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Gestational Diabetes in Colorado: Pregnancy Risk Assessment Monitoring System (PRAMS), 2006-2008

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Introduction

Gestational Diabetes Mellitus (GDM) is defined as glucose intolerance with onset or first recognition during pregnancy. GDM is the most common metabolic disorder of pregnancy and affects between 2–10 percent of pregnancies in the United States.¹ In Colorado, the prevalence of GDM was 7.1 percent from 2006–2008.² GDM is a significant health risk because it is associated with adverse outcomes for pregnant women and their offspring.

Risk factors for developing GDM include an older maternal age, family history of type 2 diabetes or GDM, history of GDM in a previous pregnancy, previous macrosomic infant (8 pounds 13 ounces or more), increased parity, prepregnancy BMI above normal range, and race and ethnicity.³

The first purpose of this report is to describe who has GDM in Colorado and identify subgroups of women at higher risk for GDM. The characteristics and weight categories analyzed in this report include maternal age, race and ethnicity, education, annual household income, prepregnancy body mass index (BMI), and weight gain during pregnancy.

Mothers with GDM are at greater risk for miscarriage, preterm birth, caesarean section and pre-eclampsia.³ Short-term fetal complications associated with uncontrolled GDM include macrosomia, delayed lung maturation, risk for shoulder dystocia and newborn metabolic abnormalities.³ Mothers with GDM are at higher risk for developing type 2 diabetes later in life and may have a higher risk for depression during pregnancy or in the year following pregnancy.^{4,5} The long-term risks for offspring exposed to GDM include a predisposition to obesity and type 2 diabetes.^{6,7}

Women with GDM are encouraged to aim for their prepregnancy weight six to 12 months after the baby is born. Lifestyle modifications to improve insulin resistance and lose weight

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include healthy eating, physical activity, and breastfeeding.⁸ Benefits of breastfeeding include weight loss for the mother, decreased likelihood of maternal progression to type 2 diabetes, reduced insulin resistance in the mother and a decreased likelihood of obesity in the child.⁹ Furthermore, data indicate the risk of childhood overweight may decrease with increased duration of breastfeeding.¹⁰

Since risks associated with developing GDM and subsequent type 2 diabetes are well established, the second purpose of this report is to compare women with and without GDM on outcomes associated with GDM and on recommended preventive postpartum behaviors. Outcomes analyzed in this report include hypertension during pregnancy and postpartum depressive symptoms; behaviors analyzed include breastfeeding initiation and duration.

Early identification of GDM among pregnant women may increase the chance that their glucose levels are managed during pregnancy, and thereby reducing the risk of adverse pregnancy and birth outcomes. Management and treatment of GDM involve dietary modification, exercise, self-monitoring of blood glucose and, in some cases, insulin therapy or other medications.

Methods

Data Source

Data for this report were collected from the Pregnancy Risk Assessment Monitoring System (PRAMS). The PRAMS is a population-based risk factor surveillance system designed to identify and monitor behaviors of women before, during, and after pregnancy. Colorado is one of 38 states participating in the PRAMS project, funded by the Centers for Disease Control and Prevention (CDC). The PRAMS is conducted by the Colorado Department of Public Health and Environment.

Study Population

Each month, a stratified random sample of Colorado mothers is selected from recent birth certificates. The PRAMS survey combines two methods of data collection: a survey conducted

by a mailed questionnaire with multiple follow-up attempts and a survey by telephone. For this report, surveys from 5,842 mothers were compiled over a three-year period (2006–2008). Results from the survey were weighted to reflect the experiences of all Colorado mothers giving birth.

Analysis

The prevalence of GDM among women in Colorado was determined by analyzing data collected from the PRAMS survey. Prevalence ratios were calculated to identify subgroups of women at higher risk for GDM. Estimated prevalence ratios of GDM for subgroups of women were determined to be statistically significant when the 95 percent confidence interval did not include one. All analyses were performed using SAS-callable SUDAAN 9.0.1 statistical software.

Results

Demographic Characteristics and Weight

On average each year, approximately 4,600 pregnant women in Colorado (7.1%) experienced GDM, according to PRAMS data from 2006–2008. The prevalence of GDM for women in Colorado is shown in Table 1. GDM prevalence was highest among women ages 35 years and older (9.7%). More than 13 percent of Asian women (13.2%) and more than ten percent of Hispanic women (10.1%) had GDM. The prevalence of GDM was highest among women with annual household incomes between \$25,000 and \$34,999 (10.1%).

More than 14 percent of the women who were obese prior to pregnancy (14.3%) had GDM. The GDM prevalence was highest among women who gained weight below the appropriate range of weights (8.8%), or gained above the appropriate range (7.9%), as recommended by the Institute of Medicine (IOM).¹¹

The prevalence ratios used to identify subgroups of women at higher risk for GDM are shown in Table 1. The prevalence of GDM was 80 percent (PR 1.8, 95% CI 1.2-2.7) higher for older women (35 years and older) as compared to younger

Table 1. Prevalence of Gestational Diabetes among Colorado women by select demographic characteristics and weight, Colorado PRAMS, 2006-2008

Characteristic	Average Annual N*	Prevalence %	Crude PR† (95% CI‡)
Maternal Age Group (years)			
15–19	230	4.0	0.7 (0.4–1.4)
20–24	765	5.5	1.00 (Reference Group)
25–34	2,604	7.5	1.4 (0.9–2.0)
35+	1,000	9.7	1.8 (1.2–2.7)§
Race and Ethnicity			
White, non-Hispanic	2,166	5.5	1.00 (Reference Group)
Hispanic (all races)	1,856	10.1	1.8 (1.4–2.3)§
Black	146	5.9	1.1 (0.4–3.1)
Asian	229	13.2	2.4 (1.3–4.4)§
Native American	34	7.5	1.4 (0.5–4.0)
Education (years)			
<12	1,018	7.8	1.3 (0.9–1.9)
12	1,273	8.9	1.5 (1.1–2.0)§
>12	2,193	6.1	1.00 (Reference Group)
Annual Household Income			
\$0–\$14,999	1,384	8.6	1.7 (1.2–2.4)§
\$15,000–\$24,999	645	8.6	1.7 (1.1–2.6)§
\$25,000–\$34,999	577	10.1	1.9 (1.2–3.1)§
\$35,000–\$49,999	6,254	6.3	1.2 (0.7–2.0)
\$50,000+	1,314	5.2	1.00 (Reference Group)
Prepregnancy Body Mass Index			
Underweight (<18.5)	88	3.3	0.7 (0.3–1.6)
Normal (18.5–24.9)	1,527	4.6	1.00 (Reference Group)
Overweight (25.0–29.9)	1,043	7.2	1.6 (1.1–2.3)§
Obese (30.0+)	1,473	14.3	3.1 (2.2–4.3)§
Weight Gain Adequacy			
In IOM range	559	3.1	1.00 (Reference Group)
Below IOM range	1,358	8.8	2.9 (1.8–4.5)§
Above IOM range	1,938	7.9	2.6 (1.7–3.9)§

* Average number of women diagnosed with gestational diabetes annually (2006-2008).

† Prevalence ratio

‡ Confidence interval

§ The prevalence ratio is statistically significant at the $p < .05$ level.

Note: IOM stands for the Institute of Medicine

women (20–24 years old). The prevalence of GDM was nearly 2.5 times (PR 2.4, 95% CI 1.3–4.4) greater for Asian women than for white, non-Hispanic women. The prevalence GDM was 80 percent (PR 1.8, 95% CI 1.4–2.3) higher for Hispanic women than for white, non-Hispanic women. The prevalence of developing GDM was 50 percent (PR 1.5, 95% CI 1.1–2.0) higher for less educated women (only 12 years of education) as compared to more educated women (>12 years of education). GDM prevalence was 1.7 times higher for women with annual household incomes less than \$15,000 (PR 1.7, 95% CI 1.2–2.4) and between \$15,000 to \$24,999 (PR 1.7, 95% CI 1.1–2.6) as compared to women with annual household incomes of \$50,000 or more. GDM prevalence was 1.9 times

higher for women with annual household incomes between \$25,000 to \$34,999 (PR 1.9, 95% CI 1.2–3.1) as compared to women with annual household incomes of \$50,000 or more.

The prevalence of GDM was 3.1 times (PR 3.1, 95% CI 2.2–4.3) higher among women who were obese prior to pregnancy than women who had a normal prepregnancy BMI. Additionally, the prevalence of GDM was 1.6 times (PR 1.6, 95% CI 1.1–2.3) higher for women who were overweight prior to pregnancy than women who had a normal prepregnancy BMI. The GDM prevalence was 2.9 times (PR 2.9, 95% CI 1.8–4.5) higher for women who gained below the appropriate range, compared to women who gained weight within the appropriate

range. Also, the GDM prevalence was 2.6 times (PR 2.6, 95% CI 1.7–3.9) higher for women who gained above the appropriate range, compared to the women who gained weight within the appropriate range.

The prevalence of GDM was stratified by race/ethnicity (white, non-Hispanic, Hispanic, and other) and maternal age (<25 years and 25+ years). The small numbers in each group led to wide confidence intervals, making it difficult to measure significant differences in the prevalence of GDM. Only among women ages 25 years and older, Hispanic (12.8%, 95% CI 9.8–16.7) women and women of other racial groups (11.4%, 95% CI 7.5–17.1) had a significantly higher prevalence of GDM than white, non-Hispanic (5.7%, 95% CI 4.7–7.0) women.

Outcomes and Behaviors

Table 2 displays the prevalence of certain outcomes associated with GDM and recommended preventive postpartum behaviors among women with and without GDM. The prevalence of hypertension during pregnancy was significantly higher among women with GDM (19.0%, 95% CI 14.5–24.6) than women without GDM (12.5%, 95% CI 11.3–13.8). Results on postpartum depressive symptoms, ever breastfed, and breastfeeding duration were similar for women with and without gestational diabetes.

Table 2. Prevalence of outcomes and behaviors among Colorado women by Gestational Diabetes status, Colorado PRAMS, 2006-2008

Outcome/Behavior	Mothers with gestational diabetes		Mothers without gestational diabetes	
	Prevalence %	95% CI†	Prevalence %	95% CI†
Hypertension during pregnancy §	19.0	14.5–24.6	12.5	11.3–13.8
Postpartum depressive symptoms*	16.5	12.0–22.3	12.4	11.2–13.7
Ever breastfed	88.6	83.4–92.3	90.1	88.9–91.2
Breastfeeding duration				
4 weeks or less	30.1	23.9–37.2	24.9	23.3–26.7
5–8 weeks	7.9	4.7–13.1	5.4	4.6–6.4
9+ weeks	62.0	54.7–68.7	69.6	67.8–71.4

* Defined as women who reported “often” or “always” feeling down, depressed, or hopeless OR who “often” or “always” had little interest or little pleasure in doing things since the new baby was born.

† Confidence interval

§ Prevalence estimates between mothers with and without gestational diabetes are statistically different.

Discussion

For some women, pregnancy may be one of the few times they have access to health care. Therefore, pregnancy and the postpartum period are opportune times for screening and counseling women on the risk factors associated with diabetes and other chronic or health-related conditions. Although a majority of women with GDM return to normal glucose tolerance after delivery, a significant number will continue to have impaired glucose tolerance or diabetes. Women with a history of GDM have as much as 45 percent risk of recurrence with the next pregnancy and as much as 63 percent risk of developing type 2 diabetes later in life.⁴ In addition to the short-term risks to the offspring, exposure to a glycemic environment in utero is associated with an increased risk for long-term health effects, such as obesity, glucose intolerance, and type 2 diabetes.^{6,7}

The results reported in this paper have limitations. The PRAMS captures only certain risk factors and adverse maternal outcomes associated with GDM. The PRAMS does not measure parity, family history of type 2 diabetes or GDM, history of GDM in a previous pregnancy, previous macrosomic infant, various birth complications, fetal outcomes, postpartum screening for type 2 diabetes or the long-term effects of pregnancy weight gain. The small number of women in certain subgroups (that is, the small sample size) results in less precise estimates (as indicated by the wide confidence intervals for certain data points, including certain race/ethnicity data). The results in this report are not adjusted for the influence of multiple factors simultaneously. Lastly, data captured in PRAMS is self-reported and is subject to recall bias.

The results of this report show that Colorado women ages 35 years and older, are Hispanic/Latino or Asian, have only 12 years of education, are from households earning less than \$35,000, have an overweight or obese prepregnancy BMI, and who gain weight during pregnancy above or below the appropriate range have a higher probability of developing GDM. Of these risk factors, prepregnancy BMI and weight gain during pregnancy are modifiable. A recent study found a body weight

reduction of 1 kg/m² was associated with nearly a 1 percent reduction in GDM prevalence.¹² Thus, even a modest decrease in prepregnancy BMI could result in a significant reduction in the incidence of GDM and its adverse maternal and offspring outcomes. Currently the IOM weight gain recommendations do not differentiate between women with or without GDM. However, excessive weight gain may lead to unhealthy maternal postpartum weight retention, increasing a woman's risk for developing type 2 diabetes and subsequent GDM pregnancies.¹³

No significant differences were shown in self-reported postpartum depressive symptoms between mothers with GDM and those without GDM in this report. The association between postpartum depression and GDM has gained attention in recent years. A study of low-income women showed those with diabetes, either pre-existing or GDM, were nearly twice as likely as women with normal glucose tolerance to have a diagnosis of depression during pregnancy or in the year following delivery.⁵

The self-reported practice of ever breastfeeding and breastfeeding duration were not significantly different between women with GDM and those without. Breastfeeding is highly recommended for all women because of its multiple immediate and long-term benefits for mother and child. For women with GDM, breastfeeding has been shown to improve subsequent glucose tolerance and may be associated with a reduced risk of type 2 diabetes in children exposed to diabetes in utero.^{9,14}

The Guidelines for Preconception and Interconception Care include recommendations to improve preconception health care for women.¹⁵ The goal of preconception care is to provide health promotion, screening and interventions for women of reproductive age to reduce risk factors that could adversely affect future pregnancies. Recommendations include counseling on optimal prepregnancy weight and interconception care. Interconception care provides intensive interventions for women who have had a prior pregnancy health problem, including GDM.

The high risk for developing type 2 diabetes for women with a previous GDM pregnancy is well established. Thus, continued follow-up and testing for diabetes is important for GDM women. Early interventions with intensive lifestyle modification programs, including nutrition and exercise, or with medication have been shown to reduce the risk for developing or delaying the onset of type 2 diabetes.⁸ In addition, informing the offspring's health care provider of the infant's exposure to GDM alerts the provider to the child's increased risk for obesity and type 2 diabetes. Then the provider can monitor risk factors closely and encourage preventive measures.

In summary, screening, early detection, and management can greatly improve outcomes for women with GDM and their offspring. In addition to counseling women with GDM on management during pregnancy, women with GDM need to be informed that glucose intolerance may not be temporary and continued health care after pregnancy is important. Postpartum and interconception care needs to highlight risks for depression and for developing type 2 diabetes, as well as benefits of breastfeeding and achieving a healthy postpartum weight.

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