

## Appendix A: Recommendations to Improve Epidemiology Capacity for GDM Surveillance in Ohio

To maintain efforts for GDM surveillance, an annual update and review of data from Vital Statistics and Medicaid is recommended. It would also be beneficial to have an update and review of statistics from BRFSS, OPAS, and OHA every 2 to 3 years.

Additionally, the use of Medicaid data could be further explored to:

- a) Assess the timing of prenatal GDM screening, and
- b) Assess ongoing (beyond postpartum) T2DM glucose screening among women with a GDM history.

Lastly, it is recommended to better understand the accuracy of Medicaid data related to postpartum glucose screening so that these data can be best applied to program planning and evaluation.

## Appendix B: Data Source Descriptions, Strengths and Limitations

### Ohio Hospital Association (OHA)

OHA represents 14 health systems and 240 hospitals in Ohio ([www.ohiohospitals.org](http://www.ohiohospitals.org)). OHA provides claims information on individuals who were admitted and discharged from the hospital. Hospital discharge data were collected by OHA and provided to ODH for analysis. Data requested from OHA for this data book were as follows:

- Women with Gestational Diabetes (ICD-9 Codes: 6488, 64880, 64881, 64882, 64883, 64884; or ICD-10 Codes beginning with 244XX but excluding Z8632)
- Obstetrics
- Inpatients
- Ohio Residents

Record identification with diabetes was based on discharge ICD-9 or ICD-10 codes without knowledge of the criteria used to make the diagnosis. In general, studies that use ICD-9 or ICD-10 codes to describe disease trends may suffer from bias, depending on the validity of the code from the condition being examined. A previous study that evaluated ICD-9-CM codes in hospital discharge data for one in obstetric research reported high positive predictive values (96 percent) and moderate sensitivity (64 percent) for the full spectrum of diabetes codes (Yasmeen, 2006). Similar results were reported in another study that assessed the validity of hospital discharge data for identifying diabetes-complicated births (Delvin, 2009). This result suggests the potential for underestimation rather than over reporting in our numbers but would not deter from our conclusions regarding the impact of diabetes among pregnant women in the U.S. Similarly, because of the nature of the data, we also cannot rule out improvement in reporting quality over time as a partial explanation for the temporal increased. Population based studies of laboratory-based diagnosis of GDM over similar time intervals; however, also documented increasing trends similar to what we report (Delvin, 2009; Yasmeen, 2006). Another limitation of the hospital discharge data is that a woman may be counted more than once if she had multiple pregnancies complicated by GDM within the time period examined.

Additionally, women with GDM may also have higher rates of indirect costs resulting from increased time off work and psychological stress (Yasmeen, 2006).

### Behavior and Risk Factors Surveillance Survey (BRFSS)

The BRFSS is a state-based system of health surveys that collects information on health risk behaviors, preventive health practices and health care access primarily related to chronic disease and injury in the adult population (18 years of age or older) living in households. The CDC established BRFSS in 1984. Currently, data are collected monthly in all 50 states, the District of Columbia, Puerto Rico, the U.S Virgin Islands, and Guam. More than 400,000 adults are interviewed each year, making the BRFSS the largest telephone health survey in the world. States use BRFSS data to identify emerging health problems, establish and track health objectives, and develop and evaluate public health policies and programs ([www.cdc.gov/brfss](http://www.cdc.gov/brfss)). The Ohio BRFSS has some state-added questions, which includes questions pertaining to Gestational Diabetes Mellitus. The state-added GDM questions were asked in 2012, 2013, 2014, and 2016-2019.

All data collected from BRFSS are self-reported, which is subject to recall bias, social desirability bias, and measurement bias resulting from wording and questionnaire design (Choi, 2005). Despite this, the accuracy of self-reporting for diabetes is reasonably high in population surveys (Saydah, 2004).

Another limitation is that GDM question in BRFSS is not specific to a current or recent pregnancy, and includes all women who had GDM in the past 10 years, regardless of age, resulting in more a cumulative prevalence estimate, rather than a cross-sectional estimate.

### Vital Statistics

In 2006, Ohio adopted the revised National Center for Health Statistics 2003 birth certificate. Under the section on the birth certificate titled “Risk Factors for Pregnancy” the following options for diabetes are available:

- Pre-pregnancy (Diagnosis prior to this pregnancy)
- Gestational (Diagnosis in this pregnancy)

These data should come from the mother’s prenatal care records, labor and delivery records, as well as infant’s medical record (each of which contributes to the facility worksheet). If the mother’s prenatal care record is not in her hospital chart, Ohio Vital Statistics recommends that the doctor and/or clerical staff contact her prenatal care provider to obtain the record or a copy of the prenatal care information.

Birth certificates only allow for one diabetes response to be chosen. This change was implemented after 2004 in most states (in 2006 in Ohio), and increases the validity of GDM reporting on birth certificates (Hoslet, 2010). The Ohio Perinatal Quality Collaborative (OPQC) in 2008 introduced a charter that would prevent unnecessary scheduled births without proper medical indications between 36 and 38 weeks. As a result of this initiative many births have been moved beyond 39 weeks, decreasing the amount of NICU admissions annually. In mid-2013, OPQC began promotion and training on accurate reporting of 13 key birth registry variables. Gestational diabetes was one of the 13.

Previous studies have shown that birth certificates underreported GDM. The accuracy of the birth certificate data relies on both the medical provider’s accurate completion of the health history and proper training of clerical staff. Without review by clinicians and little incentive for quality improvement (Northam, 2006; Devlin, 2009; Deitz, 1998), it is difficult to assess the quality of the birth certificate data, which may vary by state. For example, birth certificates in New York State showed high validity when compared to medical charts (Roohan, 2003). However, in Minnesota, hospital discharge data performed better in identifying GDM and pre-pregnancy diabetes than birth certificates (Devlin, 2009). Validity of birth certificates to report GDM in Ohio has not been quantified.

Some of the height, weight and BMI values were considered biologically implausible and hence, had to be removed from the analyses. This could be due to the fact that individuals could have been asked for their height, weight and BMI instead of actually being assessed at the health facility. Possible self-reporting of these values is therefore, a possible contribution to the discrepancy and biological implausible values that were witnessed in the dataset. Efforts to improve quality improvement in data collection can be considered for future work.

### Pregnancy Risk Assessment Monitoring System (PRAMS)

PRAMS is a population-based survey that asks about maternal behaviors and experiences before, during, and after a woman’s pregnancy and during the early infancy of her child. Center for Disease Control (CDC) developed PRAMS in 1987. Currently, 47 states, New York City, Puerto Rico and the District of Columbia participate in PRAMS. Ohio and California previously participated. (<https://www.cdc.gov/prams/states.htm>) Findings are used to develop and assess public health programs and policies to reduce adverse pregnancy outcomes. The PRAMS sample includes women who have had a recent live birth. A stratified sample of such women is selected each month from the state’s birth certificate files. Selected women are first contacted by mail 2-4 months postpartum. If there is no response to repeated mailings, women are contacted and interviewed by telephone ([www.cdc.gov/PRAMS](http://www.cdc.gov/PRAMS)).

Overall, the accuracy of self-reporting for diabetes is reasonably high in population surveys (Saydah, 2004). Data collected from PRAMS is completely self-reported, which is subject to recall bias, social desirability bias, and measurement bias resulting from working and questionnaire design (Choi, 2005). Additionally, PRAMS does not include fetal deaths or still births, which could have an association with gestational diabetes (Racusin, 2012). Although the question asks about GDM history in the most recent pregnancy, respondents may answer based on any past pregnancy.

## Gestational Diabetes in Ohio, 2008-2019

There is some reporting bias in regards to diabetes in PRAMS, a small proportion of women report having both GDM and pre-pregnancy diabetes. However, the proportion of misreporting has decreased in recent years.

### Ohio Pregnancy Assessment Survey (OPAS)

The Ohio Pregnancy Assessment Survey (OPAS) is a statewide, ongoing, targeted population-based survey that utilizes the CDC Pregnancy Risk Assessment Monitoring System (PRAMS) methodology to collect information on and attitudes of residential women who give birth in Ohio. OPAS began fielding in 2016, and provides information not available from other sources about pregnancy and the first few months after birth. OPAS questions are group to reflect experiences before, during and after pregnancy. This information can be used to identify groups of women and infants at high risk for health problems, to monitor changes in health status, and to measure progress towards goals in improving the health of mothers and infants. Additionally, the OPAS provides data to measure progress in Ohio's maternal and infant health (MIH) initiatives and is used by researchers to investigate emerging issues in the field of reproductive health.

The OPAS is a stratified mixed collection mode random survey of residential women who gave birth in Ohio. Relevant populations of interest, such as the nine Ohio Health Equity Institute (OEH) counties, are oversampled to facilitate analysis of Ohio's MIH initiatives and ongoing program development. Sampled women are contacted approximately 2-4 months after delivery and can participate by completing a mailed survey, online survey, or telephone survey.

### Medicaid

The database from which Medicaid data originate contains eligibility, demographic and transactional data for all Medicaid recipients. Data are uploaded monthly and can be obtained either at a summary level, or at the record level. Even if a mother is enrolled as a Medicaid recipient, if the service is not paid for by Medicaid, there is no record of the service in the Medicaid claims database. Only services billed to Medicaid for enrollees are included. Although probably rare, Medicaid enrolled individuals could be receiving care through a non-Medicaid provider.

Additionally, some subgroups had small sample sizes, so subgroups with denominators less than 30 were suppressed to maintain respondent confidentiality. These lead to gaps in the analysis reflected on the tables as NA.

Additional changes from the previous drafts of the ODH data book include:

- The original team who conducted the analysis discovered that the previously published tables containing BRFSS data did not restrict the female population to women of reproductive age (WRA) as previously indicated; this data was updated in the 2018 publication of the GDM Data Book.
- Some of the estimates that were previously reported no longer met the reliability criteria for reporting.
- A change from ICD-9 codes to ICD-10 codes was required due to the federally mandated conversion that occurred on October 1, 2015.

## Appendix C: Historic Data Tables

These data are no longer updated but can provide a historic view of similar data points contained in this data book.

**Table 2a.** Prevalence of preconception risk factors among women with a live birth, by demographics, Ohio, historic data

Overall (n)		2006-08		2009-10	
		(4358)		(2639)	
		%	95% CI	%	95% CI
Age (years)	18-24	34.3	32.4-36.3	32.7	30.3-35.2
	25-34	53.3	51.3-55.3	54.6	52.0-57.1
	35-44	12.4	11.2-13.7	12.7	11.2-14.5
Race/Ethnicity	Non-Hispanic White	76.9	75.7-78.1	76.8	75.3-78.3
	Non-Hispanic Black	14.7	14.4-15.1	15.3	14.9-15.8
	Hispanic	3.3	2.6-4.2	3.4	2.5-4.6
	Other <sup>a</sup>	5.0	4.2-6.1	4.5	3.5-5.7
Education	Less than HS	14.7	13.2-16.4	13.9	12.1-15.9
	HS Graduate	28.0	26.2-29.8	25.2	23.0-27.6
	Some College	21.1	19.6-22.7	22.3	20.3-24.4
	College Graduate	36.2	34.4-38.1	38.7	36.3-41.2
Pre-Pregnancy Health Insurance <sup>b,c</sup>	Uninsured	36.3	34.4-38.3	17.3	15.3-19.4
	Medicaid	15.2	13.9-16.7	23.6	21.6-25.8
	From Job	--	--	55.3	52.8-57.9
	Self Pay (not from job)	--	--	3.8	2.9-5.0
	TRICARE or Other Military	--	--	1.4	0.9-2.1
	Other	--	--	3.4	2.5-4.5
Annual Household Income	Less than \$15,000	28.9	27.1-30.8	31.6	29.2-34.1
	\$15,000-\$24,999	13.0	11.6-14.5	13.4	11.7-15.4
	\$25,000- \$34,999	11.4	10.1-12.8	8.4	7.0-9.9
	\$35,000 -\$49,999	10.9	9.6-12.2	11.0	9.5-12.8
	\$50,000 or More	35.9	34.0-37.9	35.6	33.2-38.1
County Type <sup>d</sup>	Metropolitan	52.4	50.4-54.3	55.0	52.5-57.5
	Suburban	16.4	15.0-18.0	16.0	14.2-18.1
	Appalachian	16.4	14.9-18.0	14.8	13.0-16.8
	Rural	14.9	13.4-16.4	14.2	12.4-16.1

Source: 2006-2010 Analyses using Pregnancy Risk Assessment Monitoring System

a Includes those who reported multiple races

b Significant change in structure of survey questions about pre-pregnancy health insurance in 2009-10. Comparison with 2006-08 may not be valid

c In 2009-10, mothers could select all insurance options that applied, therefore total will not add up to 100 percent

d Rural and suburban excludes counties otherwise designated as Appalachian by the Appalachian Regional Commission

## Gestational Diabetes in Ohio, 2008-2019

**Table 2b.** Prevalence of preconception health status and behavioral risk factors among women with a live birth, Ohio, historic data

Overall (n)	2006-08 (4358)		2009-10 (2639)	
	%	95% CI	%	95% CI
<b>History of Diabetes (not Gestational)</b>				
Yes	2.6	2.0-3.3	1.9	1.3-2.7
<b>History of Hypertension Before Pregnancy<sup>a</sup></b>				
Yes	--	--	9.3	7.9-10.8
<b>Pre-Pregnancy BMI (kg/m<sup>2</sup>)</b>				
Underweight (< 18.5)	6.9	6.0-8.0	7.6	6.3-9.1
Normal weight (18.5 - 24.9)	48.0	46.0-50.0	44.4	41.9-47.0
Overweight (25.0-29.9)	23.8	22.2-25.6	23.7	21.5-26.0
Obese (30.0+)	21.2	19.7-22.9	24.3	22.2-26.6
<b>Smoker</b>				
Smoked in the Past 2 Years	32.5	30.6-34.5	37.3	34.8-39.9
<b>Preconception Health Visit<sup>b</sup></b>				
Yes	27.4	25.7-29.2	29.8	27.5-32.1
No	72.6	70.9-74.4	70.2	67.9-72.5
<b>Pre-Pregnancy Exercise 3+ times per week<sup>c</sup></b>				
Yes	--	--	41.8	39.2-44.3
No	--	--	58.3	55.7-60.8

Source: 2006-2010 Analyses using Pregnancy Risk Assessment Monitoring System (Ohio Department of Health).

**Note:**

<sup>a</sup> Based on answers a or b to the question: "During the 3 months before you got pregnant with your new baby, did you have any of the following health conditions?" (Answer a: Type 1 or Type 2 diabetes (not gestational diabetes); Answer b: b. High blood pressure or hypertension)

<sup>b</sup> In 2006-10, based on answers to the question: "Before you got pregnant with your new baby, did a doctor, nurse, or other health care worker talk with you about how to prepare for a healthy pregnancy and baby?"

Only respondents who indicated they had had any type of health care visit in the 12 months prior to pregnancy answered this question.

<sup>c</sup> In 2006-10, based on answers to the question: "During the 3 months before you got pregnant with your new baby, how often did you participate in any physical activities or exercise for 30 minutes or more?"

Table 4a. GDM incidence among women with a live birth, by demographics, Ohio, historic data

		2006-08		2009-11	
		(n=438,373)		(n=412,631)	
		%	95% CI	%	95% CI
<b>Overall</b>		<b>4.9</b>	<b>4.8-4.9</b>	<b>5.8</b>	<b>5.8-5.9</b>
<b>Age (years)</b>	18-24	2.7	2.6 -2.8	3.3	3.2-3.4
	25-34	5.6	5.5 -5.7	6.6	6.5-6.7
	35-44	9.0	8.7 -9.2	10.6	10.3-10.8
	45+	12	9.2 -14.9	13.2	10.4-16.0
<b>Race/Ethnicity</b>	Non-Hispanic White	4.8	4.7-4.9	5.7	5.6-5.8
	Non-Hispanic Black	4.2	4.1 -4.3	5.1	5.0-5.3
	Hispanic	6.3	5.9 -6.6	7.6	7.2-7.9
	Other <sup>a</sup>	9.0	8.5 -9.6	10.8	10.2-11.3
<b>Currently Married</b>	Yes	5.7	5.6 -5.8	6.6	6.5-6.7
	No	3.7	3.6 -3.8	4.8	4.7-4.9
<b>Education</b>	Less than High School	3.4	3.2-3.5	4.2	4.1-4.4
	High School Graduate	4.8	4.7-5.0	5.8	5.6-5.9
	Some College	5.4	5.2-5.5	6.4	6.3-6.6
	College Graduate	5.3	5.2-5.4	6.2	6.1-6.3
<b>Migrant Status <sup>b</sup></b>	US Born	4.7	4.6-4.7	5.6	5.5-5.6
	Foreign Born	6.9	6.7-7.2	8.8	8.5-9.1
<b>Medicaid</b>	Yes	4.3	4.2-4.4	5.3	5.2-5.4
	No	5.3	5.3-5.4	6.2	6.1-6.3
<b>WIC</b>	Yes	4.5	4.4-4.6	5.7	5.6-5.8
	No	5.1	5.0-5.2	6.0	5.9-6.1
<b>County Type</b>	Metropolitan	4.8	4.5-5.1	6.6	6.3-7.0
	Suburban	4.7	4.6-4.9	5.4	5.2-5.5
	Appalachian	4.4	4.3-4.6	6.1	5.9-6.3
	Rural	4.7	4.5-4.8	5.5	5.3-5.6
<b>Birth Order</b>	First Born	7.6	6.0-9.6	7.4	5.5-9.9
	Not First Born/Unknown	11.0	9.5-12.6	11.2	9.4-13.3

Source: Vital Statistics; Resident File was used.

Note:

<sup>a</sup> Includes those who reported multiple races

<sup>b</sup> This variable was not available in the data set

Table 4b, GDM incidence among women with a live birth, by pregnancy risk factors, Ohio, historic data

	2006-08		2009-11	
	Percentage of Respondents with GDM in Most Recent Pregnancy			
	%	95% CI	%	95% CI
<b>Smoker</b>				
Yes	4.3	4.2-4.4	5.8	5.6-5.9
No	5.3	5.3-5.4	5.9	5.8-6.0
<b>First Trimester Prenatal Care</b>				
Yes	3.7	3.6-3.7	4.4	4.4-4.5
No	1.1	1.1-1.2	1.4	1.3-1.4
<b>Pre-pregnancy BMI (kg/m2)</b>				
Underweight (BMI<18.5)	2.0	1.8-2.2	2.4	2.2-2.7
Normal weight (18.5-24.99)	2.6	2.6-2.7	3.3	3.2-3.3
Overweight (25.00-29.99)	5.1	4.9-5.2	6.0	5.8-6.1
Obese (30.0+)	9.7	9.5-9.9	11.1	10.9-11.3
<b>Weight gain during pregnancy <sup>a</sup></b>				
Inadequate	5.7	5.6-5.9	6.9	6.7-7.1
Excessive	4.4	4.3-4.5	5.3	5.2-5.4
<b>Gestational Hypertension</b>				
Yes	9.2	8.8-9.7	10.9	10.5-11.3
No	4.7	4.6-4.7	5.6	5.5-5.6

Source: Vital Statistics; Resident File was used.

Note:

<sup>a</sup> Weight gain during pregnancy defined using the [IOM 2009 guidelines](#)



**Table 6. Incidence of GDM among Ohio Medicaid deliveries, by year, historic data**

		2007	2008
<b>Overall (%)</b>		<b>9.5</b>	<b>9.8</b>
<b>Age (years)<sup>a</sup></b>	18-24	7.2	7.4
	25-34	13.0	13.3
	35-44	21.1	21.1
<b>Race<sup>b</sup></b>	Non-Hispanic White	10.3	10.6
	Non-Hispanic Black	7.6	7.7
	Hispanic	9.1	10.7
	Non-Hispanic Other	12.2	13.0
<b>Urbanicity</b>	Urban	8.9	9.0
	non-Urban	10.0	10.6

**Source:** Analysis of 2007-08 data obtained from Ohio Department of Medicaid QDSS (Medstat Advantage Suite<sup>®</sup> V 4.0, Truven Health Analytics)

**Note:**

a Less than 30 respondents in subpopulation for mothers ≥ 45 years therefore that age group is too small for meaningful analysis

b Data on race and ethnicity were unavailable in 2013-2014 claims data for Medicaid enrollees.

Deliveries and gestational diabetes diagnoses were identified using the relevant ICD-9, ICD-10, CPT, and UB codes specified by HEDIS.

Gestational diabetes diagnoses were included in the analysis if they occurred during the 270 day period prior to a delivery admission.

**Table 7a. Prevalence of maternal and delivery outcomes, by GDM status, Ohio, historic data**

	2006-08		2009-10	
	%With GDM [95% CI]	% Without GDM [95% CI]	%With GDM [95% CI]	% Without GDM [95% CI]
<b>Infant</b>				
Baby in NICU	16.1 [12.4-20.5]	10.7 [9.7-11.8] <sup>ns</sup>	13.5 [9.7-18.4]	10.4 [9.1-11.8] <sup>ns</sup>
Length of Hospital Stay	*		^	
1-2 days	48.2 [41.8-54.7]	57.9 [55.8-59.9]	53.3 [45.3-61.2]	61.8 [59.2-64.3]
3 days	24.5 [19.3-30.6]	22.9 [21.2-24.7]	35.2 [28.0-43.4] (3-5 days)	28.7 [26.3-31.1] (3-5 days)
4 days	13.3 [9.5-18.3]	7.5 [6.5-8.6]		
5 days	4.0 [2.3-7.0]	2.5 [2.0-3.2]		
6 days +	8.9 [6.5-12.1]	6.8 [6.0-7.6]	10.1 [6.7-15.0]	6.8 [5.9-7.9]
<b>Maternal</b>				
High Blood Pressure	23.3 [18.6-28.8]	12.0 [10.8-13.4]*	24.8 [18.7-32.2]	13.5 [11.8-15.4]*
Preterm Labor	20.7 [25.2-36.9]	23.9 [22.2-25.7]*	29.4 [22.7-37.1]	22.3 [20.2-24.6] <sup>ns</sup>
Cesarean Section Delivery	37.1 [31.3-43.3]	28.4 [26.6-30.3]*	46.8 [39.0-54.8]	28.9 [26.5-31.3]*

^ p = 0.05      \* p < 0.01      ns = not significant

**Source:** 2006-2010 Pregnancy Risk Assessment Monitoring System, Ohio Department of Health.

**Footnotes:**

PRAMS Phase 5 of (2004-08) GDM was determined by the following questions: “Did you have high blood sugar (diabetes) that started during this pregnancy?”

PRAMS Phase 6 (2009-11) GDM was determined by the following question: “During your most recent pregnancy, were you told by a doctor, nurse, or other health care worker that you had gestational diabetes (diabetes that started during this pregnancy)?”

Table 7b, Prevalence of delivery complications, by GDM status, Ohio, historic data

	2006-08		2009-11	
	% With GDM [95% CI]	% W/out GDM [95% CI]	% With GDM [95% CI]	% W/out GDM [95% CI]
<b>Preterm</b>				
Preterm	15.6 [15.1-16.0]	10.5 [10.5-10.6]	14.9 [14.5-15.4]	9.9 [9.8-10.0]
<b>NICU Admission</b>				
Yes	9.4 [9.0-9.8]	5.9 [5.8-5.9]	10.3 [9.9-10.7]	6.5 [6.4-6.6]
<b>C-section</b>				
Yes	43.2 [42.5-43.8]	29.2 [29.1-29.3]	44.2 [43.6-44.8]	30.2 [30.0-30.3]
<b>Apgar Group</b>				
0-4	1.3 [1.2-1.5]	1.4 [1.3-1.4]	1.1 [1.0-1.3]	1.2 [1.1-1.2]
5-6	2.1 [1.9-2.3]	1.6 [1.6-1.6]	1.4 [1.3-1.6]	1.3 [1.2-1.3]
7-10	96.5 [96.2-96.7]	96.7 [96.7-96.8]	97.3 [97.1-97.5]	97.3 [97.3-97.4]

Source: Vital Statistics; Resident File was used.

**Table 9** Prevalence of self-reported postpartum visit completion, Ohio, historic data

	2006-08		2009-10	
	% With GDM	% W/out GDM	% With GDM	% W/out GDM
<b>Overall %</b> (n) <sup>a</sup> [95% CI]	<b>90.5</b> (382) [86.3-93.5]	<b>90.0</b> (3513) [88.6-91.2]	<b>91.0</b> (259) [85.4-94.6]	<b>90.4</b> (2146) [88.6-91.9]
<b>Age (years)</b>	~	~	~	*
<18	—	88.0 [78.6-93.6]	—	86.9 [72.5-94.3]
18-24	87.5 [77.4-93.5]	86.3 [83.5-88.7]	90.8 [79.3-96.2]	87.1 [83.4-90.0]
25 - 34	92.2 [86.5-95.7]	92.1 [90.4-93.6]	90.3 [80.4-95.4]	92.2 [89.8-94.0]
35-44	89.4 [78.2-95.2]	92.1 [88.3-94.7]	92.0 [80.8-96.9]	92.7 [87.7-95.8]
45+	—	—	—	—
<b>Race/Ethnicity</b>	*	*	^	~
Non-Hispanic White	90.7 [85.5-94.1]	90.9 [89.4-92.4]	95.2 [88.5-98.0]	91.0 [88.9-92.8]
Non-Hispanic Black	85.3 [76.4-91.3]	87.1 [84.7-89.1]	81.2 [70.7-88.5]	86.4 [83.1-89.1]
Hispanic	—	87.6 [77.8-93.4]	—	91.5 [76.5-97.3]
Other	—	85.5 [76.7-91.4]	—	92.6 [83.9-96.8]
<b>Marital Status - ns</b>				
Married	93.5 [88.7-96.4]	92.4 [90.8-93.8]	92.3 [84.0-96.5]	93.9 [91.9-95.5]
Unmarried	84.6 [75.6-90.7]	86.4 [84.0-88.5]	89.4 [80.0-94.6]	85.7 [82.5-88.4]
<b>Education</b>	~	^	~	^
Less than High School	81.8 [65.9-91.3]	81.5 [76.7-85.5]	96.7 [88.4-99.1]	76.2 [69.2-82.1]
High School grad	90.1 [81.9-94.8]	86.6 [83.5-89.1]	79.9 [62.4-90.5]	88.2 [84.1-91.3]
Some college	93.1 [84.0-97.2]	92.0 [89.5-93.9]	95.4 [89.1-98.1]	91.7 [88.3-94.2]
College grad	92.6 [83.5-96.8]	95.7 [94.1-96.9]	93.6 [84.9-97.5]	97.0 [95.1-98.1]

\* p < .05      ^ p < .01      ~ p < .001

See footnote at bottom of page 40.

**Table 9, Cont.** Prevalence of self-reported postpartum visit completion, Ohio, historic data

	2006-08		2009-10	
	% With GDM	% W/out GDM	% With GDM	% W/out GDM
<b>Overall</b> (n) <sup>a</sup> [95% CI]	<b>90.5</b> (382) [86.3-93.5]	<b>90.0</b> (3513) [88.6-91.2]	<b>91.0</b> (259) [85.4-94.6]	<b>90.4</b> (2146) [88.6-91.9]
<b>County Type</b>				
Metro	91.7 [86.9-94.9]	89.8 [88.0-91.3]	87.0 [77.3-92.9]	89.1 [86.6-91.1]
Suburban	89.1 [73.3-96.1]	89.8 [86.0-92.6]	94.3 [78.4-98.7]	95.7 [92.2-9.7]
Appalachia	87.8 [72.0-95.2]	88.9 [84.7-92.0]	98.1 [94.6-99.3]	85.4 [79.0-90.1]
Rural	90.2 [75.4-96.5]	92.1 [88.4-94.7]	93.4 [74.4-98.6]	94.8 [90.1-97.3]
<b>Insurance Status (Prenatal Care)<sup>b</sup></b>				
Uninsured	N/A	N/A	—	70.7 [53.2-83.7]
Medicaid	85.6 [77.1-91.4]	85.6 [82.9-87.9]	86.0 [76.0-92.3]	86.0 [82.8-88.6]
Health Insurance From Job	N/A	N/A	97.0 [90.1-99.1]	95.8 [93.9-97.1]
Health Insurance Paid For (not from job)	N/A	N/A	—	99.2 [97.5-99.8]
TRICARE Or Other Military Health Care	N/A	N/A	—	94.5 [76.3-98.9]
Other	N/A	N/A	—	85.6 [73.3-92.8]
<b>Migrant Status<sup>c</sup></b>				
U.S. Born	89.6 [85.1-92.9]	90.3 [88.9-91.5]	91.5 [85.6-95.1]	90.5 [88.7-92.1]
Foreign-Born	98.3 [95.7-99.7]	85.6 [78.6-90.6]	—	88.6 [80.2-93.7]
<b>WIC during Pregnancy</b>				
Yes	86.0 [78.1-91.4]	87.3 [84.5-89.3]	86.6 [76.7-92.7]	87.2 [84.1-89.7]
No	93.7 [88.7-96.5]	91.9 [90.2-93.9]	96.9 [91.7-98.9]	93.0 [90.9-94.7]

\* p < .05      ^ p < .01      ~ p < .001

**Sources:** 2006-2010 Pregnancy Risk Assessment Monitoring System (PRAMS).

**Notes:** GDM was determined by the following questions:

- Phase 5 of PRAMS (2004-08), “Did you have high blood sugar (diabetes) that started during this pregnancy?”;
- Phase 6 (2009-11), “During your most recent pregnancy, were you told by a doctor, nurse, or other health care worker that you had gestational diabetes (diabetes that started during this pregnancy)?”

**Based on answers to the question:** Since your new baby was born, have you had a postpartum checkup yourself? (A postpartum checkup is a regular checkup a women has after she gives birth).

<sup>a</sup> n represents an estimate of the statewide population

<sup>b</sup> Refers to insurance status for prenatal care. Significant change in structure of survey questions about health insurance for prenatal care in 2009-2010. Also, from 2009 forward mothers chose all that applied.

<sup>c</sup> This variable was not available in the data set in 2016-2019.

— too small for meaningful analysis; less than 30 respondents in subpopulation; cells with denominators less than 30 are not presented due to confidentiality concerns.

**Table 10** Prevalence of trends in postpartum visit claims among women with Medicaid insurance, Ohio, historic data

	2007-09		2010-12		2013-14	
	% With GDM	% W/out GDM	% With GDM	% W/out GDM	% With GDM	% W/out GDM
<b>Total</b>	<b>n=10,481</b>	<b>n=85,969</b>	<b>n=12,621</b>	<b>n=84,959</b>	<b>n=16,282</b>	<b>n=118,045</b>
<b>Age (years)</b>						
18-24	53.6	49.6	53.0	50.1	47.8	42.5
25-34	53.6	48.6	54.9	51.1	50.9	44.4
35-44	50.7	45.1	53.6	48.4	47.7	39.1
≥45 <sup>a</sup>	-	-	-	-	-	-
<b>Race<sup>b</sup></b>						
Non-Hispanic White	51.3	51.4	52.7	52.7	-	-
Non-Hispanic Black	50.2	47.7	54.0	49.2	-	-
Hispanic	12.5	26.0	16.8	27.8	-	-
Other	12.8	34.9	16.7	38.5	-	-
<b>Geographic Region</b>						
Urban	37.5	47.9	41.2	50.4	49.3	42.6
Non-Urban	58.2	49.8	60.3	51.2	49.6	43.8

Source: 2007-12 data obtained from Ohio Department of Medicaid QDSS (Medstat Advantage Suite® V 4.0, Truven Health Analytics) accessed April & May, 2014, Ohio Department of Health; analyses of 2012-14 data were performed by Ohio Department of Medicaid;

Notes:

<sup>a</sup>If missing, too small for meaningful analysis; less than 30 respondents in subpopulation for mothers ≥ 45 years

<sup>b</sup>Data on race and ethnicity were unavailable in 2013-2014 claims data for Medicaid enrollees.

Deliveries, gestational diabetes diagnoses, and postpartum visits were identified using the relevant ICD-9, ICD-10, CPT, and UB codes specified by HEDIS. Gestational diabetes diagnoses were included in the analysis if they occurred during the 270 day period prior to a delivery admission, and postpartum visits were included if they occurred during the period 21 to 56 days after delivery.

## Gestational Diabetes in Ohio, 2008-2019

**Table 11** Postpartum health behaviors among women with a recent history of GDM compared to women with no GDM history, Ohio, historic data

	2006-08		2009-2010	
	% With GDM [95 CI]	% W/out GDM [95 CI]	% With GDM [95 CI]	% W/out GDM [95 CI]
<b>Current Smoker</b>				
Yes	26.6 [21.1-32.9]	23.1 [21.3-24.9]	26.0 [19.4-33.9]	24.0 [21.7-26.5]
<b>Smokers Relapse</b>				
Previous Smokers that Quit During Pregnancy and Did Not Relapse	47.5 [31.5-64.1]	53.4 [47.5-59.2]	60.3 [39.5-77.9]	64.3 [58.0-70.2]
Quit for Pregnancy and Relapsed	52.5 [35.9-68.5]	46.6 [40.8-52.5]	39.7 [22.1-60.5]	35.7 [29.8-42.0]
<b>Breastfeeding Status</b>				
Ever	70.5 [64.1-76.2]	70.4 [68.4-72.3]	69.4 [61.3-76.5]	74.2 [71.7-76.6]
Never	29.5 [23.9-36.0]	29.6 [23.9-36.0]	30.6 [23.5-38.7]	25.8 [23.4-28.3]
<b>Breastfeeding Duration (among those who ever breastfed)</b>				
At 2 weeks Postpartum	88.8 [83.3-92.6]	90.6 [89.0-92.0]	85.2 [75.5-91.4]	90.4 [88.3-92.2]
Not at 2 weeks Postpartum	11.2 [7.4-16.7]	9.4 [8.0-11.0]	14.9 [8.6-24.5]	9.6 [7.8-11.7]
<b>Postpartum Depression<sup>1</sup></b>				
Yes	--	--	13.0 [8.6-19.2]	13.2 [11.4-15.2]

Source: 2006-2010 Pregnancy Risk Assessment Monitoring System (PRAMS), Ohio Department of Health

GDM was determined by the following questions:

Phase 5 of PRAMS (2004-08): "Did you have high blood sugar (diabetes) that started during this pregnancy?";

Phase 6 (2009-11), "During your most recent pregnancy, were you told by a doctor, nurse, or other health care worker that you had gestational diabetes (diabetes that started during this pregnancy)?"

<sup>1</sup>The question format changed in 2009-10

## References

- American College of Obstetricians and Gynecologists. Gestational diabetes mellitus. ACOG Practice Bulletin No. 190. *Obstet Gynecol* 2018;131:e49–64.
- Choi BCK, Pak AWP. A Catalog of biases in questionnaires. *Prev Chronic Dis* 2005;2(1):A13.
- Coustan DR. Methods of screening for and diagnosing of gestational diabetes. *Diabetes in Pregnancy* 1993;20:593-602.
- Devlin H, Desai J, Walaszek A. Reviewing performance of birth certificate and hospital discharge data to identify births complicated by maternal diabetes. *Matern Child Health J* 2009;13(5):660-6.
- Deitz P, Adams M, Kendrick J, et al. Completeness of ascertainment of prenatal smoking using birth certificates and confidential questionnaires. *Am J Epidemiol* 1998;148:1048-1054.
- Dietz PM, Vesco KK, Callaghan WM et al. Post-partum screening for diabetes after a GDM-affected pregnancy. *Obstet Gynecol* 2008;112(4):868-74.
- Hoslet AS, Nayak SG, Radigan AM. Agreement between self-report and birth certificate for gestational diabetes mellitus: New York State PRAMS. *Matern Child Health J* 2010;14(5):786-9.
- Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. *Diabetes Care*. 2002; 25(10):1862-8.
- Kjos SL, Buchanan TA, Greenspoon JS, et al. Gestational Diabetes mellitus: the prevalence of glucose intolerance and diabetes mellitus in the first two months postpartum. *Am J Obstet Gynec* 1990;163:93-8.
- Ko JY, Dietz PM, Conrey EJ, Rodgers LE, Shellhaas C, Farr S, Robbins CL. Strategies associated with higher postpartum glucose tolerance screening rates for gestational diabetes mellitus patients. *Women’s Health* 2013a;22(8):681-6 (10.1089/jwh.2012.4092).
- Ko JY, Dietz PM, Conrey EJ, Rodgers LE, Shellhaas C, Farr S, Robbins CL. Gestational Diabetes Mellitus and Postpartum Care Practices of Nurse-Midwives. *Midwifery Women’s Health* 2013b;58(1):33–40.
- Northam S, Knapp T. The reliability and validity of birth certificates. *J Obstet Gynecol Neonatal Nurs* 2006; 35, 3-12.
- O’Sullivan JB et al. Screening criteria for high-risk gestational diabetic patients. *Am J Obstet Gynecol* 1973;116:985-900.
- Oza-Frank, Ko JY, Wapner A, Rodgers L, Bouchard J, Conrey EJ. Improving care for women with a history of gestational diabetes: A provider perspective. *Child Health* 2014;18(7):1683-1690(10.1007/s10995-013-1410-y).
- Racusin D, Stevens B, Campbell G, et al. Obesity and the risk and detection of fetal malformations. *Semin Perinatol*. 2012;36:213-21.
- Rodgers L, Conrey EJ, Wapner A, Ko JY, Dietz P, Oza-Frank R. Primary Healthcare Providers’ Knowledge and Attitudes Regarding Care for Women with Histories of Gestational Diabetes. *Preventing Chronic Disease* 2014;11:140308. DOI: <http://dx.doi.org/10.5888/pcd11.140308>.
- Roohan P, Josburger R, Acar J, et al. Validation of birth certificate data in New York State. *J Comm Health* 2003;28: 335-346.
- Saydah SH, Geiss LS, Tierney E, et al. Review of the performance of methods to identify diabetes cases among vital statistics, administrative, and survey data. *Ann Epidemiol* 2004; 14(7):507-516.



## Gestational Diabetes in Ohio, 2008-2019

Shellhaas C, Conrey E, Crane D, Lorenz A, Wapner A, Oza-Frank R, Bouchard J. The Ohio Gestational Diabetes Postpartum Care Learning Collaborative: Development of a Quality improvement initiative to improve systems of care for women. *Matern Child Health J* 2016 [Epub ahead of Print] DOI: 10.1007/s10995-016-2170-2.

Vounzoulaki E, Khunti K, Abner S C, Tan B K, Davies M J, Gillies C L et al. Progression to type 2 diabetes in women with a known history of gestational diabetes: systematic review and meta-analysis *BMJ* 2020; 369 :m1361  
doi:10.1136/bmj.m1361

Yasmeen S, Romano PS, Schembri ME, et al. Accuracy of obstetric diagnoses and procedures in hospital discharge data. *Am J Obstet Gynecol* 2006;194;992-1001.

Ziegler AG, Wallner M, Kaiser I, Rossbauer M, Harsunen MH, Lachmann L. Long-term protective effect of lactation on the development of type 2 diabetes in women with recent gestational diabetes mellitus. *Diabetes* 2012;61:3167–3171.