allyson Root conceived of the study, contributed to study design, provided statistical expertise, and will conduct the primary statistical analysis. Season Majors contributed to study design and implementation. Christopher Connolly contributed to study design and implementation. Hassan Ahmed contributed to study implementation. Mary Ann Friesen contributed to study design. All authors contributed to refinement of the study protocol and approved the final manuscript.

Name and contact information for the trial sponsor

Trial Sponsor: Inova Health Care Services
Sponsor's Reference: IRB Protocol Number: 17-2642
Contact: Season Majors, PI
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Phone: 703-269-4655
Email: Season.Majors@inova.org

Role of study sponsor and funders

Funding source had no role in the design of this study and will not have any role during its execution, analyses, interpretation of the data, or decision to submit results.

Composition, roles, and responsibilities of individuals or groups

Research Team *(Allyson Root, MS; Season Majors MSN, RN; Christopher Connolly, MD; Mary Ann Friesen PhD, RN, CPHQ)*

Study planning
Design and conduct of study
Preparation of protocol and revisions
Preparation of written materials for practice orientations
Publication of study reports
Agreement of final protocol
Reviewing progress of study and if necessary agreeing changes to the protocol and/or investigators brochure to facilitate the smooth running of the study.

Research Physician *(Christopher Connolly, MD)* & **Physician Coordinator** *(Hassan Ahmed)*

Liaise with treatment primary care practice physicians and practice managers
Coordination of practice orientation meetings

Statistician *(Allyson Root, MS)*

Randomization

Data management and verification
Data Analysis
IT Coordinator *(Season Majors, MSN, RN)*
Coordinates MyChart Reminder messaging
Facilitates data pulls
Study Monitor (*Mary Ann Friesen PhD, RN, CPHQ)*
Ongoing monitoring of trial conduct
Continuing ethics review and reporting of adverse events

Introduction

6-Background and rationale

The percentage of the US population with diagnosed diabetes increased from 4% to over 7% from 1999 to 2014 (CDC 2016), with nearly $1 in $5 of health care dollars spent caring for people with diabetes (ADA 2013). There is substantial evidence that improved average blood sugar control (as measured by A1c levels) is associated with significant decreases in the probability of complications from diabetes (ADA 2016). Commercially insured patients with type II diabetes who lower their A1c, blood pressure and lipid levels, experience significant reductions in total medical costs (Fitch et al 2013). Recent research also suggests that reduction in blood glucose variability is associated with reduced risk of complications and mortality independently of average blood glucose/A1c (Cavalot et al. 2006) (Sorkin et al. 2005).

For patients who are insulin-dependent, self-monitoring of blood glucose (SMBG) is a critical aspect of disease management and regulation of blood glucose levels and variability. A landmark randomized controlled trial comparing intensive insulin therapy guided by frequent blood glucose monitoring to conventional insulin treatment. Intensive therapy delayed the onset and slowed the progression of diabetic retinopathy, nephropathy and neuropathy in patients with IDDM (Diabetes Control and Complications Trial Research Group 1993).

However, for non-insulin dependent type 2 diabetics, there has been some debate over the value of self-tracking. The ASIA randomized controlled trial of 689 patients over a period of 24 weeks found that patients assigned to perform 6 SMGB measurements per week had a statistically significant 0.3 reduction in A1c (ITT) after 6 months (Guerci et al 2001). However, the DiGem randomized trial found that SMGB without additional training had no effect on A1c after 1 year (Simon et al 2008). A Cochrane meta-analysis of 12 randomized controlled trials evaluating SMBG found a statistically significant mean reduction in A1c of 0.3 for studies with 6-month follow-up (effect sizes in individual studies ranged from .07 to .69), but no statistically significant change in A1c for studies with a 12 month follow up (Malanda et al 2012). However, the review was criticized for including few studies with 12-month follow-up (two, one of which had only 22 subjects). A more recent meta-study was updated to include the latest RCTs, finding a somewhat larger statistically significant reduction in A1c at 6-month follow-up (-.36), and a statistically significant reduction in A1c at 12-month follow-up (-.28) (Zhu et al 2016).

Potential sources of variation in effects of SMBG on A1c for insulin-naive patients across these studies include the characteristics of the patient population, differences in involvement of physicians and training/education provided to patients, as well as heterogeneity in adherence by patients. Much larger effects were found for newly diagnosed patients in comparison to those with a diagnosis greater than 1 year (-0.54 vs -.28 change in A1c). Some of the studies finding no effect of SMBG included mostly patient populations with already well-controlled A1c. Both meta-studies pooled interventions with different levels of guidance and structure to glucose testing.

Two key factors in enhancing the effectiveness of SMBG seem to be patient adherence and physician involvement (Clark 2007). In one study, structured SMBG was compared to enhanced standard care for 483 poorly controlled insulin-naive type 2 diabetics (Polonsky 2011). Analysis revealed much larger effects for patients who adhered to the intervention (-0.5 A1c change). Additionally, patients in both the treatment and control group of this intervention were assigned to quarterly office visits, with structured SMBG patients instructed to bring their readings to consult with their physician. Availability of this data encouraged primary care physicians to treat glycemia earlier, more frequently, and more effectively. Significantly more patients assigned to structured SMBG group received recommendations for a treatment change as compared with control subjects. These findings highlight the key role that physician engagement with SMBG data plays in its effectiveness.

Nearly all randomized controlled trials of SMBG have had patients monitor their glucose using either pen and paper or store the information on the monitoring device itself to be brought to an office visit for physician viewing. As emphasized above, physicians play an important role in interpreting blood glucose trends, but likely do not have access to this patient generated data between office visits. Though technology to electronically transmit blood glucose readings is available, it is not widely used as a standard practice of care. The TELEDIAB-1 study piloted the Diabeo system (a smartphone coupled to a website) which incorporated automated advice on the insulin doses required; and remote monitoring by teleconsultation. Use of the system improved A1c by 0.9% vs controls in patients with chronic, poorly controlled type 1 diabetes (Charpentier et al 2011). However, there are few examples of integration of such technologies into Electronic Medical Records systems in a manner that would allow for wide-scale use. One study demonstrated the feasibility of automatically sending data from continuous glucose monitors to EMR patient portals for physician viewing but did not test the impact of this on patient outcomes (Kumar et al 2016). To our knowledge, there is no randomized trial or prior research testing the causal effects of integrating of data from patient self-blood glucose monitoring into EMRs on a wide-scale.

Inova patients can track their blood glucose electronically through MyChart, allowing physicians to view their data in real time and be notified if results are out of range. More recently, functionality has been developed to connect Apple's HealthKit to MyChart, such that patients with compatible glucometers can link them to their smartphones, which can in turn be linked to MyChart to automatically transfer glucometer readings to the EHR. This update streamlines the tracking process for patients with compatible devices. Despite these capabilities however, few

doctors and patients at Inova use MyChart's blood glucose flowsheets. In order for patients to use the flowsheets, their physician must place an order through the EMR, and this initial step is rarely taken.

Recent research suggests that informational frictions are a key barrier to updating convention across medical practices (Chan 2016). Anecdotal evidence supports that many physicians at Inova are not aware of blood glucose tracking features in MyChart or how to set up tracking. This study will seek to test an intervention to inform physicians of the tracking capabilities and give guidance for placing bulk glucose flowsheet orders for all patients with diabetes. This aspect of the intervention is intended to remove barriers to physician action, setting a default such that patients have access to the tracking feature.

However, SMBG is most effective when patients track regularly. Many of the studies discussed above show a correlation between adherence and reduction in A1c. This study will also test the effect of reminder messaging on patient use of the flowsheets. One version of messaging will emphasize physician engagement and monitoring of flowsheet entries. Previous research has shown doctor patient communication is predictive of adherence (Friedman et al 2008). Patients may feel more accountability and value to tracking if they anticipate their physicians will be looking at their results. Additionally, as part of this design, some patients will be given a chance to receive a gift card if they fill out the flowsheets, intended to provide compensation for time spent setting up and learning how to use the tracking features. Past research in other contexts has shown higher adherence to patient driven behaviours when such compensation is provided (Roski et al 2003).

7-Objectives

This study aims to test methods of increasing adoption and integration of blood glucose monitoring into electronic medical records, and to measure the impact of widescale adoption on health status of patients with diabetes. To investigate determinants of adoption, the research will combine and test doctor and patient focused approaches to encouraging patient use of blood glucose flow sheets through the online patient portal, MyChart. Adoption will be measured on both the extensive and intensive margin: the number of patients who enter data into the flowsheets at all during the study period, and the mean number of entries per patient during the study period. Conditional on statistically significant increases in adoption, the study will examine corresponding intent-to-treat effects on patient health and consider possible mechanisms through which health indicators improve or do not improve.

Hypotheses

1. Interfacing with primary care practices to encourage physicians to implement default online orders of blood glucose flowsheets and informational messaging for all patients with diabetes will increase patient use of electronic glucose flowsheets.
2. Additional reminder messaging to patients that (1) emphasizes the value of tracking blood glucose data to the patient OR (2) emphasize the value of tracking blood glucose data to the

doctor OR (3) informs patient of their selection for a chance to receive an award conditional on tracking will increase adoption relative to no reminder messaging.

3. Promotion of adoption of electronic blood glucose tracking through the means described above will result in the following intent-to-treat effects:
    a. reduction in patient A1c
    b. increases in frequency of doctor-patient interaction
    c. changes to treatment plan path
4. Reminder messaging treatments that induce more intensive use of flowsheets will lead patients to experience larger effects as described in (3)
5. Entries of blood glucose data will be predictive of A1c on average and will lower over the study period.

8-Trial design

The trial is designed as a multisite randomized superiority trial with factorial groups. A practice level intervention will be compared with a business-as-usual control group. Randomization will be performed as a cluster randomization with 1:1 allocation and stratified by number of diabetic patients per practice. Within practices randomly selected for the practice level intervention, three versions of a patient level message reminder intervention will be compared to a no-reminder version, forming 4 subgroups. These subgroups will be assigned pseudo-randomly. Primary end points will be (1) flowsheet use rates 14 weeks after the initial practice intervention and (2) patient A1c scores 26 weeks after the initial practice intervention.

Methods: Participants, interventions, and outcomes

9-Study setting

Research will be conducted through the MyChart electronic medical records system with patients of Inova Health Systems primary care offices excluding Ashburn II Primary Care, Lake Ridge Primary Care and Springfield Primary Care (20 sites total).

10-Eligibility criteria

Non-pregnant adult patients of Inova physicians at primary care sites other than Ashburn II Primary Care, Lake Ridge Primary Care and Springfield Primary Care with a current diabetes mellitus diagnosis and active MyChart account at time of treatment administration will be included in the study. There will be no gender, age, racial or ethnic exclusions of adult patients, and study population is expected to match the distribution of diabetic patient characteristics in Inova health system. Patients will not be formally recruited for participation in the study. The intervention involves practice-level promotion of an existing feature of Inova's MyChart: electronic blood glucose flowsheets. Promotion of this feature will not be formally mandated by the study design. All communications and interactions included in the study will take place electronically through MyChart. Physicians will exclude from initial bulk flow sheet orders any individual patients whom they identify as having contraindications for tracking of blood glucose.

11-Interventions

The study consists of a total of 5 arms: 1, 2a, 2b, 2c, and 2d.

Arm 1: Control

Half of primary care practices in the study sample at Inova Health Care Services will not receive any intervention and patients/physicians located at these practices will continue with business as usual.

Arm 2: Practice Orientation for Use of Electronic Blood Glucose Flowsheets

In the other half of primary care practices in the study sample at Inova Health Care Services Providers selected for Arm 2, practices will be encouraged to batch order blood glucose flowsheets for all patients with diabetes with active MyChart accounts. This will allow diabetic patients at these practices to enter any self-monitored glucose measurements. The research team will contact physicians and practice managers with an explanation of the initiative and instructions for completing batch orders and viewing entries through the system. Additionally, providers will be given a template for a secure smart-text message to send to all patients receiving the flowsheets, instructing them to enter data for the study period. The secure message will also provide them with information on how to enter data, and on the benefits of tracking blood glucose.

Arm 2a: No additional reminder messaging

25% of individuals at practices assigned to Arm 2 will receive no additional reminder messaging to enter glucose measurements in the electronic flowsheets

Arm 2b: Standard secure message reminder

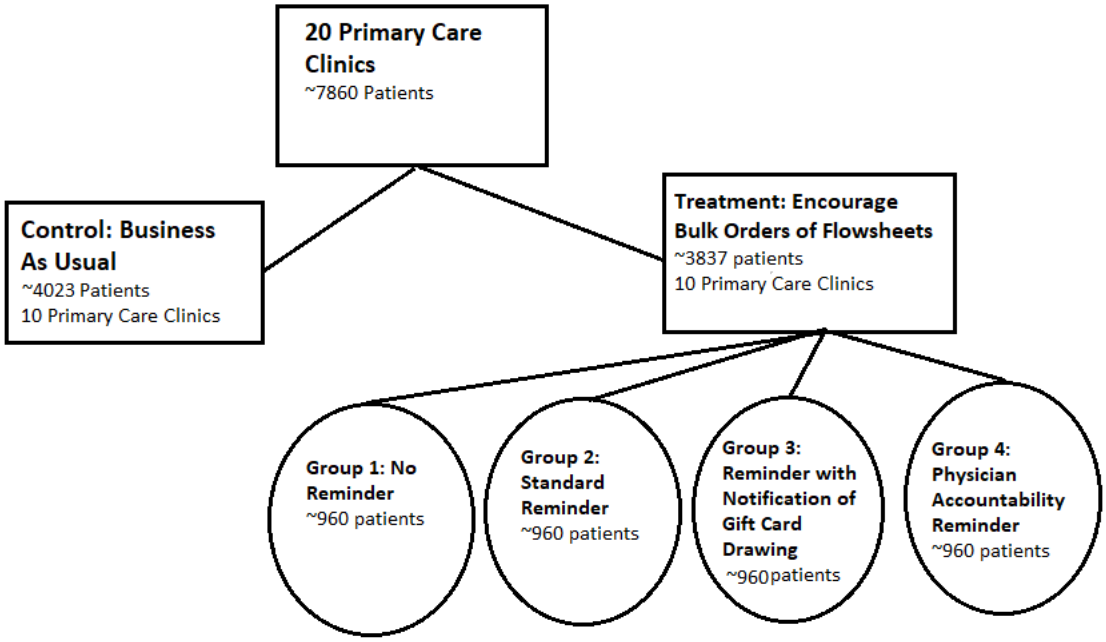
25% of individuals at practices assigned to Arm 2 will receive generic biweekly reminders, addressed from Inova Medical Group, to enter glucose measurements in the electronic flowsheets

Arm 2c: Secure message reminder with chance to receive gift card

25% of individuals at practices assigned to Arm 2 will receive generic biweekly reminders, addressed from Inova Medical Group, to enter glucose measurements in the electronic flowsheets. In these reminders, they will also be notified that that they will be entered to win a $50 gift card for each day entering data.

Arm 2d: Secure message reminder, addressed from primary care doctor

25% of individuals at practices assigned to Arm 2 will receive biweekly reminders, addressed from their physician, encouraging them to enter glucose measurements in the electronic flowsheets (Note that though messages will be addressed from physician, they will be sent by Inova IT)



Criteria for discontinuing or modifying allocated interventions

Practice level intervention (orientation meeting in Arm 2) is a one-time intervention so will not need procedure for discontinuing. Reminder messages for selected groups will continue through the study period, for as long as flowsheet orders remain active. Physicians are free to de-activate flowsheet orders as they see fit.

Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence

The research physician will coordinate with practices selected for Arm 2 to ensure practice can attend a virtual practice orientation meeting.

Relevant concomitant care and interventions that are permitted or prohibited during the trial

No concomitant care or other interventions are prohibited during the study period.

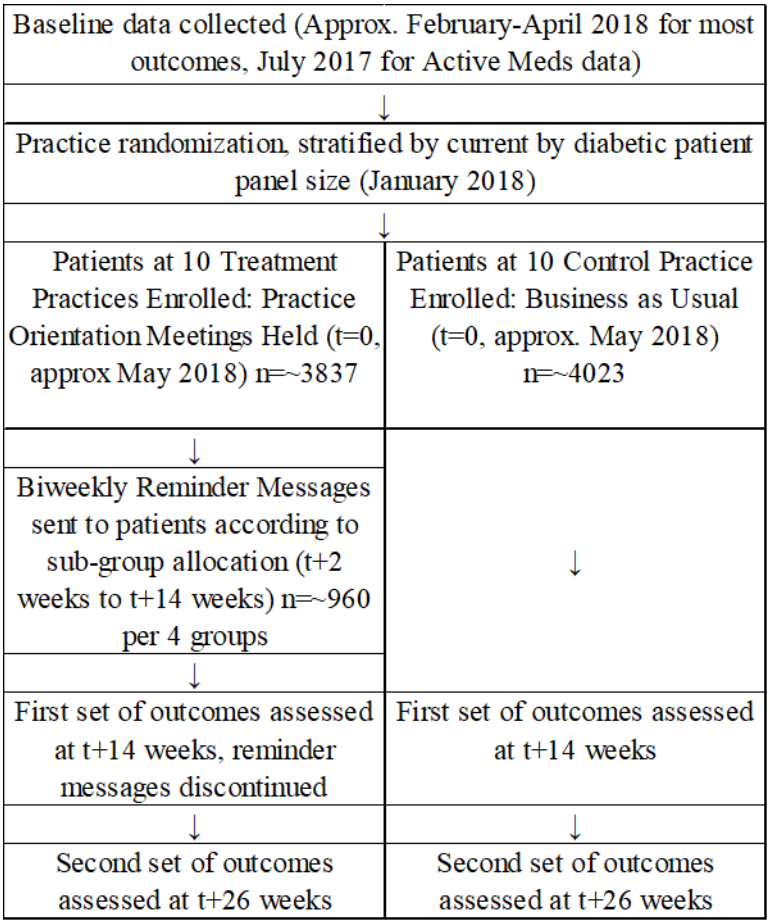
12-Outcomes

ID	Outcome(s) Description	Type	Measurement Variable	Analysis Metric	Method of Aggregation	Time Point	Explantion of Clinical Relevance
1	Flowsheet use, Extensive	Primary	Whether patient enter data to an electronic glucose flowsheet during the measurement period	Occurrence over time period	Binary (proportion)	(0-14) weeks after initial practice orientation meeting	See (i)
2	Patient HbA1c	Primary	A1c test value	Most recent test value at timepoint	Mean	26 weeks after initial practice orientation meeting	See (ii)
3	Flowsheet use, Extensive	Secondary	Whether patient enter data to an electronic glucose flowsheet during the measurement period	Occurrence over time period	Binary (proportion)	(14-26) weeks after initial practice orientation meeting	See (i)
4	Flowsheet use, Total	Secondary	Patient total days of entry to an electronic glucose flowsheet during the measurement period	Number of entries over time period	Mean	(0-14), (14-26) weeks after initial practice orientation meeting	See (i)
5	Flowsheet Orders	Secondary	Whether patient has open physician order for electronic flowsheet	Value at endpoint	Binary (proportion)	(0-14), (14-26) weeks after initial practice orientation meeting	See (i)
6	Patient HbA1c	Secondary	A1c test value	Most recent test value at timepoint	Quantile regression analysis (4 quartiles)	14, 26 weeks after initial practice orientation meeting	See (ii)
7	Patient HbA1c	Secondary	A1c test value	Most recent test value at timepoint	Mean	14 weeks after initial practice orientation meeting	See (ii)
8	Improvement in Patient HbA1c	Secondary	A1c test value	Reduction from baseline	Binary (proportion)	14, 26 weeks after initial practice orientation meeting	See (ii)
9	Patient HbA1c below benchmark	Secondary	A1c test value	Most recent test value at timepoint below 7	Binary (proportion)	14, 26 weeks after initial practice orientation meeting	See (ii)
10	Total secure messages sent by patient	Secondary	Total number of MyChart messages sent by patient during the measurement period	Total number of messages over time period	Mean	(0-14), (14-26) weeks after initial practice orientation meeting	See (iii)
11	Total secure messages sent by patient to PCP	Secondary	Total number of MyChart messages sent by patient to the PCP during the measurement period	Total number of messages over time period	Mean	(0-14), (14-26) weeks after initial practice orientation meeting	See (iii)
12	Total secure messages sent by PCP to patient	Secondary	Total number of MyChart messages sent by PCP to the patient during the measurement period	Total number of messages over time period	Mean	(0-14), (14-26) weeks after initial practice orientation meeting	See (iii)
13	Total number of patient phone appointments	Secondary	Total number of patient phone appointments during the measurement period	Total appointments over time period	Mean	(0-14), (0-26) weeks after initial practice orientation meeting	See (iii)
14	Total number of patient in-person appointments	Secondary	Total number of patient in-person appointments during the measurement period	Total appointments over time period	Mean	(0-14), (0-26) weeks after initial practice orientation meeting	See (iii)
15	Change to patient active medications	Secondary	Change (Any; Addition;Removal) to patient list of active medications during measurement period	Change (Any; Addition; Removal) from beginning to end point	Binary (proportion)	(0-14), (0-26) weeks after initial practice orientation meeting	See (iv)
16	Prescription Orders	Secondary	Number of prescription orders for patient during measurement period (Total all; Total new/non-refill; Total diabetes related)	Total number of orders over time period (All, Non-Refill, Diabetes Related)	Mean	(0-14), (0-26) weeks after initial practice orientation meeting	See (iv)
17	Flowsheet Entry Value	Secondary	Value of blood glucose entered into flowsheet	Descriptive analysis of flowsheet entries	10th 25th 50th 75th and 90th percentile flowsheet entries	(2, 4, 6, 10, 12, 14, 18, 22, 26) weeks after initial practice orientation meeting	See (i)

(i) Self monitoring of blood glucose causally associated with decreases in HbA1c for patients with type II diabetes (Zhu et al 2016), critical factor in reducing risk of complications for patients for type I diabetes (Diabetes Control and Complications Trial Research Group 1993). (ii) Improved average blood sugar control (as measured by A1c levels) is associated with significant decreases in the probability of complications from diabetes (ADA 2016). (iii) Physician communication is significantly positively correlated with patient adherence (Zolnierek 2009). (iv) People with type I diabetes must use insulin, and oral medications can help those with type II diabetes reach target blood glucose levels (ADA 2016).

13-Participant timeline

The trial consists of a 14-week intervention phase with an additional 12-week follow-up phase. The total trial period will be 26 weeks. As shown in section 12, measurements will be undertaken at three key time-points in each group: at baseline, directly after completing the 14-week intervention period, and at six-month follow-up (an additional 12 weeks after the intervention period). Baseline data will be collected for 3 months prior to first enrolment, except in the case of the dataset labelled "Active Meds" (see section 18), which will be collected starting 10 months prior to first enrolment (see Analysis Plan for further details). See the diagram below.



14-Sample size

Non-pregnant adult patients of Inova primary care physicians with a current diabetes mellitus diagnosis and active MyChart account at time of treatment administration will be included in the study. The estimated number of patients is around 7860, from 20 selected Inova primary care practices.

Power Calculations

Power calculations were performed using the "clustersampsi" command in Stata. Knowledge of available sample and estimates/assumptions of control outcome mean, variance, and intracluster correlation were used to calculate a minimum detectable effect size for the key outcomes of flowsheet adoption (extensive margin, dichotomous rate of adoption) and changes in mean A1c.

Flowsheet Adoption: Practice Level Treatment-Control Comparison
Sample Size: 7860
Number of Treatment Arms: 2
Number of Clusters: 20
Assumed Control Adoption Rate: 2%
Assumed Intra-Cluster Correlation (within practices): 0.1

Minimum Detectable Effect: **11 percentage point increase in flowsheet orders**

Mean HbA1c: Practice Level Treatment Control Comparison
Sample Size: 7860
Number of Treatment Arms: 2
Number of Clusters: 20
Assumed Control HbA1c Mean: 6.74
Assumed Control HbA1c Standard Deviation: 1.39
Assumed Intra-Cluster Correlation (within practices): 0.07
Assumed Baseline Correlation: 0.80
ITT Minimum Detectable Effect: **0.30 change in A1c**

Flowsheet Adoption: Individual Level Comparison between Messaging Assignment Groups in Treatment Practices
Sample Size: 3837
Number of Arms (including no reminder): 4
Assumed No Reminder Adoption Rate: 20%
Minimum Detectable Effect: **5.0 percentage point increase in use of flowsheets when compared to no reminder**

Justification
The sample size represents the entire population of Inova primary care patients with diabetes who have active MyChart accounts and are therefore able to access the blood glucose tracking feature. The minimum detectable effects resulting from power calculations above are in-line with similar studies cited in the protocol background. Metastudy reviews of the effect of self-monitoring of blood glucose found a 0.33-point change in A1c.

15-Recruitment
Patients will not be formally recruited for participation in the study. The intervention involves practice-level promotion of an existing feature of Inova's MyChart: electronic blood glucose flowsheets. Promotion of this feature does not represent a change in standard of care and will not be formally mandated by the study design.

Methods: Assignment of interventions (for controlled trials)
16-Sequence generation
Provider-side treatments will be cluster randomized at the practice level at 1:1 allocation. Randomization will stratify across practices by number of diabetic patients (cluster size) and will be conducted using a random number generator via the statistical package R at the outset of the study. The Statistician will conduct the randomization, and the Research Physician will notify selected practices. Reminder messaging treatments will be assigned alphabetically by first letter of patient last name, as it is logistically infeasible to do individual level patient messaging without sorting on an existing field in the patient's EHR. This assignment will be implemented by the IT coordinator. There are some concerns that ethnicity could correlate with assignment based on last

name spelling, so this form of assignment is "pseudo-random". However, the patient's race/ethnicity recorded in the medical record will be controlled for in the analysis. Causal interpretation of the results of the reminder messaging portion of the experiment will thus require the assumption that grouped last name spelling is not independently related to likelihood of flowsheet adoption. Allocation will not be concealed.

17-Blinding (masking)

Not Applicable.

Methods: Data collection, management, and analysis

18-Data collection methods

Data will be collected from patient electronic medical records for patients in all intervention arms (including control). Data in electronic medical records is part of normal care and no test or surveys will be conducted explicitly for study purposes. The table below is a description of all fields that will be pulled from the electronic medical record for analysis. Pulls will be made monthly starting from the baseline data collection period (February 2018) through end-line outcomes (October 2018).

DATASET- Variable Names	*Data Level*- Variable Descriptions	**DATASET**- Variable Names	*Data Level*- Variable Descriptions
(1) ACTIVE MEDS	*Medication level*	**(4) FLOWSHEET ORDERS**	*Order level*
pat_ID	patient ID	PAT_ID	patient ID
Most_Recent_Contact_Date	Most recent appointment date	Description	Description of Order type
PAT_ENC_CSN_ID	encounter ID of appointment	Ordering Date	Ordering Date
CURRENT_MED_ID	current medication list at time of appointment	Authrzing_PROV_ID	Provider authorizing order
IS_ACTIVE_YN	whether medication is active	**(5) FLOWSHEET READINGS**	Flowsheet entry level
description	description of medication	PAT_ID	patient id
(2) OVERALL REGISTRY REPORT	*Patient level*	entry date	date of glucose entry
PAT_ID	patient ID	entry time	time of glucose entry
Last Initial	last initial of patient name	MEAS_VALUE	value of glucose entry
Provider ID	primary care provider ID	FLO_MEAS_NAME	category of glucose entry
birth date	birthdate	**(6) MYCHART MESSAGES TO PATIENT**	*Message level*
sex	sex	MESSAGE_ID	message ID
ethnicity	ethnicity	recipient ID	patient ID
HBA1C_LAST	value of most recent A1c test	senderID	sender ID
HBA1C_LAST_DT	date of last A1c	message date	message date
last office visit	date of last office visit	message time	message time
OFF_VIS_PROV_ID	ID of last office visit	Read/Unread	whether message has been read at time of data pull
Activation date	date MyChart Activated	**(7) MYCHART MESSAGES FROM PATIENT**	*Message level*
(3) PRESCRIPTION ORDERS	*Order level*	MESSAGE_ID	message ID
ORDER_MED_ID	Order ID	recipient ID	recipient ID
PAT_ID	patient ID	senderID	patient ID
Description	description of Medication	message date	message date
dose	dose amount	message time	message time
measurement	measurement of dose	Read/Unread	whether message has been read at time of data pull
QUANTITY	quantity of doses	**(8) ENCOUNTERS**	*Encounter level*
FREQ_NAME	frequency medication prescribed	PAT_ID	patient ID
Ordering Date	date medication ordered	VISIT_PROV_ID	visit provider ID
		visit date	date of encounter
		PAT_ENC_CSN_ID	encounter ID of appointment
		NAME	in person vs telephone encounter

19-Data management

Data will be pulled from patient electronic medical records by Inova IT personnel. All data will be stored on Inova systems, and authorized collaborating researchers and personnel will access the data remotely through Citrix. A data use agreement will be entered into by Inova and the General Services Administration, and specified personnel from GSA will be authorized to access the limited dataset and perform data analysis. The limited dataset accessed through Citrix will be have facial identifiers removed in accordance with the HIPAA definition of limited dataset and personnel authorized to access will agree to (i) not use or disclose the information other than as permitted by the DUA or as otherwise required by law; (ii) use appropriate safeguards to prevent the use or disclosure of the information other than as provided for in the DUA; (iii) report to Inova any use or disclosure of the information not provided for by the DUA of which the recipient becomes aware; and (iv) not to identify the information or contact the individual. Data will be fully anonymized and linkages to identifying information will be permanently destroyed three (3) years after the conclusion of the study.

20-Statistical methods

Full details of the statistical analysis plan can be found in the appendix to the protocol (section 34).

Methods: Monitoring

21-Data monitoring

A data monitoring committee is not needed. The practice-level intervention is a discrete, one-time meeting so termination is not applicable. Reminder messages are only sent out to patients with open orders, which can be closed at doctor discretion at any point during the trial.

22-Harms

Risks from participation in this study are minimal, but one possible adverse event is breach of confidentiality. Adverse events will be reported in accordance with Inova IRB documentation IRC 11.16.

23-Auditing

The Study Monitor will lead ongoing monitoring of trial conduct, continuing ethics review and reporting of adverse events. However, all members of the research team will be responsible for ensuring study protocol is followed. Monitoring will not be independent of the study investigators/sponsor.

Ethics and dissemination

24-Research ethics approval

The protocol and all participant materials have been reviewed and approved by the sponsor and the applicable IRBs/ECs [institutional review boards/ethical committees] with respect to scientific content and compliance with applicable research and human subjects regulations Subsequent to

initial review and approval, the responsible local Institutional Review Boards/Ethical Committees (IRBs/ECs) will review the protocol at least annually. The Investigator will make safety and progress reports to the IRBs/ECs at least annually and within three months of study termination or completion at his/her site.

25-Protocol amendments

Any modifications to the protocol which may impact on the conduct of the study, potential benefit of the patient or may affect patient safety, including changes of study objectives, study design, patient population, sample sizes, study procedures, or significant administrative aspects will require a formal amendment to the protocol. Such amendment will be agreed upon by the Research Team and approved by the Ethics Committee/IRB [institutional review board] prior to implementation. Administrative changes of the protocol are minor corrections and/or clarifications that have no effect on the way the study is to be conducted. These administrative changes will be agreed upon by the Research Team and will be documented in a memorandum. The Ethics Committee/IRB may be notified of administrative changes at the discretion of the Research Team.

26-Consent or assent

A waiver of informed consent and waiver of HIPAA authorization has been approved. The study is an encouragement design aiming to increase uptake of an existing service (electronic flowsheets) provided through Inova's MyChart electronic medical record system and will not change standards of care. Patients and providers in both the treatment and control groups will have access to electronic flowsheets throughout the study unchanged from baseline. The research presents no more than minimal risk of harm to participants and involves no procedures for which written consent is normally required outside of the research context. Research could not practicably be conducted without a waiver of consent and HIPAA authorization due to the number of subjects, online nature of the experiment, and design of the study which will seek to examine outcomes for the identified population regardless of actual use of electronic flowsheets. Outcomes of the research could not practicably be studied without access to and use of protected health information.

27-Confidentiality

To minimize the risk of loss of confidentiality, the research team will implement a plan to protect the identifiers from improper use and disclosure: a limited dataset will be created and made available only to authorized researchers via secure remote access to Inova systems on Citrix. Data will be fully anonymized and linkages to identifying information will be permanently destroyed three (3) years after the conclusion of the study. Protected health information will not be reused or disclosed to any other person or entity, except as required by law, or for authorized oversight of the research project.

28-Declaration of interests

None.

29-Access to data

All data will be stored on Inova systems, and authorized collaborating researchers and personnel will access the data remotely through Citrix. A data use agreement will be entered into by Inova

and the General Services Administration, and specified personnel from GSA will be authorized to access the limited dataset and perform data analysis. The limited dataset accessed through Citrix will be have facial identifiers removed in accordance with the HIPAA definition of limited dataset and personnel authorized to access will agree to (i) not use or disclose the information other than as permitted by the DUA or as otherwise required by law; (ii) use appropriate safeguards to prevent the use or disclosure of the information other than as provided for in the DUA; (iii) report to Inova any use or disclosure of the information not provided for by the DUA of which the recipient becomes aware; and (iv) not to identify the information or contact the individual. Data will be fully anonymized and linkages to identifying information will be permanently destroyed three (3) years after the conclusion of the study.

30-Ancillary and post-trial care

Not Applicable.

31-Dissemination policy

Investigators plan to publish results in an academic journal. Additionally, results will be communicated through collaborator's website and project databases and posted to clinicaltrials.gov. Personnel listed in section (5) will be listed as authors. No current plan to share deidentified individual clinical trial participant-level data (IPD) (Undecided).

Appendices

32-Informed consent materials

A waiver of informed consent and waiver of HIPAA authorization has been approved by the IRB responsible for review. The study is an encouragement design aiming to increase uptake of an existing service (electronic flowsheets) provided through Inova's MyChart electronic medical record system and will not change standards of care. Patients and providers in both the treatment and control groups will have access to electronic flowsheets throughout the study unchanged from baseline. The research presents no more than minimal risk of harm to participants and involves no procedures for which written consent is normally required outside of the research context. Research could not practicably be conducted without a waiver of consent and HIPAA authorization due to the number of subjects, online nature of the experiment, and design of the study which will seek to examine outcomes for the identified population regardless of actual use of electronic flowsheets. Outcomes of the research could not practicably be studied without access to and use of protected health information.

33-Biological specimens

Not Applicable.

34-Statistical Analysis Plan

Project Name: Integration of Blood Glucose Monitoring into Electronic Health Records
Project Code: 1729

Date Finalized: 4/27/2018

This document serves as a basis for distinguishing between planned (confirmatory) analysis and any unplanned (exploratory) analysis that might be conducted on project data. This is crucial to ensuring that results of statistical tests will be properly interpreted and reported. In order that the Analysis Plan fulfill this purpose, it is essential that it be finalized and date-stamped before we begin looking at the data — ideally, before we take possession of the data. Once this plan is finalized, a date is entered above, and the document is posted publicly on our team website.

Data and Data Structure

This section describes variables that will be analysed, as well as changes that will be made to the raw data with respect to data structure and variables.

The table below gives a comprehensive list of raw data that will be available for analysis.

DATASET- Variable Names	*Data Level*- Variable Descriptions	**DATASET**- Variable Names	*Data Level*- Variable Descriptions
(1) ACTIVE MEDS	*Medication level*	**(4) FLOWSHEET ORDERS**	*Order level*
pat_ID	patient ID	PAT_ID	patient ID
Most_Recent_Contact_Date	Most recent appointment date	Description	Description of Order type
PAT_ENC_CSN_ID	encounter ID of appointment	Ordering Date	Ordering Date
CURRENT_MED_ID	current medication list at time of appointment	Authrzing_PROV_ID	Provider authorizing order
IS_ACTIVE_YN	whether medication is active	**(5) FLOWSHEET READINGS**	Flowsheet entry level
description	description of medication	PAT_ID	patient id
(2) OVERALL REGISTRY REPORT	*Patient level*	entry date	date of glucose entry
PAT_ID	patient ID	entry time	time of glucose entry
Last Initial	last initial of patient name	MEAS_VALUE	value of glucose entry
Provider ID	primary care provider ID	FLO_MEAS_NAME	category of glucose entry
birth date	birthdate	**(6) MYCHART MESSAGES TO PATIENT**	*Message level*
sex	sex	MESSAGE_ID	message ID
ethnicity	ethnicity	recipient ID	patient ID
HBA1C_LAST	value of most recent A1c test	senderID	sender ID
HBA1C_LAST_DT	date of last A1c	message date	message date
last office visit	date of last office visit	message time	message time
OFF_VIS_PROV_ID	ID of last office visit	Read/Unread	whether message has been read at time of data pull
Activation date	date MyChart Activated	**(7) MYCHART MESSAGES FROM PATIENT**	*Message level*
(3) PRESCRIPTION ORDERS	*Order level*	MESSAGE_ID	message ID
ORDER_MED_ID	Order ID	recipient ID	recipient ID
PAT_ID	patient ID	senderID	patient ID
Description	description of Medication	message date	message date
dose	dose amount	message time	message time
measurement	measurement of dose	Read/Unread	whether message has been read at time of data pull
QUANTITY	quantity of doses	**(8) ENCOUNTERS**	*Encounter level*
FREQ_NAME	frequency medication prescribed	PAT_ID	patient ID
Ordering Date	date medication ordered	VISIT_PROV_ID	visit provider ID
		visit date	date of encounter
		PAT_ENC_CSN_ID	encounter ID of appointment
		NAME	in person vs telephone encounter

Each of the eight datasets will be produced monthly from the baseline period (3 months prior to first enrolment of patients) through the implementation and follow-up periods. The "Active Meds" dataset lists active medications associated with a patient's most

recent encounter. For this dataset, we will have access to encounters going back to July 2017.

Outcome Variables to Be Analysed:

ID	Outcome(s) Description	Type	Measurement Variable	Analysis Metric	Method of Aggregation	Time Point	Explantion of Clinical Relevance
1	Flowsheet use, Extensive	Primary	Whether patient enter data to an electronic glucose flowsheet during the measurement period	Occurrence over time period	Binary (proportion)	(0-14) weeks after initial practice orientation meeting	See (i)
2	Patient HbA1c	Primary	A1c test value	Most recent test value at timepoint	Mean	26 weeks after initial practice orientation meeting	See (ii)
3	Flowsheet use, Extensive	Secondary	Whether patient enter data to an electronic glucose flowsheet during the measurement period	Occurrence over time period	Binary (proportion)	(14-26) weeks after initial practice orientation meeting	See (i)
4	Flowsheet use, Total	Secondary	Patient total days of entry to an electronic glucose flowsheet during the measurement period	Number of entries over time period	Mean	(0-14), (14-26) weeks after initial practice orientation meeting	See (i)
5	Flowsheet Orders	Secondary	Whether patient has open physician order for electronic flowsheet	Value at endpoint	Binary (proportion)	(0-14), (14-26) weeks after initial practice orientation meeting	See (i)
6	Patient HbA1c	Secondary	A1c test value	Most recent test value at timepoint	Quantile regression analysis (4 quartiles)	14, 26 weeks after initial practice orientation meeting	See (ii)
7	Patient HbA1c	Secondary	A1c test value	Most recent test value at timepoint	Mean	14 weeks after initial practice orientation meeting	See (ii)
8	Improvement in Patient HbA1c	Secondary	A1c test value	Reduction from baseline	Binary (proportion)	14, 26 weeks after initial practice orientation meeting	See (ii)
9	Patient HbA1c below benchmark	Secondary	A1c test value	Most recent test value at timepoint below 7	Binary (proportion)	14, 26 weeks after initial practice orientation meeting	See (ii)
10	Total secure messages sent by patient	Secondary	Total number of MyChart messages sent by patient during the measurement period	Total number of messages over time period	Mean	(0-14), (14-26) weeks after initial practice orientation meeting	See (iii)
11	Total secure messages sent by patient to PCP	Secondary	Total number of MyChart messages sent by patient to the PCP during the measurement period	Total number of messages over time period	Mean	(0-14), (14-26) weeks after initial practice orientation meeting	See (iii)
12	Total secure messages sent by PCP to patient	Secondary	Total number of MyChart messages sent by PCP to the patient during the measurement period	Total number of messages over time period	Mean	(0-14), (14-26) weeks after initial practice orientation meeting	See (iii)
13	Total number of patient phone appointments	Secondary	Total number of patient phone appointments during the measurement period	Total appointments over time period	Mean	(0-14), (0-26) weeks after initial practice orientation meeting	See (iii)
14	Total number of patient in-person appointments	Secondary	Total number of patient in-person appointments during the measurement period	Total appointments over time period	Mean	(0-14), (0-26) weeks after initial practice orientation meeting	See (iii)
15	Change to patient active medications	Secondary	Change (Any; Addition;Removal) to patient list of active medications during measurement period	Change (Any; Addition; Removal) from beginning to end point	Binary (proportion)	(0-14), (0-26) weeks after initial practice orientation meeting	See (iv)
16	Prescription Orders	Secondary	Number of prescription orders for patient during measurement period (Total all; Total new/non-refill; Total diabetes related)	Total number of orders over time period (All, Non-Refill, Diabetes Related)	Mean	(0-14), (0-26) weeks after initial practice orientation meeting	See (iv)
17	Flowsheet Entry Value	Secondary	Value of blood glucose entered into flowsheet	Descriptive analysis of flowsheet entries	10th 25th 50th 75th and 90th percentile flowsheet entries	(2, 4, 6, 10, 12, 14, 18, 22, 26) weeks after initial practice orientation meeting	See (i)

(i) Self monitoring of blood glucose causally associated with decreases in HbA1c for patients with type II diabetes (Zhu et al 2016), critical factor in reducing risk of complications for patients for type I diabetes (Diabetes Control and Complications Trial Research Group 1993). (ii) Improved average blood sugar control (as measured by A1c levels) is associated with significant decreases in the probability of complications from diabetes (ADA 2016). (iii) Physician communication is significantly positively correlated with patient adherence (Zolnierek 2009). (iv) People with type I diabetes must use insulin, and oral medications can help those with type II diabetes reach target blood glucose levels (ADA 2016).

Transformations of Variables:

Raw data will be aggregated according to the table above (see the analysis metric, method of aggregation, and time point columns). Multiple baseline Active Medications files will be aggregated to a single list of most recent active medications (based on most recent associated appointment date), which will be used as the baseline for the outcome "Change to patient active medications".

Imported Variables:

A file corresponding physician IDs to clinics, treatment assignment, and clinic size strata used for random assignment of clinics will be merged into the data described above.

Transformations of Data Structure:
After outcomes have been aggregated as indicated, they can be merged with treatment assignment status and covariates from the Overall Registry Report file using the patient ID variable.

Data Exclusion:
Only obvious data recording errors (e.g. values outside of medical feasibility) will be excluded, after assessing for any relation with treatment assignment.

Treatment of Missing Data:
The only anticipated treatment of missing data will be for covariates such as age or ethnicity which may be missing in the Diabetes Registry dataset. For specifications that include these covariates, missing values of continuous variables will be re-coded to a fixed value equal to the mean of that covariate and controlled for flexibly using dummy variable indicating that the observation has a missing value for the covariate. For categorical covariates, missing values will be coded as an additional category/dummy variable.

Statistical Models & Hypothesis Tests

This section describes the statistical models and hypothesis tests that will make up the analysis — including any follow-ups on effects in the main statistical model and any exploratory analyses that can be anticipated prior to analysis.

Statistical Models:
For all models below that indicate use of covariates for increased precision, the following list will be used: Patient Age (quadratic), Sex (categorical), ethnicity (categorical), value of most recent baseline A1c test result (linear), days since most recent baseline A1c test result (linear), days since most recent appointment at baseline (linear).

Research Question 1: Will interfacing with primary care practices to encourage physicians to implement bulk online orders of blood glucose flowsheets and informational messaging for all patients with diabetes increase patient adoption?
Outcome Measures: Comparison of individuals between treatment and control practices. Outcomes 1, 3, 4, and 5.
Specification: OLS with Lin covariate adjustment, CR2 standard errors clustered at practice level, Y=outcome, T=treatment indicator, D= doctor fixed effects , X= covariates, S= strata fixed effects
Version 1: $Y_i = \beta_0 + \beta_1 T_i + S_i + \epsilon_i$
Version 2 (main): $Y_i = \beta_0 + \beta_1 T_i + D_i + X_i + \epsilon_i$

Research Question 2: Does additional reminder messaging to patients that (1) emphasizes the value of tracking blood glucose data to the patient OR (2) emphasizes the value of tracking blood glucose data to the doctor OR (3) informs patient of their selection for a chance to receive an award conditional on tracking increase adoption relative to no reminder messaging?

Outcome Measure: Comparison of individuals across reminder messaging assignment groups (within treatment practices only) -- Outcomes 1, 3, and 4.
Specification: OLS with Lin covariate adjustment, HC2 standard errors, Y=outcome, T=treatment indicator, D= doctor fixed effects, X= covariates
Version 1: $Y_i = \beta_0 + \beta_1 T_{1i} + \beta_2 T_{2i} + \beta_3 T_{3i} + \epsilon_i$
Version 2 (main): $Y_i = \beta_0 + \beta_1 T_{1i} + \beta_2 T_{2i} + \beta_3 T_{3i} + D_i + X_i + \epsilon_i$
Version 3 (main): Same as version 2, but limited to observations with a flowsheet order (outcome 5==1)

Research Question 3: Does promotion of adoption of electronic blood glucose tracking through the means described above result in the following intent-to-treat effects:
(a) reduction in most recent patient HbA1c (test prior to study begin compared to most recent test after intervention begins)
Outcome Measures: Intent to treat comparison of individuals between treatment and control practices of the following measures at the end of the intervention period and follow-up period-- Outcomes 2, 6, 7, 8, and 9.
(b) increase in frequency of doctor-patient interaction
Outcome Measures: Intent to treat comparison of individuals between treatment and control practices of the following measures during the intervention period and follow-up period-- Outcomes 10, 11, 12, 13 and 14
For all of these outcomes, the specification that includes controls/covariates will include as a covariate a baseline measure of the outcome that is calculated of over the same length of time as the outcome period.
(c) changes to treatment plan path
Outcome Measure: Intent to treat comparison of individuals between treatment and control practices during the intervention period and follow-up period-- Outcomes 15-16
For all of these outcomes, the specification that includes controls/covariates will include as a covariate a baseline measure of the outcome that is calculated of over the same length of time as the outcome period.

Specification: OLS with Lin covariate adjustment, CR2 standard errors clustered at practice level, Y=outcome, T=treatment indicator, D= doctor fixed effects, X= covariates, S= strata fixed effects
Version 1: $Y_i = \beta_0 + \beta_1 T_i + S_i + \epsilon_i$
Version 2 (main): $Y_i = \beta_0 + \beta_1 T_i + D_i + X_i + \epsilon_i$

Research Question 4: Do reminder messaging treatments that induce more intensive use of flowsheets impact the outcomes described under research question 3 (a)-(c) above?
Outcome Measure: Intent to treat comparison of individuals across reminder messaging assignment groups (within treatment practices). Outcomes same as RQ3: 2, 6-16
Specification: OLS with Lin covariate adjustment, HC2 standard errors, Y=outcome, T=treatment indicator, D= doctor fixed effects, X= covariates

Version 1: $Y_i = \beta_0 + \beta_1 T_{1i} + \beta_2 T_{2i} + \beta_3 T_{3i} + \epsilon_i$
Version 2 (main): $Y_i = \beta_0 + \beta_1 T_{1i} + \beta_2 T_{2i} + \beta_3 T_{3i} + D_i + X_i + \epsilon_i$
Version 3 (main): Same as version 2, but limited to observations with a flowsheet order (outcome 5==1)

Research Question 5: Entries of blood glucose data will be predictive of HbA1c and will lower over the study period.
Outcome Measure: Descriptive analysis of flowsheet entry values in the treatment group during the implementation and follow-up period. Outcome=17
Specification: Non-parametric/Summary statistics

Follow-Up Analyses:
For outcomes with significant treatment effects, I will examine heterogeneous treatment effects for patients below/above A1c=7 at baseline, by sex, and by age below/above median.

Inference Criteria, Including Any Adjustments for Multiple Comparisons:
I will be using 2-tailed tests with the following cutoff p-values: 0.10, 0.05, 0.01 to infer statistical significance of treatment effects. I will not correct for multiple inferences as outcomes are expected to be highly correlated/interdependent. See: Rothman, Kenneth J. "No adjustments are needed for multiple comparisons." Epidemiology (1990): 43-46.

Limitations:
Reminder messaging groups will be pseudo-randomly assigned based on first letter of last name (due to logistical infeasibility of random assignment). Thus, for this portion of the experiment, causal interpretation will require the assumption that grouped last name spelling is not independently related to likelihood of flowsheet adoption and other outcomes, controlling for documented ethnicity.

Additionally, low take-up of the practice level intervention (bulk ordering of flowsheets) would significantly hamper power to look at other downstream outcomes.

Exploratory Analysis:
TBD

Link to an Analysis Code/Script:
N/A

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