Preventive Counseling Among Women With Histories of Gestational Diabetes Mellitus

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OBJECTIVE — The purpose of this study was to examine the association between recall of recommendations for diabetes prevention and both health behaviors and screening among women with histories of gestational diabetes mellitus (GDM).

RESEARCH DESIGN AND METHODS — We surveyed 228 women with histories of GDM within the past 5 years who were enrolled in a university-affiliated managed care plan. In a cross-sectional analysis, we assessed the association between recall of health care provider advice and both postpartum lifestyle behaviors and reported performance of postpartum diabetes screening. Multivariate models were constructed that adjusted for correlates of counseling including postpartum diabetes, dyslipidemia, insulin use during pregnancy, and provider type.

RESULTS — Participants were predominantly non-Hispanic white, college educated and affluent, and overweight or obese. The majority reported that they received counseling on lifestyle modification and postpartum diabetes screening. Postpartum physical activity levels, fruit and vegetable intake, and screening were suboptimal. No significant association existed between recall of advice and physical activity or between recall of advice and diet. Recall of advice along with distribution of laboratory slips for glucose testing was associated with performance of postpartum diabetes screening using self-report (adjusted odds ratio 2.07 [95% CI 1.51–2.84]) or claims data (1.64 [1.16–2.32]).

CONCLUSIONS — Women with histories of GDM who recalled advice regarding postpartum glucose testing and received laboratory slips were significantly more likely to report having had postpartum diabetes screening. Although women's recall of services may not reflect the actual services received, simple counseling may not be sufficient to optimize postpartum behaviors to reduce future risk of diabetes.

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Gestational diabetes mellitus (GDM) is defined as glucose intolerance first identified during pregnancy (1,2). Although glucose intolerance resolves with delivery ~90% of the time (3), women with GDM have an increased risk for future glucose intolerance (4,5). Unfortunately, studies to date suggest that women with GDM may not be informed about the implications of their diagnosis, including how to reduce their future risk of diabetes or about the advantages of lifestyle modification (6,7). Also, although guidelines recommend postpartum testing for glucose intolerance with an oral glucose tolerance test (OGTT) at 6 weeks and an OGTT or fasting glucose periodically thereafter (1,2), many women with GDM do not undergo this postpartum diabetes screening (8–10).

Several studies suggest that physician practices may contribute to these deficits. A 1998 survey of academic obstetrician-gynecologists found that only 62% believed that women with GDM were at risk for future diabetes after delivery and only 60% stated they practiced postpartum diabetes screening (11). A 2004 survey of a similar population noted that 75% practiced postpartum screening. No reports have examined other aspects of GDM care, including health care providers' discussion of future diabetes risk, lifestyle modification strategies, or screening.

Therefore, we surveyed women with histories of GDM about their recall of diabetes preventive care during and after their GDM pregnancy. We hypothesized that recall of GDM-related services would be associated with education and that recall of GDM care would be associated with patients' current lifestyle behaviors (diet and exercise habits) as well as the likelihood of postpartum diabetes screening.

RESEARCH DESIGN AND METHODS

Conceptual framework and scale development

We developed a conceptual framework for how health care for women with histories of GDM could potentially influence processes and outcomes of care related to diabetes prevention. We based our framework on a comprehensive review of existing models for health care (12–15). Our model postulates that as with diabetes care delivery, preventive care for women with histories of GDM is dependent upon health care system structure and processes, including provider interactions, particularly regarding advice in the perinatal period. On the basis of this review, the determinants of health care for GDM included provider-based prenatal care,

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Abbreviations: GDM, gestational diabetes mellitus; OGTT, oral glucose tolerance test.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

provider-based postnatal care, health care available through the provider's office or group, and health care available from the health plan or insurer. Next, we developed a preliminary set of items measuring women's receipt of services within each of these domains. A group of seven health care providers and researchers with experience in quality of care for diabetes, prenatal care, and preventive women's care developed a list of 25 potential items with ~4–7 items per domain.

Study participants and survey administration

Study participants were women enrolled in a university-affiliated managed care plan and identified as having had a GDM pregnancy within the past 5 years through a GDM delivery code (ICD-9 code 648.8) or outpatient diagnostic code 648.83 (undelivered) or 648.84 (delivered) and with at least one health care utilization event during the year before the survey. Women were contacted using a computer-assisted telephone algorithm. Women were excluded if they stated they had type 1 or type 2 diabetes before their pregnancy, denied having had GDM, were currently pregnant with the index pregnancy (although they were eligible if they were currently pregnant and had already completed another GDM pregnancy), or were unable to give informed consent. Four-hundred eight women were initially identified by claims data. A total of 30 women were ineligible, 6 because they had type 1 or type 2 diabetes before their pregnancy, 23 because they denied having GDM, and 1 because she was currently pregnant with her first GDM pregnancy. Four eligible women refused to participate or did not complete an entire survey, and 146 could not be contacted. Of known eligible respondents, the response rate was 98%. If individuals who we were unable to contact had the same rate of eligibility as those contacted and were counted in the denominator, the survey response rate was 65% (16). Surveys were completed by 228 women, with 135 consenting to telephone interviews and 93 opting to complete written surveys.

Statistical analyses

Factor analysis and reliability testing. Three items related to oral antidiabetic medication use were dropped because few women reported use. One item regarding diabetes education classes in the postpartum period was dropped because of its perfect correlation with the development of postpartum glucose intolerance. We conducted reliability testing for the remaining items according to the conceptual domains outlined above. A priori, we planned to analyze items as scales if Cronbach's α was $\geq$0.70 for a particular scale. Reliability testing according to our conceptual domains yielded Cronbach's α values from 0.60 to 0.68.

To determine whether an alternate underlying structure for these items existed and to account for the correlation between items, we conducted an exploratory factor analysis using the computer-assisted telephone interview responses and then repeated reliability testing among women who chose to respond to the written survey. Factor analysis was performed using common factor extraction with Varimax rotation. Factors were retained based on eigenvalues >1 and a scree test, the elbow of which suggested that approximately four to five factors existed. Items were formed into scales based on factor loadings and avoidance of duplicative items. Two of these factors had Cronbach's α that met our cutoff for reliability (table of online appendix [available online at http://dx.doi.org/10.2337/dc07-0435]). The first dominant factor, "recall of diabetes prevention advice," consisted of six items that related to recall of provider advice given in the prenatal and postpartum periods specific to future diabetes prevention and risk with a Cronbach's α of 0.70. A second factor, "recall of diabetes screening advice,"consisted of three items that related to postpartum diabetes screening with a Cronbach's α of 0.73. Item-scale correlations were highly significant, and reliability was not significantly improved by deletion of items from their respective scales. Cronbach's α values were similar in the written samples, and the written and telephone interview samples were combined in subsequent analyses.

To determine which patients were most likely to recall advice, we used ANOVA to examine the association between unweighted scale scores for diabetes prevention advice and participant characteristics, and the unweighted scale scores for diabetes screening advice and participant characteristics. Characteristics included demographic variables listed in Table 1. Of note, prepregnancy BMI, average weight gain during pregnancy, and current BMI were highly correlated, so only current BMI was examined in the analysis. Women could have multiple provider types during pregnancy, so prenatal provider type was characterized as several variables: contact with an obstetrician/gynecologist (yes/no), family practitioner (yes/no), endocrinologist (yes/no), midwife (yes/no), dietitian (yes/no), or other (yes/no). We did not inquire about contact with a diabetes educator, as they reliably provide lifestyle behavior counseling and therefore would be perfectly correlated with the independent variable of advice.

Next, we used ANOVA to examine the association between diabetes prevention advice scores and several dependent variables: current self-reported physical activity and dietary habits and stage of behavior change for physical activity and dietary habits. Then, we used ANOVA to examine the association between diabetes screening advice scores and postpartum screening. Self-reported physical activity was first assessed using questions from the National Health Interview Survey (17) that asked women how often they walked for exercise, the average number of minutes they spent walking each time, and how much their heart and breathing rates increased (i.e., no increase, small, medium, or large) while walking. We calculated the total number of hours per week that women spent walking. We examined the association between walking intensity and scale scores, stratified by duration (no walking, walking with no increase in heart rate, small increase, medium increase, or large increase). We also assessed degree of exertion during leisure-time activity using a single-item question validated in the Diabetes Intervention Reaching and Educating Communities Together study (18,19): women were asked which of the following four activity levels best described their present leisure-time activity: none, only light physical activity in most weeks, vigorous activity for $\geq$20 min one to two times/week, and vigorous activity for $\geq$20 min three or more times/week.

Stage of behavior change is a concept that takes into account intention to modify current behavioral practices (20). Based on the distributions of responses, women were grouped into the following stages of physical activity change: precontemplation (no intention to change activity in the near future), contemplation/preparation (intention to change activity in the near future), and action or maintenance (vigorous activity $\geq$20 min three or more times/week).

Daily consumption of fruits and vegetables was calculated from questions inquiring about fresh as well as canned, frozen, or dried preparations (21,22).

Based on the distributions of responses, women were grouped into the following stages of dietary change: precontemplation (no intention to change diet in the near future), contemplation/preparation (intention to change diet in the near future), and action or maintenance (consumption of five or more servings of fruits or vegetables per day).

We examined two measures of postpartum diabetes screening: *1*) self-report of either a postpartum fasting glucose test or an OGTT at least once ≥6 weeks after delivery and *2*) performance of an OGTT by claims data ≥6 weeks after delivery. We chose these measures because a fasting glucose test and an OGTT are both recommended as postpartum diabetes screening tests, with an OGTT generally being recommended at 6 weeks and either an OGTT or fasting glucose test thereafter (1,2). Because no separate administrative code exists for a fasting glucose test, it was not possible to reliably validate self-report for a fasting glucose test using administrative claims data. However, we were able to compare women's self-report of an OGTT performed at least once ≥6 weeks after delivery to administrative claims for OGTT (CPT codes 82951 or 82950) performed >3 weeks after delivery and before any future pregnancies. Among our participants, 43 women (19%) did not have matching OGTT claim and OGTT self-report data. Of the women who did not recall having an OGTT, 22 (12%) had a claim for an OGTT during the appropriate postpartum time period. Of the women who did recall an OGTT, 15 did not have any claim for an OGTT and 6 had a claim for an OGTT but not during the appropriate time period; therefore, 21 (60%) did not have a matching OGTT claim for the appropriate time period.

Using claims data, we also examined the frequency of other glucose tests that women received ≥3 weeks after delivery. We reasoned that tests ordered specifically for screening purposes would consist of dedicated plasma glucose testing (including fasting glucose tests, random glucose tests, and OGTTs), whereas chemistry panels including glucose levels would not necessarily be ordered for diabetes screening purposes. "Dedicated plasma glucose" tests included plasma glucose tests (CPT codes 82947, 82950, 82951, and 82952) and excluded chemistry panels, A1C, and fingerstick tests (80048, 80050, 80053, 80069, 82948, 82962, and 83036). Of the women in our sample, 60% (n = 134) had a dedicated plasma glucose test, 46% (n = 103) had a chemistry panel that included glucose (80048, 80050, 80053, and 80069), 9% (n = 20) had fingerstick glucose testing (82948 and 82962), and 30% (n = 68) had A1C measured after delivery and before their next pregnancy; 73% had at least one of any type of glucose test ≥3 weeks after delivery.

Multivariate analyses. Finally, to determine whether recall of Diabetes Prevention Advice and Diabetes Screening Advice were associated with dependent measures beyond their association with participant characteristics, we constructed multivariable logistic regression models. The first set of models included the primary independent variable as the Diabetes Prevention Advice score and the primary dependent variable as the lifestyle outcome measures listed above. A separate model was constructed for each of the dependent variables of hours per week spent walking, perceived walking intensity, degree of exertion during leisure-time activity, stage of physical activity change, category of fruits and vegetables consumed per week, and stage of dietary change. Models controlled for patient covariates listed in Table 2 that were significantly associated with recall of factors in the bivariate analyses. Covariates were obtained from self-report, including height and weight. Height is generally overestimated by an average of 0.5 inch; men have a greater tendency to overestimate height than women. In population-based surveys that examined the correlation between measured anthropometric data versus self-reported anthropometric data, the correlation between measured height and self-reported height was 0.92 in women. Similarly, weight is generally underestimated; women aged 20–29 years of age have a greater tendency to underestimate weight than other groups. In population-based surveys, the correlation between measured weight and self-reported weight exceeded 0.90 (23).

The second set of models used multiple logistic regression with the primary independent variable as the Diabetes Screening Advice score and the primary dependent variable as the self-reported performance of recommended postpartum diabetes screening. An alternate set of models substituted examined administrative claims for performance of OGTT in the regression analyses. As noted above, models controlled for covariates that were significantly associated with factors in the bivariate analysis.

We conducted several sensitivity analyses. The original definition of stage of behavior change classified behavior within the past 6 months and did not originally incorporate intensity of the outcome (20). We considered the possibility that some women with recent histories of GDM may be able to implement postpartum behavior changes that would not have been feasible during pregnancy, and these intentions may not be captured using the 6-month cutoff. Therefore, we chose to interpret intermediate levels of activity (light physical activity or occasional but insufficient vigorous activity) as also indicating intention. In this alternate classification, we defined precontemplation as no intention, contemplation/preparation as having some intention, and action/maintenance as engaging in the recommended behavior (vigorous physical activity at least three times/week). In another sensitivity analysis, we examined whether the diabetes prevention analysis scale was associated with glucose screening as well. We also included time since delivery as a covariate to determine whether the association could be stronger among women who had delivered more recently but found that this did not alter the associations (results not shown). Analyses were conducted with SAS version 9.1 software.

RESULTS — Table 1 illustrates the characteristics of participants in our sample, who, in general, were white, well educated, and affluent. The mean ± SD age of women was 36 ± 5.4 years, and their BMI was 30.3 ± 7.7 kg/m^2. Prenatal care was typically delivered by several types of health care providers. Recall of advice was high. Current diabetes, history of dyslipidemia, prenatal contact with an endocrinologist or dietitian, and insulin use during pregnancy were associated with recall of advice. Reported behaviors and screening were suboptimal, with 31% of the population reporting recommended activity, 31% reporting ideal fruit and vegetable consumption, and 33% reporting postpartum diabetes screening.

The unadjusted associations between recall of advice and behaviors are presented in Table 2. Women who recalled a greater amount of advice did not report more physical activity, regardless of the measure of activity. We also did not find associations between recall of advice and stage of physical activity change, recall of

Table 1—*Participant characteristics and association with diabetes prevention advice and diabetes screening advice scale scores*

	Total	Diabetes prevention advice	Diabetes screening advice
Age (years)			
<34	34	4.99 ± 1.46	1.65 ± 1.24
34 to <38	35	4.81 ± 1.40	1.62 ± 1.18
≥38	31	4.92 ± 1.34	1.83 ± 1.15
Race			
Non-Hispanic white	71	5.00 ± 1.28	1.60 ± 1.20
Hispanic	5	5.09 ± 1.30	1.64 ± 1.12
Asian/Pacific Islander	13	4.51 ± 1.72	1.90 ± 1.11
African American	7	4.60 ± 1.68	1.93 ± 1.16
Other	4	1.48 ± 1.93	2.00 ± 1.41
Education			
High school degree only	8	4.81 ± 1.50	1.53 ± 1.12
Some college	28	4.81 ± 1.63	1.65 ± 1.26
College or advanced degree	64	4.98 ± 1.28	1.72 ± 1.17
Annual household income			
Less than $40,000	16	4.57 ± 1.65	1.49 ± 1.25
$40,000 to <$75,0000	33	4.94 ± 1.26	1.82 ± 1.11
≥$75,000	51	4.96 ± 1.43	1.64 ± 1.21
Family history of diabetes*	54	4.90 ± 1.39	1.60 ± 1.16
Current diabetes	5	**5.55 ± 0.69**	**2.64 ± 0.67**
History of dyslipidemia	25	**5.28 ± 1.12**	**2.06 ± 1.11**
Hypertension outside of pregnancy	11	5.12 ± 1.56	1.96 ± 1.27
Current cigarette smoking	11%	4.62 ± 1.81	1.35 ± 1.23
Duration of breast-feeding without formula			
No breast-feeding or <3 months	54	4.89 ± 1.43	1.65 ± 1.19
3 months to <1 year	32	4.77 ± 1.42	1.70 ± 1.22
≥1 year or more	14	5.13 ± 1.31	1.74 ± 1.21
Current BMI			
<25 kg/m^2	34	4.75 ± 1.53	1.69 ± 1.18
25 to <30 kg/m^2	23	4.92 ± 1.38	1.43 ± 1.19
≥30 kg/m^2	43	5.04 ± 1.27	1.84 ± 1.18
Number of months since delivery			
<15 months	32	5.03 ± 1.49	1.86 ± 1.18
15 to <33 months	32	4.89 ± 1.36	1.66 ± 1.18
≥33 months	35	4.82 ± 1.35	1.58 ± 1.18
Prenatal provider type†			
Obstetrician/gynecologist	91	4.91 ± 1.40	1.71 ± 1.19
Family practitioner	15	4.79 ± 1.32	1.94 ± 1.18
Endocrinologist	42	**5.31 ± 0.94**	**2.11 ± 1.01**
Midwife	6	5.23 ± 0.83	1.92 ± 1.12
Dietitian	60	**5.17 ± 1.18**	**1.83 ± 1.15**
Other	5	5.18 ± 1.08	1.64 ± 1.29
Insulin use during pregnancy	44	**5.42 ± 0.79**	**2.06 ± 1.01**

Data are percent or means ± 1 SD. Boldface type indicates associations at $P < 0.05$. *Defined as first-degree relative with diabetes. †Women could see multiple provider types during pregnancy, so percentages do not sum to 100.

advice and fruit and vegetable consumption, and recall of advice and stage of dietary change. These findings did not differ when we used a stage of change definition that incorporated intention. However, women who recalled receiving advice about postpartum screening and laboratory slips were more likely to report postpartum diabetes screening as recommended by guidelines and were also more likely to have had at least one postpartum OGTT documented by claims data.

These associations did not change with adjustment for participant factors associated with recall of advice (Table 2); greater recall of advice was still not associated with physical activity, dietary habits, or stage of behavior change. However, greater recall of diabetes screening advice was still associated with greater performance of self-reported screening and claims for OGTTs. Because of the high percentage of women who recalled receiving glucose tests other than an OGTT, we explored whether physicians might be recommending screening but not necessarily ordering the recommended test. When we examined the association between recall of diabetes screening advice and women's self-report of any type of glucose testing, diabetes screening advice scores were associated with any glucose testing in both unadjusted (odds ratio [OR] 1.87 [95% CI 1.47–2.39]) and adjusted (1.64 [1.16–2.32]) analyses. In sensitivity analyses, we found that the diabetes prevention advice scale was also associated with any glucose testing in both unadjusted (1.67 [1.26–2.21]) and adjusted (1.38 [1.02–1.86]) analyses.

CONCLUSIONS

— Although much of the care for the GDM pregnancy focuses on perinatal outcomes, GDM is also a major risk factor for future maternal diabetes and is a "teachable moment" during which women can be alerted to that risk. We found that the majority of women recalled health care provider discussions of their diabetes risk and lifestyle modification. However, recall of health care provider advice proved to be insufficient for women to achieve improvements in activity or diet or to affect intention to improve these behaviors. The exception was that women who recalled health care provider discussions of the need for postpartum diabetes screening and received laboratory slips for screening were more likely to be screened. Recall of health care provider advice may have had more of an impact on screening because screening is a discrete event and does not require ongoing behavior modification, as is the case with changing physical activity and diet.

Studies in other populations vary as to the impact of physician advice on preventive behaviors, in part because of the varying nature and intensity of physician advice (24). Although physician counseling may provide an important supportive role, advice to improve behaviors does not appear to be sufficient to change physical activity and diet. Kreuter et al. (25) found that patients who received physician advice to increase activity and eat less fat before receiving printed educated materials were more likely to report

Table 2—*Association between recall of diabetes prevention advice and lifestyle behaviors and association between recall of diabetes screening advice and performance of screening, unadjusted and adjusted for participant characteristics*

Main outcome measure	Diabetes prevention advice	Unadjusted OR (95% CI)	Adjusted OR (95% CI)*
Number of hours spent walking over 2 weeks (reference = 0–1 h)	4.51 ± 1.45		
2 h	5.15 ± 1.26	1.37 (0.99–1.89)	1.34 (0.94–1.92)
3 h	4.83 ± 1.58	1.14 (0.86–1.52)	1.10 (0.79–1.51)
>4 h	5.00 ± 1.35	1.26 (0.97–1.63)	1.30 (0.96–1.77)
Perceived walking intensity (reference = no walking)	5.38 ± 0.74		
Walking, no increase in heart rate	3.87 ± 2.17	0.48 (0.22–1.05)	0.51 (0.20–1.29)
Walking with small increase	4.73 ± 1.43	0.64 (0.30–1.36)	0.63 (0.26–1.50)
Walking with medium increase	5.18 ± 1.13	0.84 (0.39–1.79)	0.86 (0.36–2.09)
Walking with large increase	5.11 ± 1.45	0.79 (0.35–1.82)	0.83 (0.32–2.14)
Leisure-time physical activity (reference = no activity)	4.70 ± 1.77		
Only light physical activity in most weeks	4.81 ± 1.39	1.05 (0.69–1.61)	0.74 (0.37–1.47)
Vigorous activity for 20 min, 1–2 times/week	5.16 ± 1.02	1.28 (0.80–2.05)	0.93 (0.45–1.89)
Vigorous activity for 20 min, 3 times/week	4.89 ± 1.60	1.08 (0.70–1.68)	0.77 (0.39–1.54)
Stage of physical activity change (reference = contemplation)	4.50 ± 2.00		
Precontemplation	4.77 ± 1.39	1.12 (0.72–1.74)	0.84 (0.45–1.57)
Preparation	5.16 ± 1.02	1.40 (0.86–2.26)	1.05 (0.54–2.03)
Action/maintenance	4.89 ± 1.60	1.18 (0.75–1.85)	0.87 (0.46–1.64)
Number of fruits and vegetables consumed (reference ≤3/day)	4.81 ± 1.55		
3 to <5/day	4.92 ± 1.32	1.06 (0.84–1.33)	1.07 (0.84–1.37)
>5/day	5.01 ± 1.26	1.18 (0.90–1.41)	1.17 (0.90–1.52)
Stage of dietary change (reference = precontemplation)	4.27 ± 2.24		
Contemplation	4.81 ± 1.47	1.23 (0.85–1.78)	0.95 (0.60–1.52)
Preparation	4.92 ± 1.32	1.30 (0.89–1.91)	1.04 (0.65–1.67)
Action/maintenance	5.01 ± 1.26	1.37 (0.93–2.03)	1.14 (0.71–1.84)
	Diabetes screening advice		
Performance of postpartum fasting glucose or OGTT by self-report (reference = no postpartum fasting glucose or OGTT by self-report)†	**2.36 ± 0.87**	**2.30 (1.72–3.08)**	**2.07 (1.51–2.84)**
Performance of postpartum OGTT by claims data (reference = no postpartum OGTT by claims)†	**2.24 ± 0.93**	**1.73 (1.25–2.37)**	**1.64 (1.16–2.32)**

Data are percent or means ± 1 SD unless otherwise indicated. Boldface type indicates associations at $P < 0.05$. *Adjusted for current diabetes, history of dyslipidemia, endocrinologist contact, dietitian contact, insulin use. †Association with diabetes screening advice scale score rather than diabetes prevention advice scale score.

improvements in physical activity and diet. In other studies, advice was not necessarily associated with significant improvements in physical activity (26) or with diet (27). Populations that have a higher risk, such as overweight populations (28), may be more receptive to advice, although these studies and ours were all limited by reliance on recall and self-report. Of note, the recall of physician advice in these other reports was much lower than we found, perhaps reflecting differences in our patient and physician population.

Participants in our study differed from the national profile of women with GDM in that our respondents were primarily non-Hispanic white and well-educated (29). In the Behavioral Risk Factor Surveillance System survey, Latinas had the greatest risk of GDM (30). In the Women and Infants Staying Healthy (WISH) study, 23% of women with GDM had less than a high school education (31), compared with 1% in our sample. It is likely that these population-based cohorts of women with histories of GDM, with their wider range of sociodemographic characteristics, recalled or received advice less frequently than the women in our study. Therefore, the levels of recall and behaviors that we found probably represent a "best case" scenario. Unfortunately, preventive behaviors were still not optimal, with less than half of women reporting recommended physical activity and dietary behaviors. These patterns are similar to those seen outside the U.S., particularly in Australia (6,7). Similarly, our findings of postpartum diabetes screening rates are similar or only slightly higher than those in previous reports, with less than half reporting recommended screening (8–10). Obvious barriers to screening, such as lack of insurance, were not present in our report.

It is possible that women who had postpartum diabetes screening were more likely to recall advice and receipt of laboratory slips relating to screening and conversely that women less likely to have had screening received laboratory slips but forgot. Such recall bias may have exaggerated the association between care and screening, as is suggested by the decreased (although still significant) ORs using administrative data. More intensive assessments of care, including direct observation or immediate survey after a visit or use of standardized patients or vi-

gnettes, could reduce this bias and may also provide more accurate assessments of the type of advice given. Although these methods are costly and logistically complex, they may reveal higher rates of reported advice than what we noted and also reduce the association between women's recall of advice and postpartum performance in testing and of health behaviors. When compared with direct observation of visits, patient recall of advice tends to be insensitive but highly specific (32); the fact that a high proportion of our sample recalled advice suggests that such advice was actually given and that recall bias was potentially less of a concern. Our report did not distinguish between advice delivered in different points in the pregnancy, by differently trained providers, or through structured programs. It is possible that certain types of advice, when delivered by health care providers, are more effective for changing lifestyle behaviors.

We also found that ~60% of women underwent some type of postpartum blood sampling that specifically targeted plasma glucose, and 78% had some measure of glycemia performed 3 weeks after delivery, even if the test was not necessarily the recommended OGTT at 6 weeks postpartum or fasting glucoses thereafter (1,2). This suggests that women are getting screened at higher rates than previously reported (8–10) but that the recommended screening tests are not being used. Items in the diabetes screening advice scale did not distinguish between types of glucose testing, so we do not know if these variations are due to physicians' preferences, women's preferences, or a combination of both. It is possible that physicians prefer not to order OGTTs and/or women prefer not to get them because of inconvenience, expense, or lack of belief in the superiority of recommended glucose tests compared with other types of glucose testing.

We conclude that in an insured, highly educated population of women with histories of GDM, recall of advice for future diabetes prevention and screening is high but lifestyle behaviors are suboptimal, and physician advice may be insufficient to improve activity and diet. Although we found that recall of provider advice is not sufficient to improve these behaviors, we cannot conclude it is not necessary. Rather, counseling may be the first step in increasing patient awareness regarding the importance of lifestyle behavior change. It is possible that refinements in counseling, through techniques such as motivational interviewing and stage of change assessment, may have a greater impact. On the other hand, advice and procedures enabling screening such as distribution of laboratory slips are associated with postpartum screening. Further research is needed to determine barriers to recommended glucose testing at both the physician and patient levels. Future researchers need to examine the advice more socioeconomically vulnerable women receive and techniques to maximize the impact of counseling.

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