

# PRAMSGRAM

OKLAHOMA PREGNANCY RISK ASSESSMENT MONITORING SYSTEM VOL 16 NO 1 SPRING 2012

## Gestational Diabetes Among Oklahoma Mothers

### Introduction:

Gestational Diabetes Mellitus (GDM) is a glucose intolerance first diagnosed during pregnancy. GDM is associated with increased risks for adverse maternal and infant outcomes. Fetal and newborn risks include macrosomia, shoulder dystocia, birth injuries, hyperbilirubinemia, hypoglycemia, and respiratory distress syndrome. Risks for mothers include preeclampsia, cesarean delivery, and an increased risk of developing type 2 diabetes later in life.<sup>1,2</sup> Children of women with previous GDM also have an increased risk of developing childhood obesity, prediabetes, and type 2 diabetes. A Denmark study found that these children at 19-27 years of age had almost an eight-fold risk of prediabetes or diabetes.<sup>3</sup>

The Centers for Disease Control and Prevention (CDC) reported U.S. rates of GDM range from 2 percent to 10 percent of all pregnancies, and 5 to 10 percent of mothers are found to have diabetes postpartum.<sup>4</sup> The risk for developing diabetes during the 10 to 20 years after a pregnancy with GDM increases to more than 60 percent for these mothers.<sup>4,5</sup>

Risk factors associated with developing GDM include age (over 25), ethnicity (increased risk in Native Americans and those of Hispanic, Asian, or Chinese descent), obesity, family history of diabetes, previous delivery of a large-for-gestational-age infant (more than 9 pounds or 4,000 grams), an infant with an unexplained birth defect, previous history of glucose intolerance, and possibly women with a history of polycystic ovary disease.<sup>2</sup> Diagnosis of GDM is made utilizing risk factors and oral glucose tolerance screening between 24-28 weeks of the pregnancy.<sup>6</sup>

Because GDM develops in the second half of pregnancy, it has not been associated with the increased

### In Oklahoma:

- Almost one in ten Oklahoma mothers reported GDM or high blood sugar during their pregnancy.
- The risks were highest for mothers 30 years or older, those obese prior to becoming pregnant, multiparous women, and women living in lower income households.
- Prenatal counseling on types of food to eat during pregnancy was significantly greater for women with GDM (86.7% vs. 75.1% for non-GDM); however counseling on appropriate weight gain during pregnancy and exercise did not differ between GDM and non-GDM mothers.
- Compared to women in the normal or underweight BMI categories with GDM, overweight or obese women with GDM had higher rates of adverse outcomes, such as cesarean sections, high birth weight infants, and longer hospital stays for the mother after delivery.

risk for congenital anomalies that occur with preexisting diabetes. However, increasing rates of obesity have led to more cases of undiagnosed type 2 diabetes in women of childbearing age and a rise in the number of pregnant women with undiagnosed type 2 diabetes.<sup>4,6</sup>

### Methods:

The data for this study came from the Oklahoma Pregnancy Risk Assessment Monitoring System (PRAMS) survey. PRAMS is a population-based surveillance system designed to monitor behaviors of women before, during, and after pregnancy. The data represent all live births to Oklahoma residents. From 2004 to 2008, a total of 13,619 women were selected to participate in the survey and 9,829 (72.2%) of those women completed the surveys.

Respondents were considered to have gestational diabetes if they responded “no” to the question “Did you have high blood sugar that started before this pregnancy?” and “yes” to the question, “Did you have high blood sugar that started during this pregnancy?”

Pre-pregnancy body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters and categorized according to CDC guidelines.<sup>7</sup> Weight gained during pregnancy was based on maternal self-report and ideal weight gain was determined using guidelines developed by the Institute of Medicine (IOM) based on BMI category (Figure 1).<sup>8</sup>

**Figure 1. Pregnancy weight gain determinations by pre-pregnancy BMI using IOM standards**

Pre-pregnancy BMI	< Ideal Weight Gain (lb)	Ideal Weight Gain (lb)	> Ideal Weight Gain (lb)
<b>Underweight (&lt; 18.5)</b>	<27	28-40	>40
<b>Normal weight (18.5-24.9)</b>	<25	25-35	>35
<b>Overweight (25.0-29.9)</b>	<15	15-25	>25
<b>Obese (≥ 30)</b>	<11	11-20	>20

Prevalence rates and 95% confidence interval (C.I.) estimates were calculated and the potential risk factors were identified using the Cochran-Mantel-Haenszel Chi-Square (X<sup>2</sup>) Test. Adjusted odds-ratios were estimated using a multiple logistic regression model.

All analysis in this study was done using the statistical software SUDAAN. Variables were considered significant at p<0.05.

The Pregnancy Risk Assessment Monitoring System (PRAMS) is an ongoing, population-based study designed to collect information about maternal behaviors and experiences before, during and after pregnancy. On a monthly basis, PRAMS samples between 200 and 250 recent mothers from the Oklahoma live birth registry. Mothers are sent as many as three mail questionnaires seeking their participation, with follow-up phone interviews for non-respondents. A systematic stratified sampling design is used to yield sample sizes sufficient to generate population estimates for groups considered at risk for adverse pregnancy outcomes. Information included in the birth registry is used to develop analysis weights that adjust for probability of selection and non-response.

## Results:

Overall, between 2004 and 2008, 9.3% of the pregnant women in Oklahoma were affected by GDM. This rate has remained steady over the years ranging from 9.9% in 2004 to 9.4% in 2008. Although, in 2007, there was an increase to 11.1% (data not shown).

**Table 1. Prevalence of gestational diabetes among Oklahoma mothers by selected demographic characteristics, PRAMS 2004-2008**

	Rate (%)	95% C.I	p-value <sup>1</sup>
Overall	9.3	8.4 - 10.3	
<b>Age</b>			<b>0.000</b>
< 20	4.7	3.1 - 7.2	
20-29	8.8	7.7 - 10.1	
≥ 30	12.9	10.9 - 15.1	
<b>Education</b>			0.630
<HS	9.7	7.6 - 12.2	
HS	9.6	8.2 - 11.4	
>HS	8.7	7.5 - 10.2	
<b>Maternal Race</b>			0.420
White	9.0	8.0 - 10.1	
Black	9.1	6.2 - 13.0	
American Indian	11.7	8.9 - 15.2	
Others	*	*	
<b>Hispanic</b>			<b>0.021</b>
No	8.8	7.8 - 9.8	
Yes	12.8	9.9 - 16.5	
<b>BMI</b>			<b>0.000</b>
Underweight (< 18.5)	9.6	6.9 - 13.2	
Normal (18.5-24.9)	5.8	4.8 - 7.0	
Overweight (25.0-29.9)	9.4	7.5 - 11.7	
Obese (30.0+)	17.4	14.8 - 20.3	
<b>Medicaid Status</b>			0.155
No	8.5	7.3 - 9.9	
Yes	9.9	8.6 - 11.3	
<b>Previous Live Birth</b>			<b>0.019</b>
None	7.9	6.6 - 9.5	
1 or more	10.2	9.0 - 11.6	
<b>Income</b>			<b>0.022</b>
<\$10,000	10.8	8.7 - 13.3	
\$10,000 - \$14,999	10.9	8.2 - 14.4	
\$15,000 - \$19,999	11.3	8.1 - 15.6	
\$20,000 - \$24,999	8.3	5.9 - 11.7	
\$25,000 - \$34,999	6.9	4.9 - 9.6	
\$35,000 - \$49,999	10.1	7.4 - 13.5	
\$50,000 or more	6.9	5.4 - 8.8	

\* Indicates cell size less than 30

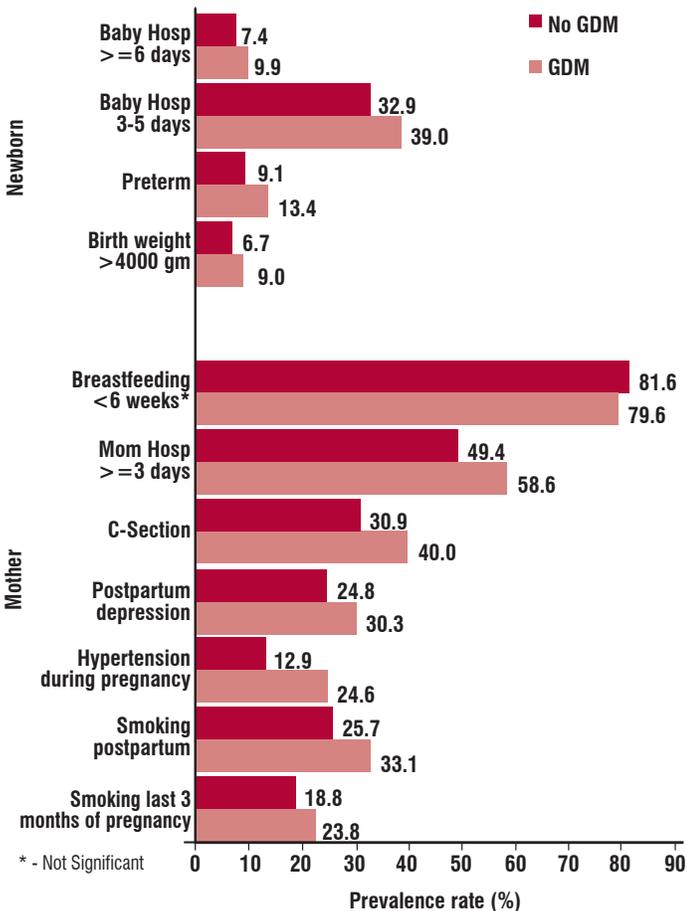
<sup>1</sup>Comparison group is mothers with no gestational diabetes. Significance is indicated by p < 0.05.

Table 1 shows the prevalence rates of GDM by maternal characteristics. GDM prevalence was highest among women 30 years or older (12.9%). Being Hispanic was significantly associated with GDM (12.8%). A significant risk factor for GDM was body mass index

(BMI). Women with BMI of 30 or more (obese) had a higher prevalence of GDM (17.4%). Women with one or more previous live births had a higher risk of having GDM than nulliparous women (10.2% vs. 7.9%). Annual household incomes contributed to risk; those households earning less than \$20,000 had an increased risk compared to households with \$50,000 or greater. Maternal education, Medicaid status, and maternal race were not significantly associated with GDM.

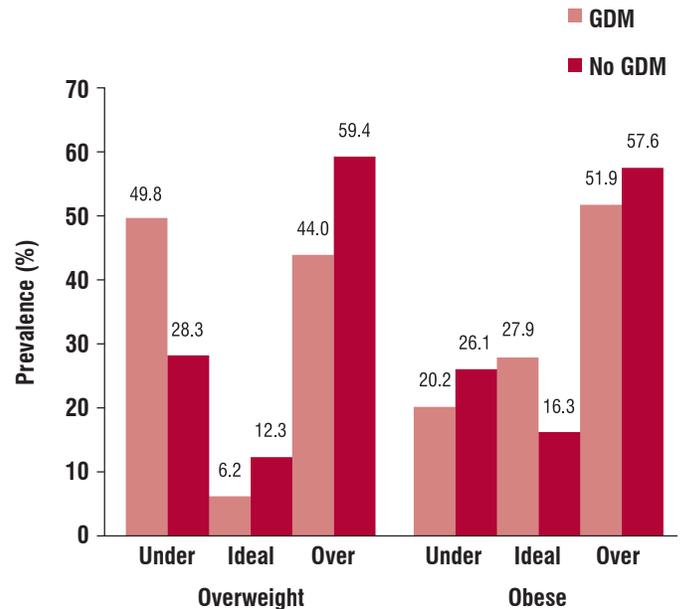
reporting GDM were also more likely to smoke during the last 3 months of pregnancy and postpartum. Results on breastfeeding duration (BF < 6 weeks) were similar for mothers with and without GDM.

**Figure 2. Outcomes associated with gestational diabetes among Oklahoma mothers and newborns, PRAMS 2004-2008**



Mothers with GDM have a significantly higher rate of hypertension, postpartum depression, and C-sections than mothers without GDM (Figure 2). Mothers with GDM also tended to stay longer in the hospital after delivery (greater than or equal to three days) than mothers without GDM. The prevalence of preterm births (13.4% vs. 9.1%) among GDM mothers was significantly higher. Newborns of GDM mothers also had a lengthier hospital stay compared to those born to mothers without GDM. As expected, the prevalence rate for infant birth weight greater than 4000 grams was significantly higher for mothers with GDM. Women

**Figure 3. Pregnancy weight gain by gestational diabetes status among overweight and obese Oklahoma mothers, PRAMS 2004-2008**



Prevalence of pregnancy weight gain (under, at, and over recommended IOM levels) by GDM status among overweight and obese mothers is displayed in Figure 3. Among overweight mothers with GDM, around 44% gained weight over the IOM recommendations during their pregnancy, while 51.9% of the obese mothers with GDM gained weight over the recommendations. For women categorized as obese, 27.9% with GDM gained the recommended amount of weight while only 16.3% without GDM gained recommended weight.

After adjusting for multiple maternal characteristics including age and race, women with pre-pregnancy BMI  $\geq 30$  had a higher risk (Odds Ratio (OR) = 3.4, 95% C.I. 2.54 – 4.57) for GDM than women with normal BMI. Likewise women in the overweight BMI category had a higher risk (OR= 1.61, 95% C.I. 1.15 – 2.26) for GDM than women in the normal BMI category. Women in the 30 years and older age group had a higher risk (OR= 1.76, 95% C.I. 1.34 – 2.32) for GDM than women in the 20-29 year age group. None of the other characteristics, such as race, ethnicity, education, income, or Medicaid status, showed any increased risk for GDM when adjusting for potential confounders (data not shown).

**Table 2: Prevalence of selected prenatal counseling topics by gestational diabetes status, PRAMS 2004-2008**

Topic	GDM		No GDM		p-value <sup>1</sup>
	%	95% C.I.	%	95% C.I.	
Type of Food	86.7	82.6 - 90.0	75.1	73.5 - 76.6	0.000
Weight Gain	77.2	72.3 - 81.5	77.2	75.7 - 78.7	0.992
Exercise	74.7	69.6 - 79.2	71.2	69.6 - 72.8	0.176

<sup>1</sup> Comparison group is mothers with no gestational diabetes.

Table 2 indicates that health care providers counseled mothers with GDM at higher rates about the appropriate types of food to eat than women without GDM.

However, the same was not true for counseling about the appropriate amount of weight to gain and exercise during pregnancy. These topics did not show any difference between GDM mothers and non-GDM mothers.

Pre-pregnancy BMI did appear to impact outcomes associated with having GDM. Women affected with GDM in the overweight and obese BMI category had a significantly higher rate of cesarean sections (C-sections) than women in the under and normal BMI category with GDM (Table 3). Hospital stays for mothers who were overweight or obese were also longer. Overweight or obese mothers with GDM had a higher rate for delivery hospitalizations of three days or more compared to mothers with GDM in the under or normal BMI categories (64.9% vs. 49.7%). In addition, mothers with GDM who were also overweight or obese mothers were more likely to deliver high birth weight infants (birth weight > 4000 grams) than under or normal weight women with GDM (10.7% vs. 6.7%).

**Table 3. Outcomes associated with Gestational Diabetes by pre-pregnancy BMI, PRAMS 2004-2008**

	Pre-Pregnancy BMI				p-value <sup>1</sup>
	Under & Normal	95% C.I.	Over & Obese	95% C.I.	
Hypertension during pregnancy	20.8	14.8 - 28.5	27.3	21.6 - 33.9	0.17
<b>C-section</b>	<b>30.6</b>	<b>23.5 - 38.8</b>	<b>46.5</b>	<b>39.7 - 53.5</b>	<b>0.00</b>
<b>Mom Hosp &gt;=3 days</b>	<b>49.7</b>	<b>41.3 - 58.2</b>	<b>64.9</b>	<b>58.0 - 71.3</b>	<b>0.01</b>
Smoking last 3 months of pregnancy	22.2	15.8 - 30.3	24.9	19.1 - 31.8	0.58
Smoking postpartum	33.0	25.5 - 41.6	33.1	26.7 - 40.3	0.99
Postpartum depression	30.5	23.2 - 38.8	30.3	24.2 - 37.1	0.64
Baby Hosp 3-5 days	34.5	26.7 - 43.3	42.1	35.3 - 49.2	0.28
Baby Hosp >=6 days	9.1	6.2 - 13.3	10.5	7.4 - 14.6	
Preterm <37 weeks	12.7	9.0 - 17.7	14.0	10.2 - 18.8	0.68
<b>Birth weight &gt; 4000 gm</b>	<b>6.7</b>	<b>5.1 - 8.7</b>	<b>10.7</b>	<b>8.8 - 12.8</b>	<b>0.01</b>
Breastfeeding <6 weeks	78.2	70.3 - 84.5	80.6	74.5 - 85.5	0.81

<sup>1</sup> Comparison group is mothers with no gestational diabetes.

## Discussion:

Gestational diabetes affects one in ten women each year in Oklahoma. Women who were overweight and obese prior to pregnancy and women who were age 30 and older are the groups most likely to have GDM. These groups of at-risk women are reflected in the current literature and the literature forecasts that 30% of these women will develop type 2 diabetes as a consequence directly following the index pregnancy and another 50% will develop type 2 diabetes in the next decade.<sup>6,9,10</sup> Their children have a 70% risk of developing type 2 diabetes.<sup>3</sup>

Type 2 diabetes can be prevented as evidenced from the “Primary Prevention Trials for Diabetes” where type 2 diabetes was prevented or delayed by 36-58%.<sup>9</sup> Prevention of type 2 diabetes for both the woman and her children included the following behavioral strategies:

- reducing current body weight by 7-10%
- reducing overall calories, by reducing fat calories to a level of less than 30%
- exercising for at least 30 minutes daily
- reducing stress levels

For the Oklahoma health care practitioner, there are several levels of opportunities to promote change in women during their reproductive years. Women who have or have had GDM are a population where the body of scientific evidence is well documented for intervention at preconception, conception, and postpartum periods. Obesity and type 2 diabetes are at an epidemic proportion in Oklahoma. Effective intervention with this population, women having experienced GDM, has the potential to reduce further increases in the epidemic. Intervention opportunities in caring for these women include:

- **PRECONCEPTION, PRENATAL, AND POSTPARTUM CARE:** Visits during pregnancy and in between pregnancies represent significant opportunities to promote healthy weight by assessing body mass index and counseling for weight management with nutrition, physical activity, and stress reduction strategies ;
- **ASSESSING PREGNANCY WEIGHT GAIN:** Prenatal care presents opportunities to promote appropriate pregnancy weight gain by assessing weight gain at each prenatal visit and by providing appropriate nutrition and physical activity

counseling and/or referral if weight gains exceed IOM recommendations;

- **DIABETES SCREENING:** Institutionalization of diabetes screening early in pregnancies to distinguish preexisting from gestational diabetes, provides a means to reduce infant and maternal complications by managing women with preexisting diabetes;
- **POSTPARTUM GESTATIONAL DIABETES SCREENING:** Performance of appropriate postpartum gestational diabetes screening, diagnosis, management, and follow-up serves to further reduce infant and maternal complications;
- **BREASTFEEDING COUNSELING:** Breastfeeding counseling and breastfeeding assistance is important in supporting the women in weight reduction following pregnancy and obesity prevention for their offspring;
- **COUNSELING ON INCREASED TYPE 2 DIABETES RISK:** Counseling on increased type 2 diabetes risk is important for the woman and her child during pregnancy and postpartum; and
- **ANNUAL WOMEN’S EXAMINATIONS:** Provision of annual women’s examinations with diabetes screening every 1-3 years are important opportunities to early identification of risk and prevention of type 2 diabetes.

Utilizing a team approach to caring for women at risk for or with gestational diabetes involving members having expertise in nutrition, physical activity, and stress reduction can impact women throughout the reproductive cycle. Nutrition counseling can include breastfeeding, portion control, caloric balance, and menu planning. Physical activity counseling can include moderate physical activity levels that increase cardiovascular fitness, fitting exercise into the daily schedule/routine for women, and counseling that promotes safe exercise for pregnant women. Stress reduction counseling can include counseling that addresses the barriers to healthy eating and physical activity.

The data in this report also suggest increased costs for the health system and the state as a whole as some women experiencing GDM and their offspring have complications and longer hospitalizations. These complications and hospitalizations are costly. With

Oklahoma’s Medicaid Program being the major payor of obstetrical care, GDM is an issue of concern for policymakers. To prevent complications, careful diabetes management of blood glucose and blood pressure levels will aid in preventing complications. Diabetes management involves utilizing a Diabetes Management Team including certified nurse, nutrition, and pharmacy educators; behavioral health specialists, and case management. If a team approach is not available, referrals to an appropriate diabetes care team should be made for the woman with GDM.

Limitations for this study include maternal self-report of GDM and other risk factors in the study. The self-reported conditions listed here (high blood sugar, high blood pressure) have a higher incidence than what is reported by clinicians on the birth record. While some of that is explained by the broad definitions given in the PRAMS survey, some discrepancy may be due to an over reporting of symptoms by mothers in PRAMS and an underreporting of conditions on the birth certificate. Recall bias and/or social desirability bias may cause over or underreporting for some topics, like prenatal care counseling and tobacco or alcohol use, respectively.

### **Recommendations:**

1. Implement a Medicaid state plan amendment for an interconception waiver to support provision of necessary care and screenings during the postpartum period and beyond.
2. Adopt a Gestational Diabetes Screening Protocol based on either American Congress of Obstetrics and Gynecology (ACOG) or American Diabetes Association and institute routine gestational diabetes screening at first prenatal visit, 24-28 week visit, postpartum visit, and annual visit.
3. Adopt the IOM weight gain for pregnancy protocol and assess weight gain at each prenatal visit. Women whose weight gain exceeds the medical standard should be counseled on appropriate weight gain and encouraged to sign a contract for behavioral changes including caloric balance, cardiovascular physical fitness, and stress reduction.
4. Provide diabetes management for pregnant women with gestational diabetes or refer them for appropriate diabetes management during the pregnancy.
5. Counsel women on the benefits of breastfeeding for obesity prevention.

6. Counsel women on the importance of the postpartum visit, schedule postpartum visit with delivery provider or medical home at delivery discharge.
7. Conduct GDM screening as a routine component of the postpartum visit.
8. Counsel women on their risk of type 2 diabetes and the risk to their infant and contract for healthier family behaviors.
9. Assess weight and counsel on weight management to prevent overweight and obesity at annual women's health visit.
10. Assess family's health behaviors and conduct nutrition and physical activity counseling to reduce risk of obesity and type 2 diabetes at annual women's health visit.

## References:

1. ACOG. Screening and diagnosis of gestational diabetes mellitus. Committee Opinion No. 504. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2011; 118: 751-3.
2. Desk Reference 2011 American Association of Diabetes Educators. Pregnancy with Diabetes pgs 621-654. *The Art and Science of Diabetes Self-Management Education Desk Reference*. Chicago, Illinois. Second Edition, 2011.
3. Damm, P. Future risk of diabetes in mother and child after gestational diabetes mellitus. *International Journal of Gynecology and Obstetrics* 2009; 104: S25-S26.
4. Metzger, B.E. Detecting and Diagnosing Gestational Diabetes. *Physician's Weekly* No. 30. August 9, 2011. Accessed on October 30, 2011. Obtained from [http://www.physiciansweekly.com/Features/11\\_30/gestational\\_diabetes.html](http://www.physiciansweekly.com/Features/11_30/gestational_diabetes.html).
5. AHRQ. Gestational diabetes: caring for women during and after pregnancy. Available at: [http://effectivehealthcare.ahrq.gov/ehc/products/107/163/2009\\_0804GDM\\_Clinician\\_final.pdf](http://effectivehealthcare.ahrq.gov/ehc/products/107/163/2009_0804GDM_Clinician_final.pdf)
6. American Diabetes Association. Standards of Medical Care in Diabetes—2011. *Diabetes Care*. 2011;34:S11-S61. Available at: [http://care.diabetesjournals.org/content/34/Supplement\\_1/S11.full](http://care.diabetesjournals.org/content/34/Supplement_1/S11.full).
7. Centers for Disease Control and Prevention. Defining overweight and obesity. Accessed November 1, 2011. Obtained from <http://www.cdc.gov/obesity/defining.html>
8. Institute of Medicine. Weight Gain During Pregnancy: Reexamining the Guidelines, May 2009. The National Academies Press. Accessed November 1, 2011. Obtained from <http://www.iom.edu/Reports/2009/Weight-Gain-During-Pregnancy-Reexamining-the-Guidelines.aspx>
9. Diabetes Prevention Research Group: Reduction in the evidence of type 2 diabetes with life-style intervention or metformin. *NEJM* 346:393-403, 2002 Shumei Y, Kaber NH, BAo-Ping Z, Brownson RC. 2003.
10. Bellamy L, Casas, JP, Hingorani AD, Williams D. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. *Lancet* 2009; 373:1773-1779

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