The effectiveness of implementing a reminder system into routine clinical practice: does it increase postpartum screening in women with gestational diabetes?

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Abstract

Introduction: During regular care, women with previous gestational diabetes mellitus (GDM) rarely receive the recommended screening test for type 2 diabetes, a 2-hour oral glucose tolerance test (OGTT), in the postpartum period. The current study examined whether the implementation of a reminder system improved screening rates.

Methods: Based on our previous randomized control trial, we implemented a postpartum reminder (letter or phone call) protocol into routine care at two of three clinical sites. We verified postpartum testing by searching hospital laboratory databases and by linking to the provincial physician service claims database. The primary outcome was the proportion of patients who underwent an OGTT within 6 months of delivery.

Results: Women who received care in a setting using a reminder system were more likely to receive an OGTT within 6 months postpartum (28%) compared with usual care (14%). The OGTT rates for both reminder groups were lower than that found in our randomized control trial (28% vs. 60%).

Conclusion: Although the screening rates remain low, postpartum reminders doubled screening rates using the recommended test, the OGTT.

Keywords: *gestational diabetes, postpartum, screening, reminders, type 2 diabetes prevention*

Introduction

Gestational diabetes mellitus (GDM), defined as hyperglycemia at the onset of pregnancy or first recognized in pregnancy, affects about 3% to 4% of non-Aboriginal women and up to 18% of Aboriginal women in Canada.[1,2] Although GDM and gestational impaired glucose tolerance (IGT) are associated with poor obstetrical outcomes, the most serious public health concern may be the 7-fold increased risk of developing type 2 diabetes (T2DM) compared to women with normal glucose tolerance in pregnancy.[3-6] The Canadian Diabetes Association (CDA) recommends that women with GDM have a 2-hour oral glucose tolerance test (OGTT) at 6 weeks to 6 months postpartum.[7] Recommendations from the International Workshop Conference on GDM suggest screening at 6 weeks postpartum using the 75-gram, 2-hour OGTT, which should then be repeated at one-year postpartum and then at least every 3 years thereafter.[8] A fasting glucose blood test alone misses approximately 40% of those with diabetes and fails to identify those with IGT.[9] When screened between 6 weeks and 3 months postpartum, 13% to 32% of women with GDM have IGT that may persist or later develop into T2DM.[10,11] The postpartum period therefore presents a unique opportunity for the identification of women at high risk of developing diabetes and provides an important opportunity for early intervention and prevention.

Although the importance of postpartum screening with an OGTT is known, screening rates remain disappointingly low in routine clinical practice.[12-14] Identified barriers to implementing the recommended postpartum screenings include poor communication between obstetrician and primary care provider, providers uncertain about screening recommendations, patients unaware of the risk of not screening and patients missing screening appointments due to competing time commitments.[15] Our group previously identified that the majority of women were not receiving the recommended postpartum screening in the Ottawa area of Ontario, Canada.[12] We did a randomized control trial (RCT) at The Ottawa Hospital (TOH) where the woman, her family physician, both of them or neither of them received a postal reminder at approximately 3 months postpartum to have an OGTT completed. If either the woman, the physician or both received the reminder, screening rates increased 4-fold from 14% (no reminder) to approximately 60%. Approximately 30% of the women in that study who completed the OGTT had an abnormal result.[16]

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Based on the results from the RCT, we implemented a reminder system into routine practice in two of three GDM clinical sites in the Ottawa area. The third site could not institute the reminder system due to logistics. The aim of our current study was to compare whether our implementation of the reminder system at the two sites made a difference in screening rates using the CDA-recommended 2-hour OGTT. We hypothesized that the women who had received care at sites implementing the reminder system would have a higher postpartum screening rate using an OGTT compared to those who had not. The analyses were based on an intention-to-treat model.

Methods

This study was approved by the Research Ethics Committee of both The Ottawa Hospital (TOH) and the Queensway Carleton Hospital (QCH). TOH is a university-affiliated tertiary centre in Ottawa, Ontario, Canada, that provides services to a catchment area of 900 000 people. TOH provides obstetrical services at two of its campuses, the Civic Campus (west) and the General Campus (east), each of which performs approximately 3500 deliveries per year. The QCH is a community-based hospital in the west end of the city that serves a population of over 400 000 and provides 2800 deliveries per year. Most women in the region are referred to one of these three sites for management of their GDM. All primary care is provided by family physicians.

We identified all the attendees at GDM education classes at one of these three sites between July 1, 2007, and June 30, 2008. Women were diagnosed with GDM following either a 50-g glucose challenge test (GCT) or a 75-g OGTT using the CDA practice guidelines criteria.[7] A GDM diagnosis was made if the woman had either (1) a 50-g GCT with a plasma glucose level greater than or equal to 10.3 mmol/L or (2) a 75-g OGTT with two of the following three results: fasting plasma glucose level greater than or equal to 5.3 mmol/L; 60-minute plasma glucose levels greater than or equal to 10.6 mmol/L; or 120-minute plasma glucose level greater than or equal to 8.9 mmol/L.[7] All the GDM education classes give information on the risks of GDM including the development of diabetes postpartum, on individualized nutrition counselling and on monitoring blood glucose at home, and patients return to the site for ongoing GDM care. At reminder site A (TOH, General Campus) and B (QCH) women were seen by an endocrinologist/internist for ongoing care and continued with their usual obstetrical care provider; at the non-reminder site (TOH, Civic Campus), women were seen by a high-risk obstetrician and obstetrical care could be transferred to the site if need be. Patients were referred to an internist if assistance with insulin management was required. Similar protocols for insulin initiation, based on the CDA recommendations, were used at all sites.

For Ontario residents, all physician visits, medical care and diagnostic testing are covered by the Ontario Health Insurance Plan (OHIP), provincial health insurance that is universally available without copayment. If patients lacked OHIP coverage, they were excluded from the study since postpartum testing could not otherwise be verified.

Approximately three months after delivery, patients from reminder site A were mailed a reminder that included information on the importance of diabetes screening and a laboratory requisition for an OGTT at a non-hospital-based laboratory, and patients from reminder site B were either sent a letter with a laboratory requisition or phoned or both. Patients from the non-reminder site did not receive a postal reminder or a reminder phone call. No sites provided routine postpartum follow-up visits for GDM.

We collected baseline characteristics and obstetrical outcomes by reviewing patient charts. We estimated socio-economic status using the neighbourhood income quintile, according to the patient's home postal code. Ethnicity and education level were not available. We searched through two sources to identify diabetes screening tests for the study participants: the hospital-based electronic record system to identify whether participants had completed postpartum diabetes screening at the hospital laboratory and records of billing claims from community laboratories, by linking each participant to the provincial physician service claims database using their unique health care number through the Institute for Clinical Evaluation Services (ICES). Because of the single-payer universal health care system in Ontario, the database includes information on all laboratory testing performed outside of the hospital setting, including the types and dates of tests. (The results of the laboratory tests are not available from these databases.)

The primary outcome was the proportion of patients who were screened for T2DM with an OGTT within 6 months of delivery. Two additional outcomes were (1) an alternate test that might have be used to screen for T2DM within 6 months of delivery (random glucose test, fasting glucose test or glycated hemoglobin [HbA1c] test) or (2) any test that might be used to screen for T2DM within 6 months of delivery (OGTT, random glucose test, fasting plasma glucose (FPG) test or HbA1c test).

Using chi-square tests and analysis of variance (ANOVA), we compared the baseline demographic, clinical and metabolic parameters between study participants and excluded participants and between the three sites. To compare screening rates at the three sites, we performed a chi-square test for each outcome versus site of delivery. We used logistic regression analyses to adjust for the following baseline characteristics: maternal age at delivery; socio-economic status; previous GDM; pre-pregnancy body mass index (BMI; normal vs. overweight vs. obese); GDM treatment (diet only vs. insulin); and family history of T2DM. We report unadjusted means and associated standard deviations for continuous variables, as well as the proportion of participants for each variable of interest (number and percent) for categorical variables. Differences are considered significant at $p \leq .05$.

Results

We identified a total of 349 cases who attended the education classes at the three sites. Of these, 60 women did not meet the criteria for GDM and 27 did not have OHIP coverage (mostly because they were residents of the neighbouring province of Quebec) leaving 262 participants. The 27 excluded women differed from the

included participants in that there was a significantly greater proportion of cigarette smokers in the excluded group (p = .002); they also gave birth to infants with a lower weight (p = .028). However, the difference in birth weight did not remain significant when gestational age at delivery was controlled for (p = .316). There were no other significant differences compared to the included participants, as seen in Table 1.

The majority of women (96.6%; 253/262) returned to the site for GDM care following their education class. Of the participants from the reminder sites, 92.2% (83/90) returned to reminder site A and 100% (55/55) returned to reminder site B, and were followed by an internist/endocrinologist for GDM care. Of the participants from the non-reminder site, 98.3% (115/117) returned and all but three were seen by the high risk obstetrician for GDM care; of these, 17.9% (21/117) were also seen by an internist/endocrinologist.

Hospital birth records were available for 91.6% (240/262) of participants. There were no differences among the sites for the following characteristics: birth weight; proportion of infants born > 4000 g; proportion of Caesarian sections; proportion of multiple gestation; proportion of primigravids or proportion of women experiencing pre-eclampsia (See Table 1). Women from the non-reminder site, however, did give birth earlier than women from reminder site B (38 vs. 39 weeks, p = .010).

At reminder site A, 96.7% of participants were sent a postal reminder with a laboratory requisition (n = 3 not sent) following delivery, but 11.5% (10/87) of these were returned because the patient no longer lived at that address. Of the participants from reminder site B, 76.3% (42/55) were mailed a reminder letter, 14.5% (8/55) were phoned by a volunteer, and 7.3% (4/55) received both a letter and a phone call; one could not be reached by telephone and no letter was sent. No patients from the non-reminder site received postal reminders or phone calls.

In the intention-to-treat analysis using all participants, 21.7% (57/262) women completed the OGTT postpartum screening within 6 months of delivery, 23.3% (21/90) from reminder site A, 36.4% (20/55) from reminder site B and 13.7% (16/117) from the non-reminder site (p = .01) (Table 2). When the reminder sites are combined, 28% (41/145) completed the OGTT, significantly more than those from the non-reminder site (chi-square [χ^2] = 7.274; p = .01; degrees of freedom [df] = 1). In the logistic regression analyses, significantly more women from reminder site B completed an OGTT compared to the non-reminder site (adjusted odds ratio [OR] = 3.10; p = .03); reminder site A did not differ from either site in OGTT completion (Table 3). When we examined the occurrence of any glucose test (random/fasting glucose test, HbA1c or OGTT) in the 6 months following delivery, we found that 41.6% (109/262) of women had completed one or more of these tests. Of the 57 women who had had OGTTs, 81% (n = 46) had records of the test in the community laboratory billing claims database. There were no statistically significant differences among the sites for the proportion of women who completed either random/fasting glucose testing or HbA1c or any diabetes screening test.

Factors that may influence screening rates were entered into a logistic regression analysis (Table 3). Women treated using diet only (vs. insulin) were less likely to complete the OGTT (adjusted OR = 0.38; CI = 0.18–0.80; p = .01). No other factors were found as significant predictors of OGTT testing. Paradoxically, women who were normal weight or overweight (vs. obese) were more likely to go for any postpartum glucose test (adjusted OR = 2.40; CI = 1.16–5.01 and adjusted OR = 3.10; CI = 1.42–6.77, respectively; p = .03). A family history of T2DM and previous GDM did not have a significant effect on the participant undergoing postpartum diabetes screening.

Discussion

We found that women with previous GDM who received care at sites where reminders are used for postpartum diabetes screening were more likely to receive the recommended test, the OGTT. The OGTT rates for both reminder groups were lower than that found in our RCT (28% vs. 60%), as expected in a comparative effectiveness study. Our rates of screening without reminders had not improved (13.7% of women from non-reminder site completed the OGTT, similar to 14.3% of women in the RCT non-intervention group). The OGTT screening rates were lower at reminder site A, but 14.4% of participants from this site did not actually receive the reminder and there was no telephone follow-up. Based on the intention-to-treat model, however, these women were still included in the analyses and participants from this group were still more likely to receive the OGTT.

Our results indicate that there were significantly fewer participants from the non-reminder site completing an OGTT compared to women from the reminder sites, but that there was no differences in the proportion that completed other glucose tests (random glucose test, FPG or HbA1c). Reluctance to perform OGTTs has been demonstrated in the general population of Ontario,[17] despite it being the best test for screening for diabetes as other types of testing may lead to false-negative results. In a recent large-scale cohort study, women with a history of GDM completed both the OGTT and the FPG; if only the FPG was used, 38% of those with prediabetes and 75% of those who met criteria for type 2 diabetes would have been missed.[18] Similarly, a Canadian study reported that when results from the FPG were used alone, 54% of women with diabetes would have been identified as normal.[9] In the current study, only about half of the women who were screened using any glucose test received the recommended test (OGTT, 21.7% vs. 41.6% any test), which suggests that the CDA guidelines are not being followed, thus missing opportunities for early intervention. Women with IGT and a history of GDM are more likely to progress to T2DM within 3 years compared to women with IGT and without a history of GDM (38.4% vs. 25.7%).[19] Many clinical trials have demonstrated that T2DM may be delayed, if not prevented, in these high risk patients through lifestyle modifications and pharmacotherapy.[19-22] In fact, women with previous GDM may benefit the most from pharmacotherapy.[19] Continued patient and provider education and service innovations are needed to improve use of an OGTT.

TABLE 1
Baseline demographic, clinical and metabolic parameters of study participants

	Non-reminder group (N = 117)	Reminder group A[a] (N = 90)	Reminder group B[a] (N = 55)	Excluded (N = 27)	*p*-value
Baseline characteristics					
Maternal age at delivery (years)	34.0 ± 5.4	33.5 ± 5.0	33.3 ± 4.0	33.7 ± 5.4	.659
Gestational age at GDM diagnosis (weeks)	26.9 ± 4.0	27.8 ± 2.8	27.8 ± 2.7	26.6 ± 3.4	.106
Pre-pregnancy BMI (kg/m^2)	27.6 ± 6.8	27.6 ± 6.0	25.4 ± 5.3[b]	28.8 ± 7.0	.039
Category of BMI (n, %)					
Unknown	0 (0.0)	27 (30.0)	1 (1.8)		
Normal	53 (45.3)	23 (25.6)	28 (50.9)		
Overweight	28 (23.9)	23 (25.6)	13 (23.6)		
Obese	36 (30.8)	17 (18.9)	13 (23.6)		
Previous GDM	30 (26.3)	20 (22.5)	6 (11.1)	5 (18.5)	.082
Primigravida	35 (29.9)	27 (30.0)	16 (29.1)	5 (18.5)	.992
Cigarette smoking in pregnancy	8 (6.8)	2 (2.6)	5 (9.1)	6 (22.2)	.258
Glucose level in challenge 50-g OGTT (mmol/L)	11.1 ± 2.2	11.8 ± 1.8	11.2 ± 1.7	11.5 ± 1.9	.202
Glucose level at 0 min 75-g OGTT (mmol/L)	5.4 ± 0.8	5.5 ± 0.7	5.2 ± 0.7	5.4 ± 0.7	.35
Glucose level at 60 min 75-g OGTT (mmol/L)	11.8 ± 1.3	11.6 ± 1.4	11.7 ± 0.9	11.5 ± 1.1	.803
Glucose level at 120 min 75-g OGTT (mmol/L)	9.4 ± 1.7	9.6 ± 1.8	9.6 ± 1.4	9.3 ± 1.3	.835
GDM care					
GDM treated with insulin	45 (38.5)	25 (27.8)	14 (25.5)	8 (29.6)	.131
Birth outcomes					
Gestational age at delivery (weeks)	38.0 ± 2.2	38.7 ± 2.5	39.0 ± 1.5[b]	37.3 ± 3.3	.01
Infant birth weight (grams)	3280.4 ± 682.6	3408.6 ± 690.0	3440.7 ± 513.8	3058.3 ± 670.0	.233
Multiple gestation	6 (5.2)	2 (2.8)	0 (0.0)	2 (7.7)	.196
Pregnancy-induced hypertension	12 (10.4)	3 (4.2)	5 (9.1)	5 (19.2)	.655
Preeclampsia	7 (6.1)	4 (5.6)	2 (3.6)	0 (0.0)	.655
Caesarian section	50 (43.9)	27 (37.5)	20 (36.4)	12 (46.2)	.552
Family Hx T2DM	59 (50.4)	51 (56.6)	27 (49.1)	13 (48.1)	.527
Income quintile (by postal code)					
Missing	2 (1.7)	1 (1.1)	0 (0.0)	n/a	.001[c]
1 (lowest)	32 (27.4)	32 (35.6)	3 (5.5)	n/a	
2	19 (16.2)	12 (13.3)	13 (23.6)	n/a	
3	27 (23.1)	17 (18.9)	13 (23.6)	n/a	
4	19 (16.2)	22 (24.4)	10 (18.2)	n/a	
5 (highest)	18 (15.4)	6 (6.7)	16 (29.1)	n/a	

Abbreviations: BMI, body mass index; GDM, gestational diabetes mellitus; Hx, medical history; N, overall sample size; OGTT, oral glucose tolerance test; p, significance; T2DM, type 2 diabetes mellitus.

Notes: n/a = data was not available due to lack of provincial insurance number to link data.

Data represent mean ± standard deviation or counts (%).

[a] Reminder groups A and B were compared to the non-reminder group using chi-square and analysis of variance (ANOVA) analyses.

[b] Significant versus non-reminder group.

[c] Reminder group B differs significantly by income quintile compared to reminder group A and the non-reminder group.

Several factors may play a role in completion of postpartum screening. There are differences in service delivery between our non-reminder and reminder sites. In particular, at the reminder sites all patients were seen by an internist/endocrinologist, whereas at the non-reminder site all patients saw a high-risk obstetrician and only saw the internist for insulin adjustments. However, given that the rate of screening was the same as in the non-intervention group in our RCT, and the model of care (other than the postpartum reminders) has remained the same at all sites, the difference is most likely due to the implementation of a reminder system. Further, despite our attempts to ensure that the reminder had been received and the patient was available for screening, there were 4 participants who were not sent a reminder and 10 mailed reminders were returned, indicating 9.6% in the reminder groups who were lost to follow-up. Also, participants in the RCT knew that they were taking part in a research study compared to the current study where women were not aware of this.

Greater contact with health care providers appears to increase screening rates. Visits to health care providers postpartum, either with an endocrinologist or during the 6-week routine follow-up visit where the provider ordered the test, were associated with higher rates of screening.[23,24] Similarly, in a cohort study of over 14 000 women with GDM, visits to an internal medicine or obstetrics/gynecology provider were independent and significant predictors of postpartum screening in the year post-delivery.[18] In our practice, no routine postpartum appointments are made with the internist/endocrinologist. Our study was limited in that we were not able to access the out-of-hospital records for postpartum care by an obstetrician or primary care provider.

Although there are no other direct studies comparing models of care delivery, case management may improve screening rates. One prospective cohort study followed women with GDM who were provided laboratory requisitions upon hospital discharge and also contacted at home by a case-manager who could perform the test; this led to an OGTT screening rate of 41%.[25] At Kaiser Permanente in Northern California, screening rates utilizing an OGTT increased from 16.6% to 71.5% when a nurse-managed care program was instituted.[18]

Women at highest risk of developing T2DM may not be returning for screening. In our study, women on insulin were more likely to complete postpartum screening, but obese women were least likely to do so, with a rate of only 28.8% completing any glucose screening. One prospective cohort study followed women with GDM who were provided laboratory requisitions upon hospital discharge and also contacted at home by a case-manager who could perform the test.[25] The women who did not return had a greater incidence of previous GDM, higher diagnostic glucose levels and were more likely to have been taking insulin during pregnancy, suggesting that women with less severe GDM were more likely to return for follow-up. We need further research on perceptions of risk vis-à-vis screening to find out why high-risk women are not being screened.

Our study has several limitations. We only followed women for 6 months postpartum in keeping with the CDA screening recommendations. (In our RCT study, we included testing done within one year.) The results from other studies are varied: one found that women will delay their testing up to 428 days postpartum,[14] whereas another demonstrated that 94.3% of women completed it by 12 weeks postpartum.[25] However, the performance of this study in one urban multicultural centre may limit the generalizability of the results.

In summary, the current study shows that reminders are an effective method of reinforcing guidelines for postpartum diabetes screening. However, the majority of women continue to not receive any glucose screening, let alone the recommended OGTT. Care providers should consider implementing a structured approach to postpartum follow-up of women with a history of GDM. Further studies should assess different methods of postpartum reminders and barriers to implementation.

TABLE 2
The proportion of study participants from each group who completed glucose screening tests in the first 6 months postpartum

	Non-reminder group (N = 117)	Reminder group A (N = 90)	Reminder group B (N = 55)
OGTT	16 (13.7%)	21 (23.3%)	20 (36.4%)[a]
Random/fasting glucose	31 (26.5%)	23 (25.6%)	12 (21.8%)
HbA1c	16 (13.7%)	12 (13.3%)	9 (16.4%)
Any glucose test	44 (37.6%)	38 (42.2%)	27 (49.1%)

Abbreviations: HbA1c, glycated hemoglobin test; N, sample size; OGTT, oral glucose tolerance test; *p*, statistical significance.

[a] $p = .01$, reminder group B vs. non-reminder group.

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TABLE 3
Adjusted logistic regression models for predicting postpartum glucose screening among women with a history of GDM

Outcome	Effect	Adjusted OR	95% CI	*p*-value
OGTT				
	Site			.029
	Reminder A vs. non-reminder	1.57	0.66 – 3.70	
	Reminder B vs. non-reminder	3.10	1.35 – 7.14	
	Age			.262
	< 30 vs. ≥ 40 years	2.51	0.58 –10.83	
	30–39 vs. ≥ 40 years	3.06	0.79 –11.84	
	Prior GDM	0.49	0.20 – 1.23	.131
	BMI			.134
	Normal vs. obese	2.42	0.92 – 6.36	
	Overweight vs. obese	3.30	1.20 – 9.06	
	GDM treatment			
	Diet vs. insulin	0.38	0.18 – 0.80	.012
	Family Hx T2DM	1.07	0.55 – 2.05	.845
	SES quintiles			.635
	1 (lowest) vs. 5 (highest)	0.89	0.29 – 2.63	
	2 vs. 5	0.96	0.33 – 2.84	
	3 vs. 5	0.85	0.29 – 2.47	
	4 vs. 5	1.68	0.59 – 4.77	
Any test				
	Site			.734
	Reminder A vs. non-reminder	1.09	0.56 – 2.13	
	Reminder B vs. non-reminder	1.33	0.65 – 2.71	
	Age			.595
	< 30 vs. ≥ 40 years	0.74	0.28 – 1.98	
	30–39 vs. ≥ 40 years	1.05	0.44 – 2.49	
	Prior GDM	0.68	0.35 – 1.34	.264
	BMI			.032
	Normal vs. obese	2.40	1.16 – 5.01	
	Overweight vs. obese	3.10	1.42 – 6.77	
	GDM treatment			
	Diet vs. insulin	0.60	0.32 – 1.12	.107
	Family Hx T2DM	0.77	0.45 – 1.31	.328
	SES quintiles			.195
	1 (lowest) vs. 5 (highest)	0.92	0.38 – 2.21	
	2 vs. highest	1.33	0.54 – 3.31	
	3 vs. highest	0.85	0.35 – 2.04	
	4 vs. highest	2.09	0.85 – 5.13	

Abbreviations: BMI, body mass index; CI, confidence interval; GDM, gestational diabetes mellitus; Hx, medical history; OGTT, oral glucose tolerance test; OR, odds ratio; SES, socio-economic status; T2DM, type 2 diabetes mellitus.

Notes: The category listed first on each line represents the reference group.

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