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# Follow-Up of Gestational Diabetes Mellitus in an Urban Safety Net Hospital: Missed Opportunities to Launch Preventive Care for Women

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## Abstract

***Background:*** Our study assessed the follow-up of gestational diabetes mellitus (GDM) in the postpartum period among a racially and ethnically diverse group of women receiving care in a major urban medical center.
***Methods:*** We conducted cross-sectional analysis of clinical and administrative data on women aged 18–44 years who gave birth at Boston Medical Center (BMC) between 2003 and 2009, had GDM, and used BMC for regular care. We calculated the rate of glucose testing by 70 days and by 180 days after delivery and used logistic regression to assess the predictors of testing.
***Results:*** By 6 months postpartum, only 23.4% of GDM-affected women received any kind of glucose test. Among these, over half had been completed by 10 weeks but only 29% were the recommended oral glucose tolerance test (OGTT). After accounting for sociodemographic and health service factors, women aged $\leq 35$ years of age and women with a family practice provider were significantly less likely to be tested than their counterparts (odds ratio [OR] 0.51; 95% confidence interval [CI] 0.32, 0.83 and OR 0.36; 95% CI 0.19, 0.71 respectively). Women who attended a primary care visit within 180 days after birth had three times higher odds of being tested than those without such a visit (OR 3.10; 95% CI 1.97, 4.87).
***Conclusions:*** Despite widely disseminated clinical guidelines, postpartum glucose testing rates are exceedingly low, marking a critical missed opportunity to launch preventive care for women at high risk of type 2 DM. Failed follow-up of GDM by providers of prenatal and postpartum care also reflects a broader systems failure: the absence of a well-supported transition from pregnancy care to ongoing primary care for women.

## Introduction

In 2010, 12.6 million women over age 20 years in the United States had type 2 diabetes mellitus (type 2 DM), up from 8.1 million in 1998;[1,2] and it is estimated that 30% of these women were originally diagnosed with GDM.[3] Gestational diabetes mellitus (GDM), defined as ''first onset of carbohydrate intolerance during pregnancy,''[4,5] is both a complication of pregnancy and a sentinel event, signaling increased health risks for women (pre-diabetes, type 2 DM, and related complications).[6–9] In the United States, GDM affects at least 7% and possibly as many as 18% of pregnancies (i.e., 200,000–700,000 women a year),[1] and the rate is on the rise, most markedly among younger pregnant women.[10] Minority women are up to two times more likely to have a GDM-affected pregnancy than white women, with the highest rates among Native American, Asian, Hispanic, and African American women, respectively.[10,11] These patterns of GDM both reflect and contribute to the ''sister epidemics'' of obesity and diabetes.[12,13]

According to a recent meta-analysis, women with a GDM-affected pregnancy have a 7-fold higher risk for type 2 DM than their counterparts without the complication.[14] By 10 years postpartum, the cumulative incidence of type 2 DM among women with a history of GDM is estimated to be 60%.[6] Moreover, GDM recurs in at least 45% of subsequent pregnancies (52%–69% in minority women); and each GDM-affected pregnancy substantially increases the likelihood of developing type 2 DM.[15,16] This condition of pregnancy and harbinger of future risk presents young women and their providers an impressive prevention opportunity.

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Lifestyle changes in diet and physical activity can delay or prevent development of type 2 DM,[17] underscoring the critical importance of testing and following women with GDM, and postpartum glucose testing has been found to be cost effective.[18] Despite clear clinical guidelines from the American College of Obstetrics and Gynecology (ACOG)[19] and the American Diabetes Association (ADA),[20] actual use of postpartum testing is exceedingly low.[21–28] A recent meta-analysis found postpartum glucose testing rates of 34%–73% across a wide range of clinical settings and populations,[29] with especially low rates in the highest risk groups, such as minority women and those with the most severe GDM.[21,26] In the only study at an institution with predominantly low-income and minority patients, rates were found to be 33.7% overall (fasting plasma glucose or oral glucose tolerance test) by 6 months and only 18% for Latinas.[26] Our study is the first to examine the use and predictors of postpartum glucose testing in an urban safety net hospital (''a hospital with significant level of care to low-income, uninsured, and vulnerable populations'')[30] with a primarily black population and in a multispecialty setting, including obstetrician-gynecologists and family practice providers.

## Materials and Methods

We conducted a retrospective cross-sectional study of women who had a diagnosis of GDM and gave birth at Boston Medical Center (BMC) during a 6- year period (2003–2009). Each year, approximately 2,400 births occur at BMC, the flagship teaching hospital for Boston University School of Medicine and a major source of primary care for low-income and minority patients in Boston. The study was approved by the Institutional Review Board of Boston Medical Center under exempt status.

Using data from both administrative and clinical databases at BMC (merged to form the ''clinical data warehouse''), we identified women aged 18–44 years who gave birth between September 2003 and September 2009 and had a diagnosis of GDM (as defined by the *International Classification of Diseases* code [ICD] 648.0 or ICD 648.8) ($n = 415$). We used ICD 648.0 and 648.8 to define the GDM sample because in practice at the institution under study, these codes are used interchangeably (as per ob-gyn authors RI and ALP). Since ICD 648.0 could include pregnant women with pre-existing diabetes, women with a diabetes diagnosis prior to pregnancy were excluded based on a recorded diagnosis of diabetes (ICD 250.xx) prior to the onset of pregnancy. In addition, women were excluded if they reported their ''regular source of primary care'' to be outside the hospital clinic network (a data element obtained at registration and recorded in the administrative database). We specified variables for analysis based on models reported in the literature[21–29] and on available data. We included socio-demographic characteristics (race/ethnicity, preferred language, insurance source, age, parity, gravidity) and health service–related factors (gestational age at initiation of prenatal care, specialty of prenatal care provider, attendance at postpartum visit, and primary care visit by 6 months postpartum). A postpartum visit is defined by ICD-9 code 594.30, occurring between 21 and 56 days after delivery. A primary care visit is defined as any ambulatory care visit with a family medicine practitioner or internist up to 180 days after the delivery date, without a postpartum ICD-9 code. We defined women as ''postpartum tested'' if they received a 2-hour 75-gram oral glucose tolerance test (OGTT), hemoglobin A1C, or a fasting plasma glucose (FPG) test within two overlapping time periods: by 10 weeks (first 70 days) and by 6 months (first 180 days) after birth. We broadened the postpartum period to include up to 70 days to allow for the frequent gap between postpartum visit and lab testing; and the 180-day time period is intended to capture primary care-based testing. We included all three types of glucose tests in our broad variable in order to reflect common practices; in addition, we examined the use of the preferred (but least often used) OGTT test. All were performed after discharge and in the outpatient setting. Clinical variables, such as insulin use during pregnancy and severity of GDM, were not available.

Sociodemographic and health service characteristics of the sample are described with percentages and descriptive statistics; rates of glucose testing and healthcare visits (postpartum and primary care) are described with percentages and 95% confidence intervals (95% CI). We conducted bivariate analysis through logistic regression models to determine which factors were associated with the odds of obtaining a glucose test by 10 weeks and by 6 months. For the race/ethnicity variable in the bivariate analyses, we excluded 11 women who were classified as ''other'' due to the small size and heterogeneity of the group, making it difficult to interpret the results. Factors with statistical significance at $p < 0.05$ were entered into a multiple logistic regression model to determine those independently associated with the receipt of glucose testing by 6 months postpartum. Approximately 8% of the women in our sample had two deliveries during the study period; as a result, we ran the adjusted logistic regression model using a generalized estimating equation analysis with a logit link function to account for potential correlation between outcomes from the same mother. An $\alpha$ level of 0.05 was used to determine statistical significance. The statistical analyses were generated using SAS/STAT software, version 9.2 of the SAS System for Microsoft Windows (© 2002–2008, SAS Institute Inc.).

## Results

Sample characteristics are displayed in Table 1. The sample was racially diverse; the median age was 32 years; the primary language was predominantly English, with a mix of Haitian Creole, Spanish and other languages; the mean parity was 1.2; and almost three-quarters had some form of public insurance (including Medicaid and a Medicaid-related community health center-based managed care plan). While most of the sample (81%) received their prenatal and postpartum care in the ob-gyn department (both physicians and certified nurse-midwives), 19% were cared for by family medicine physicians.

Table 2 shows the proportion of women who received each type of glucose test by 10 weeks and by 6 months overall and stratified by attendance at a postpartum visit (by 10 weeks) and a primary care visit (by 6 months). By 6 months postpartum, 23.4% of women had received some type of glucose test. In this time frame, only 6.8% of all women received the recommended OGTT; 16.6% received the A1C, and 7.2% received the fasting glucose test. Thus, even when we apply the most liberal definition of testing (OGTT, A1C, or FPG) postpartum glucose testing, rates were extremely low. Over

Table 1. Sociodemographic and Health Service Characteristics of Gestational Diabetes Mellitus–Affected Deliveries ($N=415$)

| *Characteristic* | n *(%)* |
|---|---|
| Age at delivery | |
| Range | 18–44 |
| Median (IQR) | 32 (27–36) |
| Age at delivery (years) | |
| 18–24 | 54 (13.0) |
| 25–34 | 221 (53.3) |
| 35–44 | 140 (33.7) |
| Race/ethnicity | |
| Black (non-Hispanic) | 274 (66.0) |
| Hispanic | 52 (12.5) |
| White | 48 (11.6) |
| Asian | 30 (7.2) |
| Other | 11 (2.7) |
| Preferred language | |
| English | 288 (69.9) |
| Spanish | 23 (5.6) |
| Haitian | 51 (12.4) |
| Other | 50 (12.1) |
| Unknown | 3 |
| Gravidity | |
| Range | 1–13 |
| Median (IQR) | 3 (2–4) |
| | 3.2 (2.1) |
| Gravidity | |
| 1–2 | 186 (44.8) |
| 3+ | 229 (55.2) |
| Parity | |
| Range | 0–9 |
| Median (IQR) | 1 (0–2) |
| Parity | |
| 0 | 160 (38.6) |
| 1+ | 255 (61.4) |
| Gestational age (weeks) at PNC initiation | |
| Range | 4.1–40.0 |
| Median (IQR) | 11.9 (9.0–16.9) |
| Unknown | 15 |
| Gestational age (weeks) at PNC initiation | |
| 4.1–12.5 | 228 (57.0) |
| >12.5–24.5 | 126 (31.5) |
| >24.5 | 46 (11.5) |
| Unknown | 15 |
| Department of PNC provider | |
| Obstetrics and gynecology | 338 (81.4) |
| Family medicine | 77 (18.6) |
| Specialty of PNC provider | |
| MD, obstetrics and gynecology | 293 (76.1) |
| MD, family medicine | 23 (6.0) |
| Nurse midwife | 69 (17.9) |
| Unknown | 30 |
| Payor source | |
| Medicaid/Medicare | 100 (26.5) |
| Boston Medical Center Health Plan | 131 (34.7) |
| HMO and other insurance | 74 (19.6) |
| Free care | 72 (19.1) |
| Missing | 38 |
| Postpartum visit within 10 weeks | 333 (80.2) |
| Primary care visit within 6 months | 140 (33.7) |

IQR, interquartile range; PNC, prenatal care.

Table 2. Descriptive Analysis of Glucose Testing and Health Service Utilization After a Gestational Diabetes Mellitus–Affected Pregnancy ($N=415$)

| *Type and timing of postpartum glucose test* | N (%) | *95% CI* |
|---|---|---|
| GTT | | |
| By 10 weeks postpartum | 21 (5.1) | 3.2, 7.6 |
| By 6 months postpartum | 28 (6.8) | 4.5, 9.6 |
| A1C | | |
| By 10 weeks postpartum | 32 (5.3) | 5.3, 10.7 |
| By 6 months postpartum | 69 (16.6) | 13.2, 20.6 |
| Fasting glucose | | |
| By 10 weeks postpartum | 22 (5.3) | 3.4, 7.9 |
| By 6 months postpartum | 30 (7.2) | 5.9, 10.2 |
| Any glucose screening test | | |
| By 10 weeks postpartum | 57 (13.7) | 10.6, 17.4 |
| By 6 months postpartum | 97 (23.4) | 19.4, 27.8 |
| Postpartum visit within 10 weeks | 333 (80.2) | 76.1, 84.0 |
| With GTT within 10 weeks | 17 (5.1) | 3.0, 8.1 |
| With any glucose test within 10 weeks | 46 (13.8) | 10.3, 18.0 |
| With GTT within 6 months | 22 (6.6) | 4.2, 9.8 |
| With any glucose test within 6 months | 77 (23.1) | 18.7, 28.0 |
| Primary care visit within 6 months | 140 (33.7) | 29.2, 38.5 |
| With GTT within 6 months | 11 (7.9) | 4.0, 13.6 |
| With any glucose test within 6 months | 54 (38.6) | 30.5, 47.2 |
| Both postpartum visit within 10 weeks and primary care visit within 6 months | 116 (27.9) | 23.7, 32.5 |
| With GTT within 6 months | 7 (6.0) | 2.5, 12.0 |
| With any glucose test within 6 months | 43 (37.1) | 28.3, 46.5 |

95% CI, 95% confidence interval; A1C, hemoglobin A1c test; GTT, glucose tolerance test.

half (59%) of the women tested by 6 months received their test by 10 weeks postpartum. However, despite the large majority (80%) who attended a postpartum visit by 10 weeks, very few received a glucose test, either by 10 weeks (13.8%) or by 6 months (23.1%) after delivery. Primary care visits were less frequent in this population (about one-third had such a visit), but testing rates were higher among those with such a visit (38.6%).

Bivariate analyses revealed only a few variables to be significant predictors of testing by 6 months (Table 3). Women who were nulliparous, <35 years old, had prenatal care with a family medicine provider, and those who did not receive a primary care visit within 180 days of delivery had significantly lower odds of receiving glucose testing by 6 months postpartum. In addition, we found notable differences by race/ethnicity, although they did not reach statistical significance. Testing rates were highest (though still low) among black non-Hispanic (25.3%) and Hispanic (23.1%) women, followed by Asian (16.7%) and white women (8.3%).

In our multivariate analyses, all variables associated with postpartum testing in our unadjusted analyses remained significant, except parity (Table 4). Younger women (<35 years of age) had far lower odds of being tested than their older

Table 3. Bivariate Associations Between Sociodemographic and Health Service–Related Variables and Glucose Testing by Six Months After Birth Following a Gestational Diabetes Mellitus–Affected Pregnancy

| | *Glucose testing by 6 months* | | *Unadjusted* | |
|---|---|---|---|---|
| *Independent variable* | n, *No* | n, *Yes* | *OR (95% CI)* | P |
| Age at delivery | | | | |
| 18–24 | 49 | 5 | 0.20 (0.08, 0.54) | 0.001 |
| 25–34 | 176 | 45 | 0.51 (0.31, 0.82) | |
| ≥35 | 93 | 47 | 1.00 (ref) | |
| Race/ethnicity | | | | |
| Black | 204 | 70 | 3.78 (1.31, 10.88) | 0.077 |
| Hispanic | 40 | 12 | 3.30 (0.98, 11.1) | |
| Asian | 44 | 4 | 2.20 (0.54, 8.95) | |
| White | 25 | 5 | 1.00 (ref) | |
| Preferred language | | | | |
| English | 223 | 65 | 1.00 (ref) | 0.672 |
| Spanish | 17 | 6 | 1.21 (0.46, 3.20) | |
| Haitian | 36 | 15 | 1.43 (0.74, 2.77) | |
| Other | 40 | 10 | 0.86 (0.41, 1.81) | |
| Gravidity | | | | |
| 1–2 | 146 | 40 | 0.83 (0.52, 1.31) | 0.418 |
| 3+ | 172 | 57 | 1.00 (ref) | |
| Parity | 131 | 29 | 0.61 (0.37, 0.99) | 0.047 |
| 0 | 187 | 68 | 1.00 (ref) | |
| 1+ | | | | |
| Gestational age (weeks) | | | | |
| 4.1–12.5 | 167 | 61 | 1.73 (0.77, 3.93) | 0.202 |
| >12.5–24.5 | 101 | 25 | 1.18 (0.49, 2.83) | |
| >24.5 | 38 | 8 | 1.00 (ref) | |
| Department of PNC provider | | | | |
| Family medicine | 67 | 10 | 0.43 (0.21, 0.87) | 0.020 |
| OB | 251 | 87 | 1.00 (ref) | |
| Specialty of PNC provider | | | | |
| MD, OB | 228 | 65 | 1.00 (ref) | 0.599 |
| MD, family medicine | 20 | 3 | 0.53 (0.15, 1.83) | |
| Nurse midwife | 54 | 15 | 0.97 (0.52, 1.84) | |
| Payor source | | | | |
| Medicaid/Medicare | 73 | 27 | 1.25 (0.68, 2.27) | 0.758 |
| Boston Medical Center Health Plan | 101 | 30 | 1.00 (ref) | |
| HMO and other insurance | 59 | 15 | 0.86 (0.43, 1.72) | |
| Free care | 54 | 18 | 1.12 (0.57, 2.20) | |
| Postpartum visit within 10 weeks | | | | |
| Yes | 256 | 77 | 0.93 (0.53, 1.64) | 0.808 |
| No | 62 | 20 | 1.00 (ref) | |
| Primary care visit within 6 months ($n=415$) | | | | |
| Yes | 86 | 54 | 3.39 (2.12, 5.42) | |
| No | 232 | 43 | 1.00 (ref) | <0.001 |

OR, odds ratio.

counterparts (odds ratio [OR] 0.51; 95% CI 0.32, 0.83), even after controlling for all other factors. Patients of family medicine physicians were only 36% as likely to receive a postpartum glucose testing as those with ob-gyn providers (OR 0.36; 95% CI 0.19, 0.71). Patients who had a primary care visit within 6 months postpartum were three times more likely to be tested compared with those without such a visit (OR 3.10; 95% CI 1.97, 4.87), once all other factors were taken into account. On the other hand, attendance at a postpartum visit within 10 weeks of delivery did not significantly affect the likelihood of testing.

## Discussion

In this study conducted in an urban academic medical center providing obstetric care to a a racially/ethnically diverse and predominantly black population, we found lower rates of postpartum glucose testing among women with GDM than those previously reported: 23.4% received any glucose test and only 7% received the OGTT by 6 months. Prior studies, all conducted in the years following publication of the ADA and ACOG Guidelines, have reported rates ranging from 38% to 58%, with uniformly lower use of the

Table 4. Multiple Regression Results, Associations Between Sociodemographic and Health Service–Related Variables and Glucose Screening by Six Months After a Gestational Diabetes Mellitus–Affected Delivery

| | *Adjusted GEE* | |
|---|---|---|
| *Independent variable* | *OR (95% CI)* | P |
| Age at delivery (years) | | |
| <35 | 0.51 (0.32, 0.83) | 0.007 |
| ≥35 | 1.00 (ref) | |
| Parity | | |
| 0 | 0.59 (0.34, 1.01) | 0.055 |
| 1+ | 1.00 (ref) | |
| Department of PNC | | |
| Family medicine | 0.36 (0.19, 0.71) | 0.003 |
| OB | 1.00 (ref) | |
| Primary care visit within 6 months | | |
| Yes | 3.10 (1.97, 4.87) | <0.001 |
| No | 1.00 (ref) | |

GEE, generalized estimating equation.

recommended OGTT.[29] In one moderate-sized study of a mostly white, socioeconomically advantaged population in a university center, the postpartum testing rate was 38% for any glucose marker and 23% for the OGTT.[27] A large cohort study conducted within a California prepaid group practice documented improvements between 1995 and 2006, yet even with the widest definition of testing (any measure of blood glucose within 12 months of delivery), still found rates of 53.8%, with FPG accounting for 80% of the tests performed.[25] In the only other known study in an urban safety net hospital with predominantly minority women (largely Latina), investigators at the University of California at San Francisco found a rate of postpartum glucose testing of 33.7% at 6 months postpartum, but only 18% among Latinas.[26] These findings and ours' point to two parallel and contradictory trends: particularly low use of postpartum glucose testing in institutions with a high volume of low-income and minority patients, even as these groups have disproportionately high rates of GDM and other risk factors for type 2 diabetes.

Factors significantly associated with low utilization have included clinical factors (e.g., prenatal insulin use,[27] GDM subtype A2,[26] severity of pregnancy GTT fasting glucose,[21] having GDM coded at discharge;[24] sociodemographic factors (age ≤35 yrs,[24,26] being married,[22,27] and being Latina[22,24–26]); and health service–related factors: attending a postpartum visit,[24,26] a prenatal endocrinology consult or any visit with an endocrinologist after delivery,[27] and total number of visits after delivery.[27]

Several studies point to significant ethnic variation in testing rates, yet findings are not consistent. As noted, Stasenko and colleagues[26] found testing rates to be lowest among Latina women in a San Francisco urban safety-net hospital; however, investigators in Rhode Island,[22] California,[26] and Texas,[30] found Hispanic women to be the most likely to be tested. Two studies in California have documented rates among Asian women to be highest.[24,25] In our Boston-based study, as noted, testing rates were highest among black non-Hispanic and Hispanic women, with somewhat lower rates among Asians, and by far the lowest rates among white women. As other investigators have postulated, providers may be biased toward testing women from racial/ethnic groups with high rates of type 2 DM. In our institution, such bias may be operating, but the statistical significance of the differences could be masked by very low numbers of white and Asian women. Our study reinforces the importance of age as a predictor of postpartum testing. Like others, we found younger women (under 35) to be far less likely than older women to receive glucose testing after a GDM pregnancy.[24,25] It is possible that older women (and their providers) are more aware of their risk for type 2 DM and are more proactive in seeking follow-up testing and care.

In our sample, women who attended a primary care visit within 6 months of delivery were over three times more likely to receive glucose testing than their counterparts. This finding corroborates prior studies and supports the notion that some contact with a healthcare provider—whether a postpartum, primary care, or specialist visit—boosts women's chances of being referred to and receiving a postpartum glucose test. However, it is sobering to recognize that these visits are far from sufficient to assure universal testing. In several studies, women attending postpartum care were over three times more likely to receive a test than their counterparts.[22,24] Kim and colleagues found that the total number of visits in the postpartum period and a visit with an endocrinologist predicted testing, but only 42% of women with these visits received a glucose test.[27] A study conducted at two large Massachusetts hospitals found that 37% of women received an OGTT, with a median of 428 days postpartum, even as 94% of the same group received a cervical cancer screen with a median of 49 days postpartum.[21]

At BMC, 80% of all patients attended a postpartum visit, while only 23% received a postpartum glucose test, and despite the predictive power of primary care visits within 6 months, among those who attended such a visit, only 38% received a glucose test. Paradoxically, almost half of all family medicine patients had a primary visit, compared with only 30% of ob-gyn patients, yet these patients were the least likely to receive a glucose screen. We speculate that primary care visits are the venue for referrals, yet the pattern of referrals among types of providers and uptake among patients are both uneven.

Patients with an ob-gyn provider were 64% more likely to receive follow-up testing than their counterparts with a family medicine provider. Respondents to surveys of family medicine providers also self-report low use of postpartum testing. As earlier noted, in a 2003 national survey of ACOG fellows, 75% reported performing routine postpartum testing, although only half of these reported using the recommended OGTT.[31] In a telephone survey performed among Canadian primary care physicians, somewhat lower rates of glucose tolerance testing were reported. Of the 173 (out of 233) who responded, 64% (N = 110) reported routinely testing their patients for type 2 DM after a GDM-affected pregnancy, with 64 of the 173 (37%) using the recommended OGTT.[32] On the other hand, a statewide survey of family medicine and obstetrical physicians in Oregon uncovered exceedingly low self-reported rates of postpartum testing in both groups, with the lowest rates among family medicine practitioners (19% compared with 35% among obstetricians).[33] The only known study conducted among family medicine physicians in the

United States suggests that knowledge deficits may in part explain their relatively low utilization rates. Only 5.2% of respondents recognized that women with a history of GDM were at risk for type 2 DM or recurrent GDM; however, 52.1% answered correctly that some form of postpartum glucose testing is recommended.[34] We speculate that a higher awareness of the implications of GDM for future type 2 DM and of ACOG's guidelines among ob-gyn compared to family medicine physicians (even those practicing obstetrics), contribute to the observed difference.

The reasons for low overall use and variations among provider types cannot be explained by our study, and research probing these questions and overall low utilization of the postpartum glucose testing by providers is sorely lacking. Investigators postulate that provider barriers include gaps in knowledge about long-term risk and guidelines; ambiguity about who is responsible for such screening, fragmentation in women's postpartum care, and the complexity of the OGTT itself.[32,35,36] One unpublished qualitative study conducted by Williams and colleagues engaged women (with GDM and type 2 DM) and healthcare providers (physicians and nurse-practitioners) in separate focus groups to probe their perspectives on reasons for low postpartum use of glucose testing. Interestingly, the most common barriers cited by physicians and nurse-practitioners focused on women's lack of knowledge and awareness, low motivation and limited access to care, all of which providers felt were out of their control. Women noted their own lack of knowledge, as well as confusion about what was expected of them since different providers gave different advice. Both groups mentioned that conversion to type 2 DM in the future was not a major theme for them in the prenatal and postpartum periods (Williams et al., unpublished data).

Other studies aimed at clarifying patient-related factors are few. Bennett and colleagues recently reported results of a qualitative study of women's perspectives on the barriers and facilitators to receipt of postpartum glucose testing. In in-depth interviews, women emphasized as relevant barriers new demands of motherhood, dissatisfaction with care, and fears of bad news; and as relevant facilitators, they noted access to work release, childcare, convenient times for testing, and connection with clinical staff.[37] In the Canadian study mentioned above, patients reported time to be the most critical reason for not pursuing glucose testing after delivery.[32]

In 2001 and again in 2009, ACOG published recommendations for glucose testing following GDM at or soon after the postpartum visit (within 6–8 weeks after birth), noting the 75-g OGTT as the preferred method.[19] In 2004, the American Diabetes Association (ADA) followed suit.[20] However, changes in clinical practice often lag behind the dissemination of guidelines,[38–40] and such is the case with postpartum glucose testing, as demonstrated by empirical findings in a wide range of settings and populations.

Recent efforts by ACOG to equip their members with paper-based tools to inform and refer patients for postpartum glucose testing represent a step towards heightening awareness and changing practice,[41] though evidence to suggest that such tools are effective is lacking. Postal or electronic reminders to physicians have been shown to boost utilization;[42,43] however, broader strategies are needed. Zapka and colleagues draw two relevant conclusions from their systematic review of the evidence regarding low compliance with guidelines regarding the follow-up of abnormal mammographies—a different procedure in women's healthcare with some parallels to postpartum glucose testing. First, they conclude that we must gain a full understanding of systems-, provider-, and patient-driven reasons for low use in order to inform strategies for change, especially when the underutilized test occurs at a point of transition in care from one provider to another. Second, such strategies must be multipronged, focusing on patient–provider communication as well as organizational practices and norms.[44]

We add to these conclusions the recognition that poor follow-up of GDM by providers of prenatal and postpartum care reflects a broader systems failure: the absence of a well-supported and informed transition from pregnancy-based to ongoing primary care for women. Without policies—financial and organizational—that create a system in which pregnancy is a portal for ongoing women's healthcare, the prevention challenge presented by gestational diabetes and other complications of pregnancy that signal risk for a woman's life course cannot be met.[45] Innovations for care coordination and integration across specialties under the Affordable Care Act, especially medical homes and community-wide electronic medical record systems, represent ideal opportunities for shoring up the transition between pregnancy and primary care for women. Gestational diabetes is a meaningful sentinel event to track in these new systems.

Our study has several limitations. The findings may not be generalizable to settings that are not academic or multispecialty and do no serve a multiethnic, low-income, urban population. Given the retrospective study design, we are unable to account for all potential effect-modifying or confounding factors in our analysis of predictors of postpartum testing. In particular, our data do not include clinical variables such as timing of diagnosis and severity of GDM. It is possible, though we believe unlikely, that the patients received postpartum glucose testing at a site other than their self-identified primary care site. Further, the administrative and clinical data are limited in several key ways. Clinicians at BMC tend to use two ICD-9 codes for GDM interchangeably (648.0 for GDM and 648.8 for glucose intolerance); thus, we selected our sample based on both. As such, we can assume but not verify that all GDM cases were accurately identified. We have no data on test results, and we do not know if tests were ordered but not completed or requested but not ordered, making it impossible to distinguish between provider- and patient- related reasons for the absence of a postpartum glucose test. Finally, as noted, the data do not allow us to examine the reasons for low utilization of postpartum testing.

## Conclusion

Our study confirms and elaborates prior reports of missed opportunities to identify risk for and prevent type 2 DM among women with GDM, starting in the postpartum period. As the first study conducted in an urban safety net hospital that largely serves black women, it documents the disproportionately low rates of postpartum glucose testing in this population. Further research is needed to explore factors that affect the motivation of providers and patients and the barriers and facilitators within systems, so that strategies to improve postpartum follow-up can be tailored to the complexity of GDM and the emerging context of patient-centered

medical homes. Key challenges include prevention strategies that focus on future risk, the integration of chronic illness management and maternity care, and the creation of a system that capitalizes on pregnancy as a portal for ongoing women's healthcare.[45,46] Without meeting these challenges, we will miss a critical opportunity to mitigate the enormous human and financial costs of diabetes among women as they age.[47,48]

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### Author Disclosure

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