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Diabetes Screening Reminder for Women With Prior Gestational Diabetes: A Randomized Controlled Trial

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Abstract

Objective—To evaluate whether an electronic health record reminder improves rates of screening for type 2 diabetes (T2DM) in women with prior gestational diabetes (GDM).

Methods—We randomly allocated primary care providers (by clinic site) to a reminder for T2DM screening within the electronic health record or to usual care. Women with previous GDM were identified through an automated search of laboratory results and the problem list. We compared rates of screening during the study period (2010–2012) in women at intervention sites with those at control sites. With a sample size of 850 participants, we had 80% power to detect a 15% difference in screening rates.

Results—We included 847 individuals seen at a participating clinic during the study period, of whom 471 were at a reminder clinic and 376 were at a control clinic. A similar proportion of women were screened for T2DM in both groups (N=265, 56.3% of the reminder group vs. N=206, 54.8% of the control group, p=0.67; adjusted OR 1.04, 95% CI 0.79, 1.38. Patient characteristics associated with risk for diabetes including BMI (aOR per kg/m^2 1.05, 95% CI 1.01, 1.08) and race (aOR for non-white race 2.14, 95% CI 1.57, 2.92) were significantly associated with screening.

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Clinical Trial Registration

ClinicalTrials.gov, www.clinicaltrials.gov, NCT01288144.

Conclusions—A simple electronic health record reminder did not increase the rate of diabetes screening in women with prior GDM.

Introduction

Gestational diabetes (GDM) affects 3–8% of pregnancies in the United States.(1) A diagnosis of GDM is associated with an increased risk for future type 2 diabetes; as many as 50% of women with GDM will develop diabetes within 5 years of delivery.(2) Consequently, the American College of Obstetricians and Gynecologists and the American Diabetes Association recommend that women diagnosed with GDM undergo screening at 6–12 weeks postpartum to detect type 2 diabetes, and continued screening for type 2 diabetes at least every three years.(3, 4) Despite these recommendations, screening rates remain suboptimal even in the immediate postpartum period.(5–8)

Previous interventions to increase diabetes screening have targeted obstetric providers in the postpartum period,(9, 10) however we are unaware of efforts targeting primary care providers. Provider-level barriers to ongoing diabetes screening among women with a history of GDM include lack of knowledge as well as poor communication between obstetricians and primary care providers about pregnancy complications.(11) Clinical decision support utilizing the electronic health record has shown promise as a system improvement that may improve quality of care.(12)

In a cluster randomized trial of electronic health record reminders conducted in our system, reminders improved rates of screening for hyperlipidemia in adults with chronic disease.(13) We therefore sought to study whether an electronic health record reminder in a primary care setting would increase screening for diabetes among women with a history of GDM.

Materials and Methods

We performed a cluster randomized trial of a reminder within the electronic health record to evaluate the impact on diabetes screening in women with a history of GDM. As our intervention targeted providers, we chose a cluster randomized design to avoid contamination by colleagues within participating practices. We included primary care sites from within the Partners HealthCare System, a non-profit network of outpatient and inpatient facilities founded by Brigham and Women's Hospital and Massachusetts General Hospital based in Boston, Massachusetts. All of the participating sites utilize an internally-developed electronic health record called the Longitudinal Medical Record (LMR). These 23 clinics included community health centers, hospital-based practices and off-site practices and have consented to participate in LMR-based research projects. The Partners Institutional Review Board approved this study. The trial is registered at ClinicalTrials.gov (study identifier NCT01288144).

We randomized the sites stratified by primary hospital affiliation (Brigham and Women's Hospital or Massachusetts General Hospital) and practice type (women's health center, community health center or off-site practice) to balance provider and patient characteristics between the intervention and control groups. One site in which providers are housed in separate suites was divided into 4 clusters for randomization, resulting in 26 clusters in total.

Within each stratum, we used SAS to generate a random sequence, assigning 13 clusters to the intervention and 13 to be controls.

The LMR allows providers to maintain problem, medication and allergy lists, to view laboratory and radiology results, and to generate medication prescriptions and laboratory orders. The first screen visible when a clinician accesses the electronic record for a patient is called the summary screen, and is viewed each time the patient record is opened. The system includes several clinical reminders including cancer screening, chronic disease management and smoking cessation which are displayed on the summary screen when indicated. The diabetes screening reminder text read “Patient has a history of gestational diabetes and should be screened for type 2 diabetes.” For clinicians at intervention sites, the reminder was displayed within the summary screen along with any other clinical reminders each time the record was accessed. The diabetes screening reminder was not visible to providers practicing at control sites. At intervention sites, a drop-down menu with coded responses was displayed with the reminder (figure 1). Clicking on the reminder displayed provider education about the rationale and recommended screening strategies in women with a history of GDM as well as links to further information online. The reminder content was approved by an interdisciplinary committee of providers who use the LMR.

Patients and physicians were enrolled on the first occasion during the study period (November 25, 2010 to December 1, 2012) that a 1) provider at a participating site opened a patient chart within the LMR and 2) a reminder was generated. Women were therefore enrolled in the study at the time their provider accessed their chart. Each time that a clinician opened a patient chart within the LMR, an algorithm was run to identify women with a history of GDM and exclude women who were recently screened, were less than 3 months postpartum or had already been diagnosed with diabetes. The algorithm was developed with the input of the Partners electronic medical record clinical content committee, and prioritized specificity of GDM diagnosis over sensitivity. The algorithm to identify women with a history of GDM searched all laboratory results as well as the problem list. Women aged 12–55 years who had either failed a 100-gm oral glucose tolerance test by Carpenter-Coustan criteria or had GDM in the problem list were identified as probable GDM cases. To exclude women who had already been screened, the algorithm then excluded women who had a 75-gm oral glucose tolerance test within the past year. Of note, at this point in time both Brigham and Women’s Hospital and Massachusetts General Hospital use the two-step screening method for GDM and therefore patients receiving prenatal care within either system would not have undergone a 75-gm OGTT during pregnancy. The algorithm excluded women less than 3 months postpartum, by searching for a weight documented within the obstetric record within the past 3 months. Finally, it excluded women with a coded diagnosis of diabetes in the problem list. Reminders were generated within the system and logged electronically, but were not visible to providers outside of the participating sites.

Baseline patient characteristics including age, self-reported race and insurance status were collected from the electronic health record. Body mass index (BMI) was calculated from the last documented height and weight prior to the index visit at which intervention status was assigned. Provider characteristics including age and gender were collected from administrative databases. We used laboratory databases to identify the date, time and result

of the first testing performed. We defined our primary outcome of diabetes screening as performance of a hemoglobin A1C, 2-hour 75 gm oral glucose tolerance test, or fasting glucose during the study period.

We compared patient and provider characteristics at enrolled sites using t-tests for continuous covariates and chi squares for categorical covariates. We compared unadjusted rates of screening in interventions versus controls using a chi square. We used a mixed effects model (PROC GENMOD in the SAS statistical package) to account for clustering of patients within clinical sites. The model was then adjusted for patient age, race, BMI and insurance status, provider age and sex and whether GDM was included as a coded problem in the electronic problem list. We performed sensitivity analyses to estimate the impact of the reminder within a group of women without demographic risk factors for diabetes by comparing screening rates in the population restricted to normal weight women, and also in women who did not have GDM in the electronic problem list.

We estimated that a sample size of 1000 participants would be needed to give us 80% power to detect a 15% absolute difference in screening rates between the control and intervention arms when adjusting for an intracluster correlation coefficient of 0.05 and a mean cluster size of 50 patients.(14) Based on our actual mean cluster size of 33 patients, a sample size of 850 participants gave us greater than 80% power to detect a 15% absolute difference in screening rates between the control and intervention arms.

Results

There were 6439 women with a history of GDM identified during the study period, of whom 847 visited an eligible primary care provider at a participating clinic. Of those patients, 376 (44.4%) were first seen at a control site and 471 (55.6%) were first seen at an intervention site. Patients were a mean of 41.0 ± 7.3 years old, and 47% were Caucasian. Women seen at intervention sites were less likely to have private insurance (65% vs. 72%, p=0.03) and more likely to have GDM as a coded problem within the LMR problem list than women at control sites (86% vs. 75%, p<0.0001) but were otherwise similar to women at the control sites. Providers at intervention sites were younger (mean age 42.9 ± 10.6 years versus 46.6 ± 11.7 years, p<0.0001) than providers at control sites (Table 1).

A mean of 2.0 ± 1.6 reminders were generated per patient; this did not differ between intervention sites, where reminders were visible, and control sites, where the reminders were not visible to providers. During the study period, 265 (56%) of eligible patients at intervention sites were screened compared to 206 (55%) of eligible patients at control sites (p=0.67). The majority of women who were screened had a hemoglobin A1C performed (N=242 of 265 (91%) screened in the intervention group vs. 194 of 206 (94.1%) screened in the control group, table 2). There was no significant difference in the number of cases of diabetes identified in patients at intervention sites (N=22/471, 4.7%) compared with those at control sites (N=15/376, 4%) (p=0.74). There was no significant difference in the proportion of women screened on the same day as the first visit during the study period (22% of intervention subjects vs. 21% of control subjects, p=0.52). Among the patients at an

intervention site, the coded response “Done” or “Done Elsewhere” was selected infrequently (N=48, 10.2%).

Adjustment for cluster effects, patient and provider characteristics did not change the effect estimate of the reminder. The electronic reminder was not associated with diabetes screening (adjusted OR 1.04, 95% CI 0.79, 1.38). In the final adjusted model, only patient-level predictors were significantly associated with screening. For each unit increase in BMI, there was a 4% increased odds of screening, while non-white race was associated with a 2-fold increased odds of screening (table 3).

Among the 321 women with a normal BMI, 82 (45%) of intervention subjects were screened compared to 58 (41%) of control subjects (p=0.49). Among the 164 women without a history of GDM documented in the electronic problem list, 51% of the control subjects were screened compared with 60% of the intervention subjects (p=0.24).

Discussion

In our study, 55% of women with prior GDM were screened for diabetes. An electronic health record reminder had no effect on the rate of diabetes screening. Patient race and BMI were significant predictors of screening.

This study has several strengths. We were able to include a diverse cohort of women with prior GDM as well as a broad representation of medical practices. Unlike previous postpartum screening studies, our study evaluated screening after the postpartum period in a primary care setting.

Our results must be interpreted in the context of the limitations of our study design. The algorithm to identify at-risk women included a search for GDM in the problem list, thus a system-wide change to allow GDM to remain an active problem after delivery was implemented prior to the study start date. It is therefore possible that allowing providers to see GDM in the problem list was in and of itself an intervention in both arms of the study. In a secondary analysis including only women without GDM in the problem list we found no significant difference in the proportion screened, however by restricting the population we were underpowered for small differences in screening rates. Another potential explanation for our findings is that the reminder was passive and designed to have a low impact on provider workflow, and therefore may have been overlooked. We were unable to assess how many providers noticed the reminder but did not acknowledge with a coded response, and as many sites used paper lab orders at the time of the study, we were unable to assess the number of women for whom screening was ordered but not done. While we attempted to limit the intervention to primary care providers, it is also possible that patients were seen for problem visits rather than preventive care visits and therefore that screening was deferred.

Our intervention was directed only at providers, and patient-level factors were significantly associated with screening. Fewer women in the intervention arm were privately insured, a patient-level predictor associated with screening in other studies. It is possible that this baseline difference biased our findings toward a null result, even though we did not see any association with insurance status and screening in our adjusted model. Patient race and BMI

were associated with screening, suggesting that providers screened women they were able to easily identify as at risk. Although HbA1C is less sensitive than an OGTT for diabetes screening, it was the test performed for nearly all women who were screened, highlighting the difficulty of obtaining fasting tests that require subsequent visits.

Our screening rates were similar to those reported within the first year postpartum. (7) Retrospective studies of quality improvement initiatives to increase postpartum diabetes screening in women with prior GDM that included both provider and patient-level interventions suggested that provider reminders may be effective (10, 15). Clark reported a successful pilot randomized trial of patient and provider reminders to improve postpartum screening, however screening rates were lower in clinical practice (28%) than in the trial (60%).(16) Our study extends the existing literature to include a randomized trial in a primary care setting beyond the postpartum period

Electronic health records represent a promising technology for quality improvement and are widely used. However our study shows that a passive reminder is not sufficient to change performance. We hypothesize that a multi-pronged approach, including actionable reminders that facilitate care plans as well as patient-facing technology to engage women in their own care, is needed to improve diabetes screening for women with a history of GDM.

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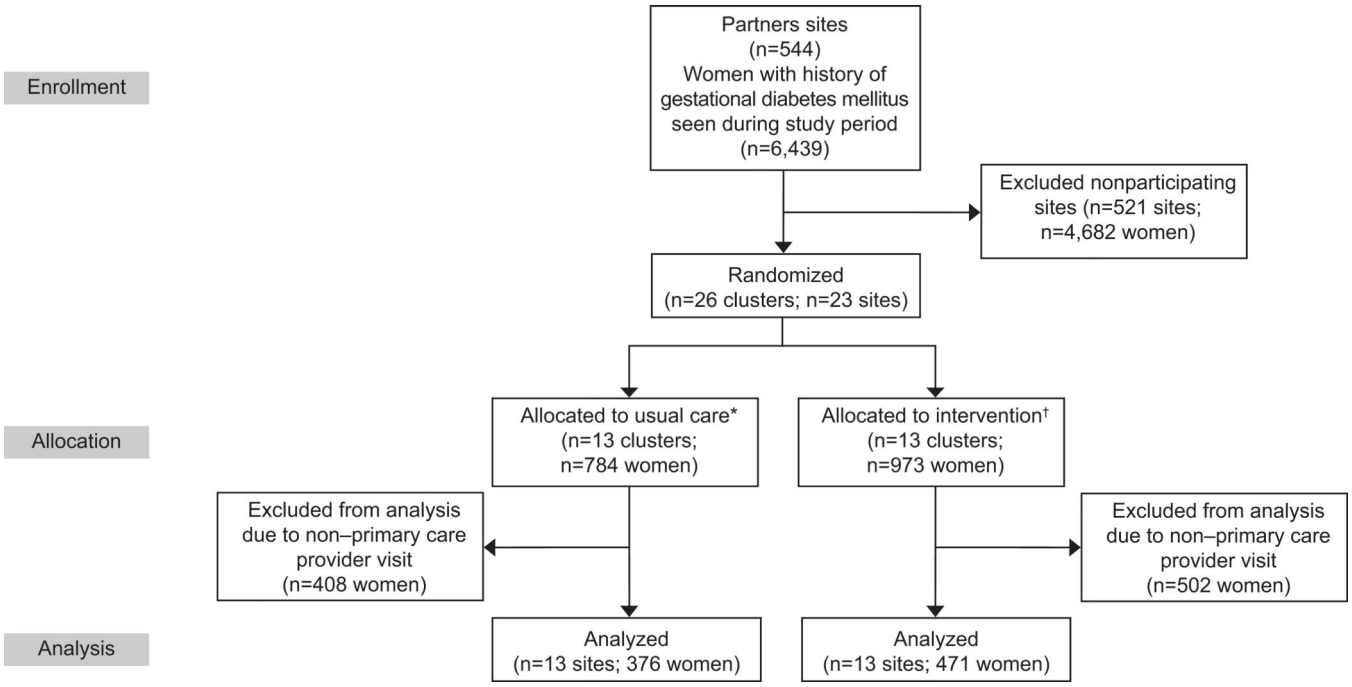

Figure 1.

Study flow. *Mean cluster size (n=29); range (n=3–91). †Mean cluster size (n=36); range (n=10–94).

Table 1

Patient and Provider Characteristics among Enrolled Clinics

	Control	Intervention	p
N (%)	376 (42.3)	471 (57.7)	
Patient characteristics			
Age, mean ± SD	41.1 ± 7.3	40.9 ± 7.3	NS[1]
Race, N (%)			NS
Caucasian	186 (49.5)	215 (45.7)	
Black/African American	52 (13.8)	66 (14.0)	
Hispanic	76 (20.2)	127 (27.0)	
Asian	52 (13.8)	50 (10.6)	
Other or unknown	10 (2.7)	13 (2.7)	
Privately insured, N (%)	272 (72.3)	307 (65.2)	0.03
BMI in kg/m^2, mean ± SD	30.0 ± 6.9	29.3 ± 6.9	NS
GDM in EMR problem list, N (%)	280 (74.5)	403 (85.6)	<0.001
Provider characteristics			
Age in years, mean ± SD	46.6 ± 11.7	42.9 ± 10.6	<0.001
Male, N (%)	103 (27.4)	106 (22.8)	NS

[1] NS: non-significant (p>0.05)

Table 2

Diabetes Screening in Participating Clinics

	Control	Intervention	P
N	376	471	
Number of reminders generated, mean ± SD	2.1 ± 1.6	2.0 ± 1.5	NS[2]
Screened, N (%)	206 (54.0)	265 (56.3)	NS
Hemoglobin A1C	194 (94.2)	242 (91.1)	NS
OGTT	14 (3.7)	14 (2.8)	NS
Fasting glucose	22 (5.9)	27 (5.7)	NS
Coded response "Done"	1 (0.3)	48 (10.2)	<0.001
Screened same day, N (%)	77 (20.5)	105 (22.3)	NS
Diabetes, N (%)	15 (4.0)	22 (4.7)	NS

[2]NS: non-significant (p>0.05)

Table 3

Multivariate Model: Odds of Diabetes Screening

	Model 1[3]		Model 2[4]	
Predictor	**Odds Ratio**	**95% CI**	**Adjusted Odds Ratio**	**95% CI**
Reminder	1.06	0.79–1.43	1.04	0.79–1.38
Age, per year			1.02	0.997–1.04
BMI, per kg/m^2			**1.04**[5]	**1.01–1.08**
Non-white race			**2.14**	**1.57–2.92**
Private Insurance			1.28	0.87–1.87
Provider age, per year			1.01	0.99–1.03
Male provider			1.01	0.68–1.49
GDM in problem list			1.02	0.72–1.44

[3] Adjusted for cluster effect

[4] Adjusted for cluster effect, age, BMI, race, private insurance, provider age and sex, and presence of GDM in the problem list.

[5] Significant associations bolded for emphasis