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Diabetes Risk Perception in Women with Recent Gestational Diabetes: Delivery to the Postpartum Visit

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Abstract

Objective—Low perceived risk for type 2 diabetes (T2DM) may be a barrier to lifestyle change in women with recent gestational diabetes (GDM). We assessed perceived risk for T2DM at delivery and postpartum.

Methods—We used a validated diabetes risk perception instrument to survey women with GDM at delivery and postpartum. We compared women with low perceived risk for T2DM at delivery to those with high perceived risk.

Results—The majority (N=43 of 70, 61%) perceived high risk at delivery. Women who perceived low risk were younger (30.7 ± 6.3 versus 35.0 ± 4.5 years, $p=0.003$) than women who perceived high risk. Although knowledge of risk factors for T2DM was poor (mean 6.0 ± 1.9 , of 11 points), 95% correctly identified GDM as a risk factor. Perceived risk was maintained in most (N=51 of 58, 88%) who returned for their postpartum visit. Low perceived risk was not associated with loss to follow up, however correct identification of GDM as a risk factor was protective (OR 0.05, 95% CI 0.005, 0.56).

Conclusions—Risk perception is accurate in most women with GDM at delivery and postpartum. Further study is needed to translate perceived risk into preventive behaviors in women with recent GDM.

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Declaration of Interest

The authors report no declarations of interest.

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Introduction

Women with a history of gestational diabetes (GDM) are at high risk for progression to type 2 diabetes mellitus (T2DM).(1) Both the American College of Obstetricians and Gynecologists (ACOG) (2) and the American Diabetes Association (ADA) (3) recommend screening for T2DM at the postpartum obstetric visit, typically scheduled for 6 to 12 weeks after delivery, as well as counseling regarding T2DM risk-reducing lifestyle modification. Despite these recommendations, many women do not get screened for T2DM in the postpartum period.(4–7) Similarly, many women do not engage in healthy lifestyle modification following delivery, even when enrolled in studies targeting postpartum weight loss.(8, 9) Patient-level behavioral barriers to screening and lifestyle intervention in the postpartum period are not yet well-characterized.

The degree of perceived vulnerability to a particular disease state can play an important role in adoption of preventive health behaviors.(10) In women with a history of GDM, it is possible that low perceived risk for future T2DM is a barrier to adherence both to recommendations for postpartum screening and risk-reducing lifestyle change. Prior work in women with a history of GDM surveyed an average of 2 years post-delivery suggests that despite knowledge of general recommendations for screening as well as the risk of progression to T2DM, few perceive themselves to be at high risk for T2DM.(11, 12) However, little is known about perception of risk for T2DM around the time of delivery and in the postpartum period in women with GDM. The postpartum period, when connections to obstetric providers persist and access to the health care system is easily obtained, may represent an important “window of opportunity” to improve the health of women with recent GDM, especially prior to future pregnancies.(13–17)

We hypothesized that as time from pregnancy progressed, women with a history of GDM would perceive themselves to be at less and less risk for developing T2DM. We therefore sought to quantify perceived risk of future diabetes at delivery and compare it to perceived risk at 6 to 12 weeks postpartum.

Methods

Study population

We included women enrolled in the Taking Early Action for Mothers with GDM (TEAM GDM) study, a randomized controlled trial of a web-based lifestyle intervention for weight loss in the first postpartum year (clinical trial registration #NCT01158131, clinicaltrials.gov). Women were eligible for the study if they had GDM in their most recent pregnancy, a body mass index of ≥ 30 kg/m², no history of bariatric surgery or other medical condition known to affect glucose tolerance, and were not using medications known to affect glucose tolerance. Women were recruited into the study during the third trimester or their delivery hospitalization, but were not randomized until the completion of their first study visit at 6 to 12 weeks postpartum. Therefore, all participants in this analysis were studied prior to randomization. Postpartum study visits were scheduled at the time of the delivery hospitalization or by phone following hospital discharge. All appointments were confirmed by telephone or email, and women were contacted by telephone up to three times if they did not attend the scheduled study visit in an attempt to reschedule. Of the 70 eligible participants who were consented and completed diabetes risk perception questionnaires at delivery, 58 attended the randomization study visit scheduled at 6 to 12 weeks postpartum and completed a second diabetes risk perception questionnaire.

Exposure assessment

Eligible participants had GDM in their most recent pregnancy diagnosed by Carpenter-Coustan criteria after a 100 g OGTT, a 50 g GLT result of >200 mg/dL, or a clinical diagnosis of GDM documented in the medical record by their obstetric provider.

Outcome assessment

Risk perception for T2DM was assessed using a questionnaire adapted from the Risk Perception Survey for Developing Diabetes, a 22-item tool originally utilized in the Diabetes Prevention Program (Supplemental file S1).(18, 19) The questionnaire was adapted for the GDM population and validated in a prior study of risk perception in women with a history of GDM.(11) Specifically, risk perception for diabetes was assessed using the question: “What do you think your risk or chance is for getting diabetes over the next 10 years?” Possible responses included “almost no chance,” “a slight chance,” “a moderate chance,” or “a high chance.” A second question addressed women’s plans for lifestyle change by asking the question “If you don’t change your lifestyle behaviors, such as diet or exercise, what is your risk or chance of getting diabetes over the next 10 years?” Other questions assessed hypothesized behavioral modifiers of risk perception including personal control, optimistic bias, belief in the benefits of preventive activities and knowledge of diabetes risk factors. Each item on the personal control, optimistic bias and benefits of preventive behaviors subscales was scored 1 through 4 and the scores were then averaged, with higher scores reflecting greater perceived control over future diabetes risk, more optimism regarding one’s own risk for future diabetes and greater belief in the benefits of preventive activity, respectively. A total of 11 multiple choice questions assessed knowledge of diabetes risk factors.

Covariates

A structured questionnaire was used to assess socio-demographic variables including race and ethnicity, primary language, level of education and household income as well as family history and personal medical history. A trained research assistant abstracted participants’ pregnancy and delivery outcomes from the electronic medical record. Study physicians verified all medical history, pregnancy and delivery outcomes.

Statistical analysis

Women were classified by perceived level of T2DM risk. Those who perceived themselves to have a “slight” or “almost no chance” for developing T2DM were classified for analysis as “perceived low risk” and those who perceived themselves to have a “moderate” or “high” chance for developing T2DM were classified as “perceived high risk.” Low and high risk groups were compared with respect to socio-demographic factors, pregnancy and diabetes risk characteristics using Fisher’s exact test or a Wilcoxon rank sum where appropriate. We explored hypothesized modifiers of risk perception by calculating univariate odds ratios with logistic regression. All statistical analyses were performed using SAS v9.2 (SAS Institute, Cary, NC).

This study was approved by the Institutional Review Board of Brigham and Women’s Hospital and all participants provided written informed consent.

Results

There were 70 women with recent GDM enrolled in the TEAM GDM study who completed risk perception questionnaires at a mean of 3.6 ± 4.7 days post-delivery. Study participants were diverse; 50% were non-white and 41% spoke a primary language other than English. In addition to a recent history of GDM, other risk factors for diabetes were prevalent. Many

participants (50%) reported having a 1st degree relative (mother, father, or sibling) with diabetes, and the majority (67%) of study participants required insulin for treatment of GDM (Table 1, column 1).

Risk Perception at Delivery

At delivery, more than half (N=43, 61%) of the study participants accurately considered themselves to be at high risk for progression to T2DM within the next 10 years. When participants were asked to estimate their risk if they did not change their current diet or exercise regimen, nearly all (N=58, 83%) felt they were at high risk for progression to T2DM (table 2).

When compared to women who perceived themselves to be at high risk at the time of delivery for developing T2DM, women who perceived themselves to be at low risk for developing T2DM were younger (30.7 ± 6.3 years versus 35.0 ± 4.5 years, $p=0.003$). Other characteristics were similar between the two groups (table 1).

Women who perceived themselves to be at low risk for progression to T2DM at the time of delivery had greater optimistic bias for not developing diabetes than women who perceived themselves to be at high risk (mean optimistic bias score 2.3 ± 0.4 vs. 1.9 ± 0.3 of 4 possible points, $p=0.0005$). Personal control and belief in the benefits of preventive behaviors were not different between the two groups. Knowledge of risk factors for diabetes overall was low (mean \pm SD score 6.0 ± 1.9 , of 11 possible points) and did not differ between groups. Although total knowledge scores were low, when individual items were analyzed at least 85% of participants were aware that regular physical activity, controlling weight gain, and eating a healthy diet were behaviors that could decrease risk for T2DM. Nearly all (N=66, 94%) of the participants correctly identified GDM as a risk factor for future T2DM and were aware of at least one preventive behavior that could decrease the risk for T2DM. (Table 2)

Risk Perception at 6 to 12 weeks Postpartum

Of the 70 women who completed risk perception questionnaires at delivery, 58 (83%) returned for the postpartum study visit and completed a second risk perception questionnaire at a mean of 43 ± 15 days after delivery. Risk perception at delivery was modestly correlated with risk perception at 6 to 12 weeks postpartum (Spearman correlation coefficient 0.56, $p<0.0001$). Risk perception was maintained or higher at the postpartum study visit in 51 (88%) participants, and the majority (N=38, 66%) correctly considered themselves to be at moderate to high risk for progression to T2DM (table 3). When asked about risk in the context of lifestyle change, 43 (74%) identified themselves to be at moderate or high risk for T2DM if they did not change current diet and exercise behaviors.

A small percentage (N=7, 12%) of women had lower perceived risk for diabetes at the postpartum study visit than they had at delivery; all of those women had perceived themselves to be at high risk at delivery. There were no differences in maternal characteristics, diabetes risk factors, timing of the study visit or potential behavioral mediators of risk perception in this group of women.

Loss to follow up

Twelve (17%) of enrolled subjects who completed a risk perception questionnaire at delivery could not be scheduled for or did not attend the scheduled study visit at 6 to 12 weeks postpartum. Age, race, ethnicity and pregnancy outcomes did not differ between women who attended the postpartum study visit and those who were lost to follow up. Of interest, low risk perception at delivery was not associated with loss to follow up (unadjusted odds ratio 1.17, 95% CI 0.33–4.14). However, knowledge of diabetes risk

factors was protective against loss to follow up, as each additional correct answer was associated with a 36% decreased odds of loss to follow up (OR 0.64, 95% CI 0.45, 0.92). Correct identification of GDM as a risk factor for T2DM was associated with a 95% decreased odds of loss to follow up (OR 0.05, 95% CI 0.005, 0.56).

Discussion

In our cohort of women with a recent history of GDM, many of whom had multiple risk factors for T2DM, the majority correctly perceived themselves to be at high risk for future T2DM when surveyed at delivery. Perceived risk did not decline in most of the participants between delivery and the 6–12 week postpartum study visit. There were no apparent differences in perceived risk for diabetes at delivery between the women who attended the first study visit and the 17% of the women who did not attend the first study visit. Finally, although overall knowledge of diabetes risk factors was not comprehensive, nearly all women in the study accurately identified GDM as a risk factor for T2DM and demonstrated awareness of at least one preventive behavior.

Our study is the first of which we are aware to examine diabetes risk perception at delivery and in the 6 to 12 week postpartum period. When Kim and colleagues surveyed women with a history of GDM an average of 2 years postpartum, they found that 57% of women with a history of GDM believed they had a moderate or high risk for developing diabetes.(11) This is similar to our findings that the majority of the women in our study believed they were at risk and maintained that belief through the first postpartum study visit. Similar to Kim's study, in which more than 90% of women with a history of GDM accurately identified GDM as a risk factor for future diabetes, our study population recognized GDM as a predictor of future diabetes. Nonetheless, knowledge of risk factors for diabetes and the value of preventive behaviors did not appear to mediate perceived risk in our study. As expected, higher scores on the optimistic bias subscale were associated with lower perceived risk of T2DM; otherwise, only younger age was significantly associated with low perceived risk. Taken together with our findings regarding knowledge of diabetes risk factors, it is possible that women with low perceived risk for T2DM might benefit from intervention targeting this optimistic bias, potentially framing their risk in an age-appropriate socio-cultural context (20) rather than simply educating them regarding the risks facing the general population of women with recent GDM.

Several authors have identified pregnancy as a “window of opportunity” for both identifying women at risk for future disease and encouraging lifestyle change.(13, 15–17) It is not clear how long this window of opportunity persists into the postpartum period. Kim found an association between risk perception and time from delivery, with women who perceived themselves to be at high risk a mean of 22.5 ± 15.4 months postpartum compared to women who perceived themselves to be at almost no risk a lowest risk perception a mean of $37.4 + 19.2$ months postpartum ($p = 0.05$) (11), suggesting that risk perception for T2DM may attenuate with increasing time since delivery. However, our study demonstrates that if attenuation occurs, it does not appear to occur over the first 6–12 weeks after delivery. Therefore, if risk perception affects preventive behaviors, our finding that risk perception was correct in a high percentage of women and that most women maintained this perception through 6 to 12 weeks postpartum suggests the possibility that women in the postpartum period may be receptive to recommended screening and adaptation of health behaviors to prevent T2DM, especially prior to future pregnancies.

Despite multiple efforts to schedule a study visit 6 to 12 weeks after delivery, 17% of our subjects did not attend a postpartum study visit. We speculated that risk perception at delivery might influence the likelihood of coming for their postpartum study visit, however

we did not observe such an association in our population. We did identify an association between knowledge and loss to follow up. Although knowledge was generally accurate, it was lower in those lost to follow up and those who returned. We hypothesize that efforts to identify women with less baseline knowledge regarding risks might help increase postpartum follow up. Further efforts to identify patient-level barriers to recommended screening and lifestyle change in the postpartum period are needed to help inform successful interventions for this population.

Strengths of our study include a diverse population; only half of our subjects were Caucasian and nearly half our subjects did not speak English as their primary language. As our subjects were primarily recruited from a multidisciplinary clinic serving women with GDM at a tertiary care center, a large proportion of our subjects used insulin during pregnancy and therefore were at particularly high risk for developing T2DM (refs).(7, 21) We recognize the limitations of our data as our small sample size precluded stratified or multivariate analyses that might account for confounders of the relationship between diabetes risk perception and loss to follow up. Nonetheless, our longitudinal follow-up and rigorous assessment of diabetes risk perception as well as relevant covariates gave us the ability to investigate multiple potential mediators of diabetes risk perception. This study provides an understanding of diabetes risk perception in women with recent GDM in the early postpartum period, a time when women remain engaged in obstetric care and potentially receptive to health prevention efforts.

In summary, we found that when surveyed at delivery and at 6 to 12 weeks postpartum, most women with recent GDM accurately perceive themselves to be at elevated risk for progression to T2DM. This finding suggests that risk-reducing interventions in the early postpartum period may need to focus not just on education but employ unique strategies to motivate women who realize they are at high risk. Further longitudinal study is needed to characterize if and when diabetes risk perception changes after pregnancy affected by GDM so that the postpartum “window of opportunity” for risk-reducing intervention is effectively utilized.

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Table 1

Association of Participant Characteristics with Risk Perception at Delivery

	Total	Low Risk	High Risk	P value
Respondents, N (%)	70	27 (37.0)	43 (61.4)	
<i>Maternal Characteristics</i>				
Age, mean (SD)	33.3 (5.6)	30.7 (6.3)	35.0 (4.5)	0.003
Race, N (%)				
	Caucasian	12 (44.4)	23 (53.4)	
	African American	8 (29.6)	8 (18.6)	0.43
	Asian	3 (11.1)	6 (14.0)	
	Other	4 (14.8)	6 (14.0)	
	Missing	0	2 (4.7)	
Hispanic, N (%)	15 (21.4)	6 (22.2)	9 (20.9)	1.0
Primary language other than English, N (%)	29 (41.4)	10 (37.0)	19 (44.2)	0.47
College graduate, N (%)	46 (65.7)	19 (70.3)	27 (62.8)	0.60
Annual household income >\$75K, N (%)	29 (41.4)	12 (44.4)	17 (39.5)	0.80
Married, N (%)	42 (57.5)	15 (55.6)	27 (62.8)	0.76
Parity, mean (SD)	2.0 (1.1)	1.7 (1.0)	2.1 (1.1)	0.06
Ever smoked, N (%)	21 (30.0)	4 (14.8)	17 (39.5)	0.08
<i>Pregnancy Outcomes</i>				
Gestational age at delivery in weeks, mean (SD)	38.6 (1.3)	38.7 (1.0)	38.5 (1.5)	0.58
Vaginal delivery, N (%)	37 (52.9)	16 (59.3)	21 (48.8)	0.47
Hypertensive disorder, N (%)	15 (21.4)	5 (18.5)	10 (23.3)	0.77
<i>Diabetes risk factors</i>				
Family history of diabetes, N (%)	35 (50.0)	15 (55.6)	20 (46.5)	0.62
BMI at delivery, kg/m ² , mean (SD)	30.0 (5.9)	28.9 (5.4)	30.6 (6.2)	0.28
Insulin during pregnancy, N (%)	47 (67.1)	16 (59.3)	31 (72.1)	0.30
Number of GDM pregnancies, mean (SD)	1.3 (0.5)	1.2 (0.5)	1.3 (0.5)	0.18
History of hypertension, N (%)	15 (21.4)	5 (18.5)	10 (23.3)	0.77
History of hyperlipidemia, N (%)	2 (2.9)	0	2 (4.7)	0.51

Abbreviations: GDM, gestational diabetes; BMI, body mass index.

Table 2

Risk Perception at Delivery

	Total	Low Risk	High Risk	P
Respondents, N (%)	70	27 (38.6)	43 (61.4)	<0.0001
Risk for diabetes in next 10 years, N (%)				
Almost no chance	2 (2.9)	2 (7.4)	0	
Slight	25 (35.7)	25 (92.6)	0	
Moderate	31 (44.3)	0	31 (72.1)	
High	12 (17.1)	0	12 (27.9)	
Risk for diabetes in next 10 years if no lifestyle change, N (%)				<0.0001
Almost no chance	1 (1.4)	1 (3.7)	0	
Slight	11 (15.7)	10 (37.0)	1 (2.3)	
Moderate	27 (38.6)	11 (40.7)	16 (37.2)	
High	31 (44.3)	5 (18.5)	26 (60.5)	
<i>Modifiers of risk perception</i>				
Personal control, mean (SD)	3.2 (0.4)	3.2 (0.5)	3.2 (0.4)	0.67
Optimistic bias, mean (SD)	2.1 (0.4)	2.3 (0.4)	1.9 (0.3)	0.0005
Benefits/barriers, mean (SD)	3.5 (0.6)	3.5 (0.6)	3.4 (0.6)	0.45
<i>Knowledge of diabetes risk factors</i>				
Correctly recognized the following modifiable risk factors, N (%):				
Regular physical activity	64 (91.4)	25 (92.6)	39 (90.7)	1
Controlling weight gain	62 (88.6)	25 (92.6)	37 (86.0)	0.39
Eating a healthy diet	65 (92.9)	26 (96.3)	39 (90.7)	0.28
Correctly identified GDM as a risk factor, N (%)	66 (94.3)	25 (92.6)	41 (95.3)	0.64
Total knowledge of diabetes risk factors (of 11 possible points), mean (SD)	6.0 (1.9)	5.9 (1.7)	6.1 (2.0)	0.68

Table 3

Risk Perception at 6 to 12 Weeks Postpartum

	Total	Low Risk	High Risk	P
Respondents, N (%)	58	22 (37.8)	36 (62.1)	
Risk for diabetes in next 10 years, N (%)				0.0008
Almost no chance	0	0	0	
Slight	20 (34.5)	14 (63.6)	6 (16.7)	
Moderate	27 (46.6)	7 (31.8)	20 (55.6)	
High	11 (19.0)	1 (4.5)	10 (27.8)	
Risk for diabetes in next 10 years if no lifestyle change, N (%)				0.004
Almost no chance	1 (1.7)	0	1 (2.8)	
Slight	13 (22.4)	10 (45.5)	3 (8.3)	
Moderate	20 (34.5)	7 (31.8)	13 (36.1)	
High	23 (39.7)	4 (18.2)	19 (52.8)	
<i>Modifiers of risk perception</i>				
Personal control, mean (SD)	3.3 (0.4)	3.4 (0.4)	3.2 (0.4)	0.05
Optimistic bias, mean (SD)	2.1 (0.5)	2.3 (0.5)	2.0 (0.5)	0.02
Benefits/barriers, mean (SD)	3.4 (0.5)	3.5 (0.7)	3.4 (0.4)	0.48
<i>Knowledge of diabetes risk factors</i>				
Correctly recognized the following modifiable risk factors, N (%):				
Regular physical activity	55 (94.8)	21 (95.5)	34 (94.4)	1
Controlling weight gain	54 (93.1)	22 (100)	32 (88.9)	0.29
Eating a healthy diet	56 (96.6)	22 (100)	34 (94.4)	1
Correctly identified GDM as a risk factor, N (%)	56 (96.6)	22 (100)	34 (94.4)	0.52
Total knowledge of diabetes risk factors (of 11 possible points), mean (SD)	6.4 (1.6)	6.3 (1.5)	6.5 (1.7)	0.35