Gestational Diabetes in Medicaid:
Prevalence, Outcomes, and Costs

As Required By

Rider 75, Senate Bill 1

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Strategic Decision Support ◆ Financial Services Division

TEXAS HEALTH AND HUMAN SERVICES COMMISSION

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Rider 75: Reporting on Gestational Diabetes in Medicaid

The 2014-2015 General Appropriations Act (Article II, Health and Human Services Commission, Rider 75, Senate Bill 1, 83rd Legislature, Regular Session, 2013) requires the agency to *'…develop a report to identify the impact of gestational diabetes on the Medicaid population. The report shall include an analysis of cost implications, the number of pregnant women screened and diagnosed, and patient outcome measures. In consultation with the Texas Diabetes Council, the published report shall recommend strategies to reduce the impact of the condition and to improve outcomes for this population. The report is due to the Legislature and Governor by August 31, 2014'.*

EXECUTIVE SUMMARY

Diabetes is a metabolic disease characterized by an elevation of blood glucose due to defects of the pancreas' insulin producing capabilities, insulin action or a combination of the two [(3)] and represents several diseases with differing etiologies. Type 1 diabetes is an autoimmune disorder that may be due to a combination of genetic, environmental, and antigenic exposure. Type 2, insulin resistant or non-insulin dependent diabetes, was formerly referred to as adult onset diabetes. But, with the increase in obesity among all age groups, type 2 diabetes mellitus has become a health concern among obese children, as well other segments of the population not previously affected by the disease. [(3)]

The presence of either of these diabetes variants among women who later become pregnant is considered pre-gestational diabetes (PGDM). Gestational diabetes (GDM) is defined by the World Health Organization (WHO) as *'carbohydrate intolerance resulting in hyperglycemia of variable severity with onset or first recognition during pregnancy'.* [(4, 5, 6)]

Gestational Diabetes Prevalence

Diabetes has increased rapidly among the Texas adult population over the past decade. Data from the Texas Department of State Health Services (DSHS) Behavioral Risk Factor Surveillance System (BRFSS) and the Centers for Disease Control and Prevention (CDC) indicate that the prevalence of diabetes has increased almost 50% from 2002 to 2012. Diabetes prevalence among child bearing age women sampled by the Texas BRFSS from 2002 to 2012 has grown 40%. The growth in the prevalence of diabetes, and likelihood of having or developing the disease during pregnancy (gestational diabetes mellitus), increases health risks to mother and child as well as increases costs for the management of high-risk pregnancies and birth outcomes.

The true prevalence of gestational diabetes mellitus (GDM) worldwide, nationally, and at the state level is variable and likely under reported. The Texas rate, based on readily accessible vital records indicated that fewer than 5% of pregnant Texas women were diagnosed with the disease during 2012. More recent analyses based on THCIC discharge data increased the estimated prevalence to 6%. This report, which focuses on Medicaid enrollees, suggests that as many as 9% of all pregnant women in Texas may develop GDM prior to delivery.

Key Findings:

- The prevalence of gestational diabetes mellitus (GDM) among women participating in any Texas Medicaid program was approximately 9% during SFY 2012.
- Although a majority of GDM diagnoses among participants in the Medicaid Pregnant Women Program occurred between 25 through 30 weeks gestation, women utilizing Emergency Medicaid services are diagnosed late in their pregnancy (between 37 to 40 weeks). GDM is the most frequently occurring form of diabetes during pregnancy. Over 4% of Texas women giving birth in 2012 reported GDM on their child's birth certificate. An additional 0.7% of live births reported pre-gestational diabetes (PGDM).
- Texas birth certificate data suggest that all diabetes prevalence among women delivering between 2003 through 2012 increased almost 70%. The majority of this increase can be attributed to an increase in the number of women developing gestational diabetes during pregnancy.
- Between 40 to 50 percent of women participating in the Medicaid or CHIP Perinatal program were screened for GDM during SFY 2012
- The majority of GDM diagnoses among women utilizing Medicaid services during pregnancy occur between 25 through 30 weeks gestation.
- Women utilizing emergency Medicaid services are more likely to be diagnosed late in their pregnancy; between 37 to 40 weeks gestation, at or near the time of delivery.[*]
- The incidence of GDM diagnoses among Medicaid Pregnant Women[†] and Emergency Medicaid Program[‡] participants screened for the disease is approximately 7.5%. CHIP Perinatal enrollees had a prevalence of slightly greater than 11%.[§] These rates are higher than the values reported from Texas

[*] The number screened among women utilizing Emergency Medicaid (TP30) is minimal, largely due to their lack of prenatal care within the Medicaid program. This does not imply that these individuals were never screened for GDM; rather, if they received prenatal care which included GDM screening, the information was unavailable to the Texas Medicaid program.
[†] Includes only Medicaid TP 40.
[‡] Includes only Medicaid TP 30.
[§] CHIP perinatal contains TP30s which may be more likely to be of Hispanic descent and more genetically prone to DM

vital records and Texas Health Care Information Collection (THCIC) hospital discharge data. However, by linking Medicaid data with birth records the prevalence of GDM exceeds the rate found among Medicaid participants screened during pregnancy.

- Linked Medicaid[**] and birth certificate data indicate that 18,035 (9%) women enrolled in Texas Medicaid developed or were diagnosed with GDM during SFY 2012. Another 8,192 (4.1%) women had a diagnosis of pre-gestational diabetes (PGDM)..
- Based on the findings from this study, it appears that birth certificate and hospital discharge data may underestimate the prevalence of GDM by as much as 50%.

Prenatal, Perinatal, and Infant Outcomes among Women and Infants Utilizing Medicaid

The higher rate of GDM, and the likelihood that it will continue to increase over time, has significant implications on the health of not just the pregnant woman, but the immediate and long term consequences to her newborn. Like pre-gestational diabetes, chronic hyperglycemia as a result of GDM contributes to higher risks for C-section, adverse maternal outcomes, macrosomia, dystocia and other abnormal conditions of the newborn that may also lead to a greater likelihood of NICU admission. The onset of GDM during pregnancy leads to a greater risk of both the mother and her child developing type 2 diabetes later in life.

However, unlike PGDM, the risk for gestational diabetes if identified before or early during pregnancy may be preventable, thereby reducing the likelihood of poor pregnancy outcomes. One avenue that seems to be indicated by this report is reducing the risk of adverse pregnancy outcome via weight management. It is clear from the linked birth certificate and Medicaid data that women with normal body mass indices (BMI)[††] are less likely to be at risk for poor perinatal outcomes than overweight and obese women.

[**] The linked Medicaid data used in this report includes ALL women giving birth during SFY2012 whose claim or encounter was paid for by Medicaid; regardless of program type.

[††] BMI values used in this report are 1) normal < 25, 2) overweight = 25 to 30, and 3) obese $\geq$ 30.

Key Findings:

- The risk of adverse outcomes among women diagnosed with GDM and their newborns was intermediate to health risks found among non-diabetic mothers and women diagnosed with PGDM (e.g., non-diabetic health risks < GDM health risks < PGDM health risks).
- Regardless of whether a woman was diagnosed with any form of diabetes, her risk and the risk to her newborn of adverse health outcomes were significantly increased if she was overweight or obese.

Outcomes: Prenatal

- Based on THCIC hospital discharge data less than 10% of hospitalizations among non-diabetic pregnant women and pregnant women with GDM occur without a delivery. More than one-third (36.8%) of all hospitalizations among pregnant women diagnosed with PGDM were for reasons other than delivery (Table 3).
- One third of the pre-delivery hospital visits among women diagnosed with GDM are diabetes related (Table 4). More than one half of admissions among pregnant women with PGDM are diabetes related. A third of all diabetes related deliveries are discharged with a principal diagnosis related to diabetes in pregnancy (Table 5).[‡‡]
- Lengths of stay after delivery for women with GDM are, on average, one half day longer than non-diabetic women; women with PGDM experience stays that are one and a half to two days longer. These differences may be explained, in part, by the greater likelihood of diabetic women to deliver by C-section which would increase their length of stay to 3-4 days, compared to 1-2 days typical of a vaginal delivery.
- Birth certificate data demonstrate the strong influence maternal pre-pregnancy weight has on maternal and natal complications. As maternal body mass index (BMI) increases from overweight to obese, risks to overweight women and their infants double and quadruple respectively compared to women of normal weight. Women diagnosed with GDM have intermediate risk levels relative to women entering into the pregnancy with preexisting type 1 or type 2 diabetes (e.g., non-diabetic health risks < GDM health risks < PGDM health risks).
- Birth certificate data also show that the difference in onset of care between all Medicaid enrollees and non-Medicaid women is two to four weeks (beginning at 14 to 16 weeks gestation) and may account for the average decrease of prenatal visits by one over the course of the pregnancy. However, the

[‡‡] If the patient is diabetic, has not had a previous C-section, or has not had a non-diabetic coded diagnosis, such as hypertension (HTN), fetal arrhythmia, malposition, etc. DM will appear as primary diagnosis; otherwise it may be coded as a secondary diagnosis.

average non-emergency Medicaid participant is fully in prenatal care before the 24 to 28 week milestone for diagnosing gestational diabetes. Any Medicaid participant diagnosed with GDM or PGDM tends to enter into prenatal care earlier than their non-diabetic counterparts, with PGDM entering the earliest.

Outcomes: Maternal Risks

- The frequency of C-section and early gestation (<37 weeks) deliveries tends to follow a gradient with percentages increasing both by type of diabetes (non-diabetic < GDM < PGDM) and by BMI (normal BMI < Overweight < Obese). These trends are even more marked for chronic and gestational hypertension**.**
- Overweight women, regardless of diabetes type, have an approximate three-fold greater risk of hypertension (Chart 12).
- Obese women with PGDM are four to seven times more likely to suffer poor maternal outcomes (e.g., C-section delivery, hypertension, or ICU admission).
- GDM related maternal deaths reported by the DSHS Vital Statistics Unit are rare and represent a small fraction of all maternal deaths in any year reported over the past decade. No long term trend can be discerned at this time regardless if the mother's death was directly or indirectly related to GDM. However, there has been a small increase in the maternal death rate specific to any diabetes cause (most of which are unidentified by type) since CY 2003.

Outcomes: Newborn Risks

- GDM shows only a slight increase in risk compared to non-diabetic deliveries for newborns born with any abnormal condition or infants admitted to the neonatal intensive care unit (NICU). However, infants of women with PGDM show a marked elevated risk for both of these outcomes.
- Large for gestational age (LGA) infants also tend to follow a gradient with percentages increasing both by type of diabetes (non-diabetic < GDM < PGDM) and by BMI (normal BMI < Overweight < Obese).
- Women with PGDM have a three to four-fold greater risk of delivering a child with a poor neonatal outcome (e.g., prematurity, low birth weight, large for gestational age, congenital defect, or NICU admission).
- Based on DSHS data, 12.5% of all infants born to diabetic mothers were admitted to a NICU. The statistics reported from Medicaid data, are somewhat higher, but approximate this trend. Medicaid data

suggest that the likelihood of NICU admission appears to double if the mother had PGDM during pregnancy.[§§]

- For Medicaid participants, fetal death rates were 33% lower for women who develop GDM during pregnancy (2.4/1,000) but 50% higher for women with PGDM (4.7/1,000) than for non-diabetic Medicaid deliveries (3.6/1,000). Fetal death rates among deliveries to women not participating in Medicaid were higher than Medicaid participants for both non-diabetic and GDM women (5.6/1,000) and substantially higher among PGDM pregnancies (26.7/1,000)
- Deaths rates of infants born to women without diabetes during pregnancy (6.3 – Medicaid; 4.6 – non-Medicaid) were almost double those of women diagnosed with GDM (2.6 – Medicaid; 3.0 – non-Medicaid). However, death rates among infants born to women diagnosed with PGDM was lower at 2.5/1,000 for Medicaid participants but doubled (9.2/1,000) among non-Medicaid paid deliveries.
- In general, overweight women, regardless of diabetes type, have an approximate two-fold risk of poor neonatal outcomes above normal weight women (Table 6).
- Obese women with PGDM are five times more likely to deliver an infant with neonatal complications**.**

Maternal, Perinatal, and Infant Costs

The financial costs of GDM are less clear. Maternal costs (medical + drug) for gestational diabetic women enrolled in the Medicaid program cost the health care system about 12 million dollars more than their non-diabetic counterparts (Table 13). The cost among GDM infants is another 5.5 million dollars over the cost of infants of non-diabetic mothers. Because there are many more complicated births among non-diabetic newborns – and their costs overwhelm the total costs of similar infants born to GDM mothers, the costliest 5% of all infants were excluded from this calculation.

Key Findings:

- Medical and drug costs among women diagnosed with GDM and their infant were slightly higher than costs to non-diabetic women, but well below the costs incurred by women diagnosed with PGDM and their newborns.

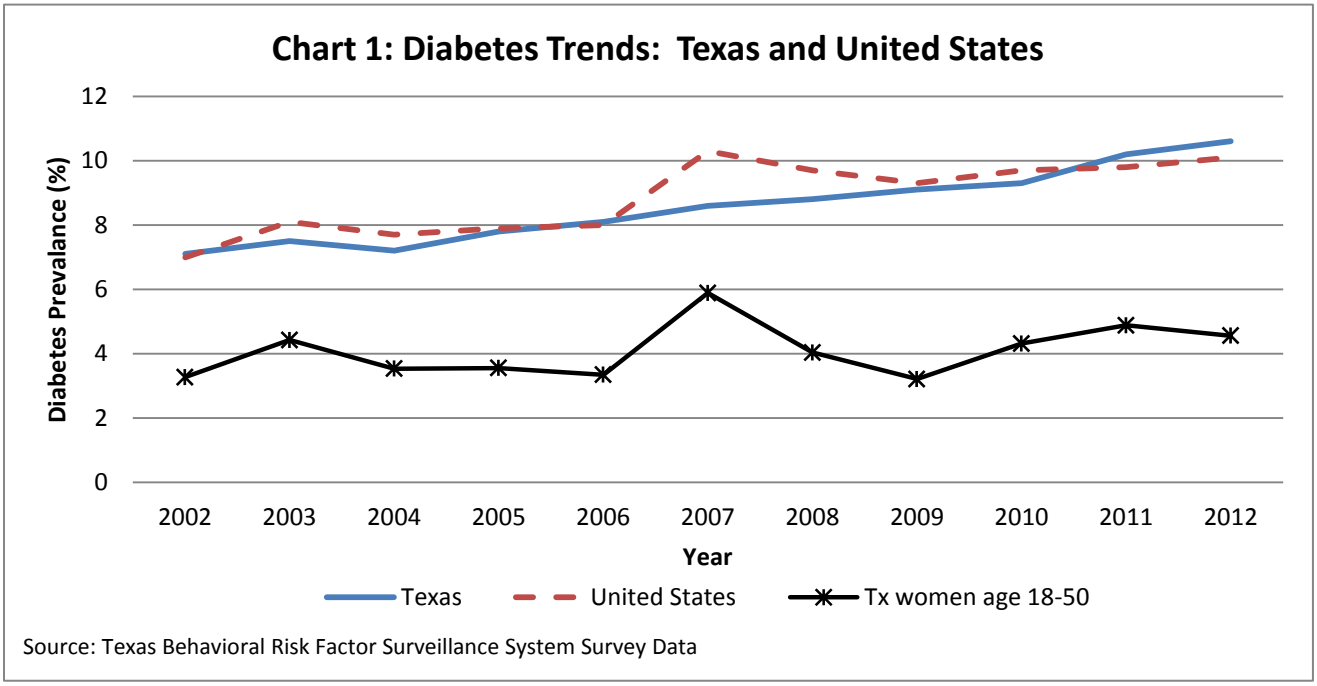
[§§] This will vary based on hospital practices. Some will place the newborn in a higher level nursery for a few hours to monitor for hypoglycemia if the mother is diabetic and/or the infant is LGA. Other hospitals will perform this observation in a normal newborn nursery.

- In Medicaid, the excess costs (compared to non-diabetic normal weight women) was 10 million dollars among women diagnosed with GDM and over 60 million dollars among women diagnosed with PGDM (Table 11).
- Women (and their children) diagnosed with GDM have per capita costs that are slightly higher than non-diabetic women.
- Medical and drug costs in the Medicaid population increase among women with diabetes; but, GDM costs are relatively small when compared to total costs as a result of PGDM.
- Per capita costs among women with PGDM are approximately 50% higher than non-diabetic and GDM diagnosed women and their children.
- Obesity, regardless of diabetes type, is a significant cost driver. However, obesity co-occurring with diabetes substantially increases costs above what a normal weight diabetic woman or her infant would incur.
- The majority of infant related costs occur during the first two weeks after delivery. Five percent of all infants account for over 50% of all costs. These are high risk infants that may have health conditions unrelated to diabetes. Adjusting the cost analyses by excluding these exceptionally costly infants, average GDM costs become intermediate to the prenatal and infancy costs of non-diabetic and PGDM pregnancies (non-diabetic costs < GDM costs < PGDM costs).
- The excess cost of gestational diabetes over the index cost (average cost of a non-diabetic / normal pre-pregnancy BMI woman) was approximately ten million dollars during SFY 2012. If the costliest 5% infants are excluded the excess cost is 17 million dollars.
- The excess costs attributed to PGDM related pregnancies were over 38 million dollars in SFY 2012. Eliminating the costliest 5% infants increases this excess to over 63 million dollars.

Although the focus of Rider 75 which mandated this report is gestational diabetes, the impact of pre-gestational diabetes on pregnant Medicaid enrollees cannot be ignored. Pregnant women with PGDM are 4 to 5 times more likely to suffer adverse pregnancy outcomes, as are their infants. These poor outcomes translate to considerably higher per capita costs compared to GDM affected pregnancies. The health and financial costs among PGDM pregnancies may not be completely avoidable. However, as made clear by data presented within this report, the relationship of BMI to PGDM (as well as for GDM) indicate that interventions reducing these costs such as early detection and weight management prior to and during pregnancy may be possible.

DIABETES MELLITUS AS A MATERNAL AND INFANT HEALTH RISK

Diabetes mellitus (DM) has increased rapidly among the Texas adult population over the past decade [1] (Chart 1). Data from the Texas Department of State Health Services (DSHS) Behavioral Risk Factor Surveillance System (BRFSS) and the Centers for Disease Control and Prevention (CDC) indicate that the prevalence of diabetes has increased almost 50% between 2002 and 2012. [2, 26]*** The diabetes prevalence among child bearing age women sampled by the Texas BRFSS grew 40% during this time frame.



Diabetes is a metabolic disease characterized by an elevation of blood glucose due to defects of the pancreas' insulin producing capabilities, insulin action or a combination of the two [3] and represents several diseases with differing etiologies. Type 1 diabetes is an autoimmune disorder that may be due to a combination of genetic, environmental, and antigenic exposure. Type 2, insulin resistant or non-insulin

*** Since 2004, BRFSS began planning and testing the addition of cellular telephone households and improvements in its methods of statistical weighting. These new methods were implemented during the fielding of the 2011 BRFSS and were released in 2012. Trend analyses may include artifactual differences between 2011 data and data from previous years. For more information, see http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6122a3.htm.

dependent diabetes, was formerly referred to as adult onset diabetes. But, with the increase in obesity among all age groups, type 2 DM has become a health concern among obese children, as well other segments of the population not previously affected by the disease. [3]

The presence of either of these diabetes variants among women who later become pregnant is considered pre-gestational diabetes (PGDM). Gestational diabetes (GDM) is defined by the World Health Organization (WHO) as *'carbohydrate intolerance resulting in hyperglycemia of variable severity with onset or first recognition during pregnancy'*. [4, 5, 6]

GDM is one of the most common metabolic disorders and medical complications of pregnancy. [5, 7] Depending on the population, the prevalence of GDM can range between 1 to 16%. [7, 8] GDM accounts for approximately 90% of all DM during pregnancy. [9]

Current definitions of GDM make it difficult to distinguish between PGDM and hyperglycemia induced by or diagnosed during pregnancy. This is due, in part, to a lack of screening for diabetes among women of childbearing age.[10] It is likely that a fraction of diabetes cases designated as GDM were actually undiagnosed PGDM.

Clinical findings during pregnancy differ between GDM and PGDM. Women with PGDM tend to experience higher morbidity rates for certain pregnancy outcomes (e.g., hypertension and C-section) when compared to women who develop GDM. [11] The severity of PGDM adverse perinatal outcomes compared to GDM outcomes may be explained by the prolonged and more severe exposure mother and fetus have to the *'hyperglycemic milieu'* during pregnancy. [12]

GDM contributes to a metabolically altered fetal environment that is associated with high birth weight and subsequent obesity of the child. [13] During pregnancy, diabetes (whether PGDM or GDM) causes an excess transfer of glucose to the fetus. The fetus responds to this stimulus by developing hyperinsulinemia (which in turn can cause an overgrowth of insulin-sensitive tissues), developing metabolic complications such as hypoglycemia, developing an increased risk of intrauterine fetal death, fetal polycythemia, hyperbilirubinemia, and the possibility of developing a long-term postnatal risk of obesity or diabetes. [4]

The prevalence of GDM appears to correlate with the frequency of type 2 diabetes in the underlying population. [10] Five to ten percent of women who develop GDM during pregnancy continue to exhibit diabetes, usually type 2, after delivery [5, 8] and have up to a 60% chance of developing diabetes within the following two decades. [8] A history of GDM increases the lifetime risk of type 2 diabetes and the metabolic syndrome (MetS) which in turn may increase the risk of developing cardiovascular disease. [14] GDM may be a risk factor for the development of early atherosclerosis before the onset of subsequent type 2 diabetes or metabolic disease. [14]

Several cohort studies found that the likelihood of poor pregnancy outcomes grew with increasing gradients of glucose intolerance. [4] The Adverse Pregnancy Outcome Study found a continuous relationship between maternal glucose levels and the risk of C-section, macrosomia, and fetal hyperinsulinemia.[5]

Longitudinal studies suggest that offspring of women who developed GDM during pregnancy are at increased risk of becoming overweight, are at an increased risk of developing insulin resistance, and risk suffering from type 2 diabetes as they age. [9, 15] More difficult to determine, however, is whether GDM and/or large birth weight is a causal factor for subsequent obesity – or if these are even potential risk factors. [13]

Because diabetes has been on the rise in Texas over the past several decades, the health risks and potential costs are of great concern. Over 50% of all Texas pregnancies are paid for by Medicaid. Complications arising during pregnancy that threaten the health of mother or child may require intensive perinatal medical care and costs. Diabetes, regardless of its form, has long-term health implications. Post-natal disease management in the form of extended NICU stays or complicated infant care are potentially preventable Medicaid cost drivers.

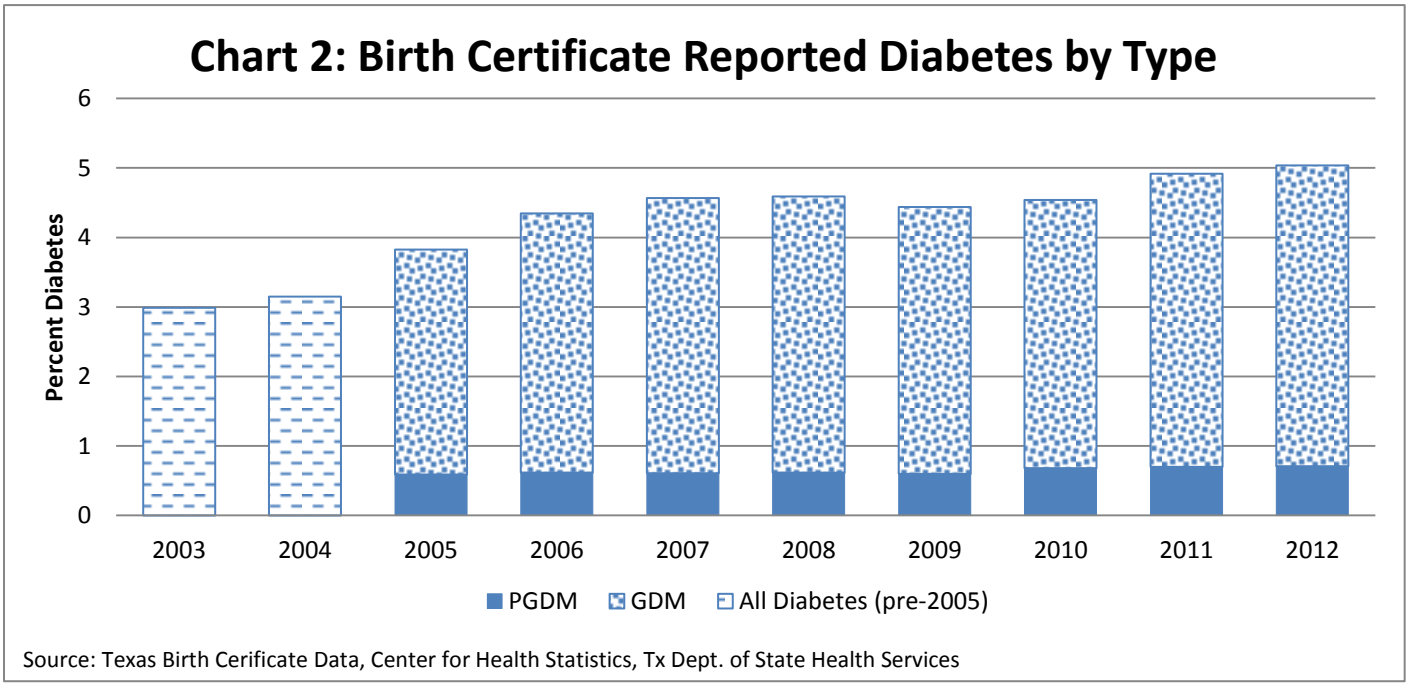
Pursuant to Rider 75, this report describes the prevalence of gestational diabetes mellitus among Texas Medicaid participants, both before and at delivery; prenatal and perinatal maternal health issues; infant health outcomes; and overall costs of the impact of GDM to the Texas Medicaid program. We accomplish this by examining the most current Medicaid and related vital data (state fiscal year [SFY] 2012) which can be linked into a more comprehensive data set. These data include Texas Health Care Information Collection (THCIC) Hospital Discharge data and Texas vital (live birth, fetal death, and infant death) data.

DIABETES PREVALANCE AMONG TEXAS WOMEN DURING PREGNANCY

Key Points:

- ***Diabetes has been on the increase in Texas for the past decade***
- ***Gestational diabetes (GDM) is the most frequently occurring form of diabetes during pregnancy***
- ***The birth certificate likely underestimates the prevalence of GDM by as much as 50%***
- ***Linked Medicaid and birth certificate data indicate the rate of GDM to be over 9 percent***
- ***Between 40 to 50 percent of women participating in the Medicaid or CHIP perinatal program were screened for GDM during SFY 2012***
- ***The majority of GDM diagnoses among women utilizing Medicaid services during pregnancy occur between 25 through 30 weeks gestation***
- ***Women utilizing emergency Medicaid services are more likely to be diagnosed with GDM late in their pregnancy; between 37 to 40 weeks gestation***

Texas birth certificate data indicate that diabetes, in general, impacted 5% of all pregnancies during CY 2012. Diabetes among Texas women delivering a live birth between 2003 through 2012 increased almost 70% (Chart 2). The majority of this increase can be attributed to an increase in the numbers of women developing gestational diabetes mellitus (GDM) during pregnancy. Texas vital statistics did not separate the reporting of gestational diabetes from all other diabetes until 2005. With the data collected from that point forward, it becomes clear that the prevalence of PGDM among women has remained stable at slightly more than 0.6% of all live births, while the prevalence of GDM among pregnant women has grown over 30% from 3.2% during 2005 to 4.3% in 2012. On average, 85% of DM reported on the Texas birth certificate is designated GDM.



Source: Texas Birth Cerificate Data, Center for Health Statistics, Tx Dept. of State Health Services

Early screening and diagnosis is a safeguard against the impact of diabetes on mother and infant. GDM as a causal factor for variations in rates of emergency caesarian section, neonatal unit admission, and costs of care has significant implications on the health outcomes and costs for maternal and post-natal Medicaid services. Interventions that prevent the onset of GDM have the potential to yield substantial economic and clinical benefits. **(16)**

GDM screening is currently recommended to occur, and usually carried out, during the target period of 24-28 weeks gestation. However, GDM is a potential risk factor throughout pregnancy. **(20)** Although the disease has long been considered a serious health threat, initial screening often consists of obtaining the patient's medical history with an emphasis on past obstetric outcomes and a family medical history of type 2 diabetes. Still, this approach can miss up to half of all women who develop diabetes during pregnancy. **(5)**

No consistent statistic exists to determine the prevalence of GDM among pregnant women. National estimates over the past few decades have ranged from a low of two percent to a high of over ten percent. More recent estimates tend to be higher, in part due to an increase in screening as well as growth in the numbers of overweight and obese women giving birth.

Differing methods in how diabetes data are collected and the manner in which those data are analyzed present challenges in determining the true incidence of GDM among Texas women. Screening results are available for pregnant women enrolled in Medicaid (TP40), women in CHIP perinatal, and Emergency Medicaid (TP30) as well as for vital records (birth and fetal death) and hospital discharge data.

Data derived from Texas vital records (birth and fetal death certificates) may underestimate the incidence of all forms of diabetes. Prior to CY 2005, a checkbox on the vital certificate only indicated whether diabetes was present during the pregnancy. Beginning in CY 2005, the checkbox was split into two choices: whether diabetes, if present, was gestational or pre-existing. Regardless, the presence of diabetes is not always validated against a women's medical history and no verification of the accuracy of the diabetes notation is made once the birth certificate leaves the certifier (5 days after the event). Therefore, it is possible that an unknown fraction of diabetes cases remain unidentified or diabetes coded as GDM may have been misidentified (including not previously diagnosed) PGDM.

Texas hospital discharge data may provide a more robust source of diabetes prevalence data relative to vital records. Individual discharge records are coded for both admitting and principal diagnoses. Additional diagnoses may be provided which allow the physician and hospital to report complicating diagnoses or other conditions present on admission or discharge. Hospital discharge data managed by

DSHS THCIC and available from their Public Use Data File[†††] are based on individual episodes of care. Therefore, an individual that is admitted several times during the course of a calendar year (or any time frame per the research design) will appear as multiple individuals and cannot be unduplicated from the data set. Further, hospital discharge data will not capture events that occur prior to admission; such as outpatient or clinic visits that may be related – in this instance – to prenatal care. In addition, home births, discharge data from most rural providers, and other specifically exempted entities may be excluded from THCIC files. Each of the aforementioned conditions may be a source of discrepancy between statistics reported on hospital discharge data and vital records.

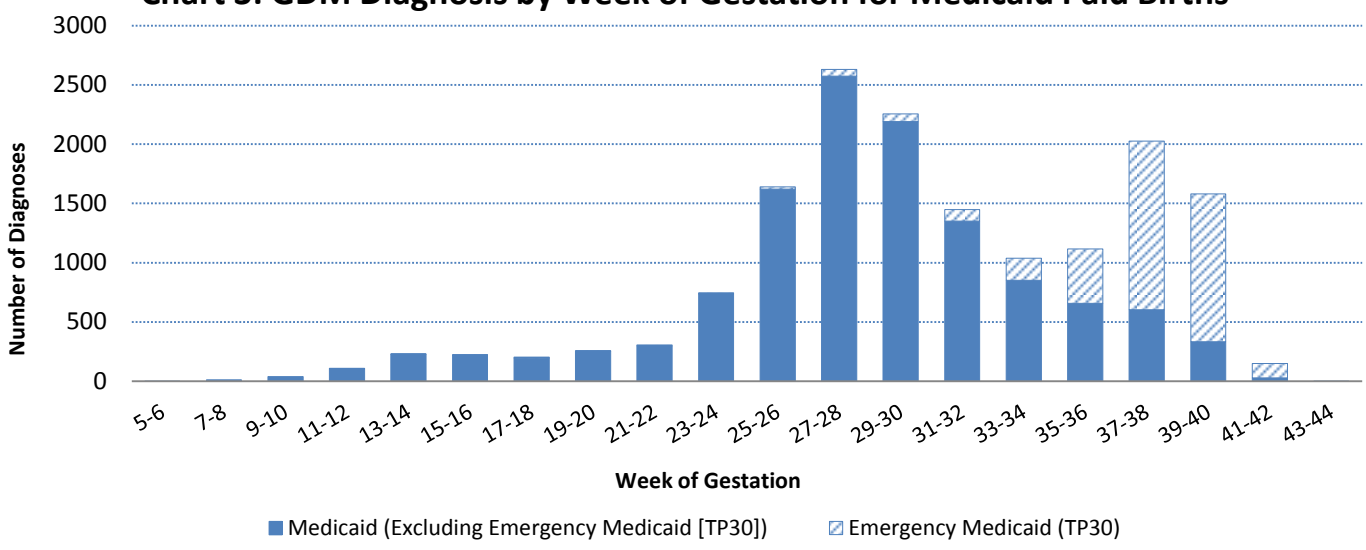
Texas Medicaid data are more comprehensive than available state vital data. By utilizing Medicaid data, a woman's extended medical history can be followed over the course of her pregnancy unlike THCIC discharge data. Having data from multiple visits enables the researcher to resolve conflicts due to discordant or missing data. Medicaid claims and encounters provide multiple levels of diagnoses which enable us to determine both the nature and prevalence of any existing diabetes diagnoses. HHSC is able to identify specific individuals and unduplicated multiple claims or encounters. However, it is possible that an individual is able to participate in multiple Medicaid service delivery types [fee for service (FFS)/primary care case management (PCCM)/managed care organization (MCO)] or, move to a completely different program type (e.g., CHIP Perinatal to Medicaid Pregnant Women) due to changes in qualifications.

Prevalence of Gestational Diabetes (GDM) among Texas Medicaid and CHIP Enrollees

Screening and diagnosis of GDM typically occur between the 24th and 28th weeks of pregnancy. The chart below merges Medicaid and birth certificate data for SFY 2012 and indicates the week of gestation a women's GDM was first diagnosed (Chart 3). The data indicate that most GDM diagnoses among women participating in Medicaid (except TP30 Emergency Medicaid) occur between 27 through 30 weeks gestation (slightly later than the proscribed 24 to 28 week screening period). However, a secondary peak occurs beginning at week 37 through 40. This peak reflects diagnoses among women in the Emergency Medicaid program (TP 30). Undocumented women utilizing TP 30 services may receive little, if any, prenatal care prior to delivery and are likely to remain undiagnosed with GDM until they present for delivery.[‡‡‡]

[†††] More detailed research files are available from THCIC which may allow linkages among distinct hospitalizations. However, both the Public Use Data File (PUDF) and the research files exclude outpatient and ambulatory care data.

[‡‡‡] A portion of TP30 patients are enrolled in CHIP Perinatal for prenatal care. Further, there may be regional variations, e.g., TP30s are the majority of CHIP perinatal in Harris County.



Source: Texas Birth Cerificate Data, Center for Health Statistics, Tx Dept. of State Health Services and Medicaid Claims and Encounter Data, Tx Health and Human Services Commission

Between 40% and 50% of women enrolled in Medicaid TP40 and the CHIP Perinatal Program were screened during pregnancy (Table 1). The number screened among women utilizing Emergency Medicaid (TP30) appears minimal relative to TP40 and CHIP Perinatal. Part of this discrepancy is due to some participants lack of prenatal care within the Emergency Medicaid program (undocumented aliens). This does not imply that these individuals were never screened for GDM; rather, if they received prenatal care which included GDM screening, the information was unavailable to the Texas Medicaid program. However, another part of this discrepancy is explained by the relationship of the CHIP Perinatal Program and Emergency Medicaid. Delivery services for women participating in CHIP Perinatal are paid through Emergency Medicaid. Thus, a women participating in CHIP Perinatal will be screened (and potentially diagnosed) by that program – but due to their delivery, these women will also be counted as an enrollee in TP30.[§§§]

[§§§] Table 1 also appears to overestimate the number of women delivering Medicaid paid births during SFY2012. Table M1 (Methods) indicates that Birth files linked to Medicaid files yields almost 234,000 Medicaid paid births during SFY2012 vs approximately 368,000 pregnant enrolled women in TP40 and TP30 (CHIP Perinatal deliveries are paid under TP30). When the number of TP40 and TP30 enrollees is adjusted by accounting for A) number of months a delivery can occur [12], B) number of months that women may participate in the program but will not have delivered [estimated at 6], and C) number of months women that have delivered are eligible to receive post-partum services [TP40 only; 2] the estimated number of deliveries is ((Total TP40 enrollees/20)+(Total TP30 enrollees/18))*12 or 226,013 estimated deliveries during SFY2012.

The incidence of GDM among enrollees participating in the Medicaid Pregnant Women Program (TP40) was approximately 7.6% during SFY 2012 and slightly more than 11% of women utilizing CHIP Perinatal services were diagnosed with GDM (Table 1). Women utilizing Emergency Medicaid services (TP30) had an estimated GDM prevalence of 7.5%. However, this is likely an underestimate because, as noted in the discussion above, this value is likely influenced by the impact of CHIP Perinatal enrollees being counted in the denominator.[****]

Table 1 (see also Tables A1-A3; Supplemental Data)

Texas Pregnant Women Utilizing HHS Services with Gestational Diabetes, SFY 2012

Program Type	Number of Women Diagnosed with Gestational Diabetes (All diagnosis ICD-9 code 648.8)*	Number of Patients Screened for Gestational Diabetes**	Number of Pregnant Women Enrolled in Program (x, y, z)	Percentage of Pregnant Women Screened for Gestational Diabetes	Percentage of Pregnant Women Diagnosed with Gestational Diabetes
TP 40 (x)	22,425	123,951	294,878	42.03%	7.60%
TP 30 (y)	5,495	251	73,629	0.34%	7.46%
CHIP Perinate (z)	11,110	49,905	96,949	51.48%	11.46%

* Note: Gestational Diabetes was defined as ICD-9 code 648.8 listed as any diagnosis on the claim/encounter during FY 2012.

**Note: Gestational Diabetes Screenings were defined as procedure codes:

82947= ASSAY, GLUCOSE, BLOOD QUANT
82950= GLUCOSE TEST
82951= GLUCOSE TOLERANCE TEST (GTT)
82962= GLUCOSE BLOOD TEST

(x) Note: Pregnant Women were defined as Medicaid Clients enrolled in Type Program 40 during FY 2012.
(y) Note: Pregnant Women were defined as Medicaid Clients for FFS enrolled in Type Program 30 during FY 2012.
(z) Note: Pregnant Women were defined as CHIP Clients enrolled in the CHIP Perinatal Program during FY 2012.

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database, DSP.CHIP_HX . CHIP Enrollment file 2013(Risk_Group Codes: 305 & 306), HHSC.

These rates are higher than the number of women coded with GDM from Texas birth records (4.3%) and THCIC Hospital Discharge Data diagnoses (6%; Table 2). The reason for this discrepancy may be multifold. Birth certificate data do not constitute an official medical record. Historical information of the women's condition may not be available at the time the record was completed. Data from vital certificates reflect a combination of self-reported information at the time of delivery or medical chart review. Diabetes information provided on the certificate may not be verified beyond the point at which the record is submitted to the state for registration. Hospital Discharge Data pose a similar issue. Unless

[****] Women who deliver under the Medicaid TP30 program can receive prenatal care through the CHIP Perinatal Program. Because women may participate in either program at various times during their pregnancy the total counts of enrollees and diagnoses may not be unduplicated.

diabetes is considered a reportable or billable diagnosis at the time of delivery, it is possible that it may be unreported on the discharge record.

When the birth certificate data were linked with claims and encounters data to identify ALL women with Medicaid paid services[††††] that were diagnosed with GDM 6 months prior through 1 month post-delivery, the GDM rate among Medicaid participants increased to 9%. This rate was more in line with what was reported for Medicaid TP 40 and CHIP Perinatal enrollees (Table 2).

GDM estimates for TP 40 of 7.5% indicate an almost 75% higher prevalence of diabetes over birth data. This may be due in part that Medicaid data, rather than representing a 'point in time' event (the delivery) represents an extended pre-natal episode of care. Any visit or screen indicating GDM by a participant will be counted in the tabulation of GDM rates for this report. At 11.5%, CHIP Perinatal estimates are over 2.5 times higher which may reflect the predominately Hispanic participation in the CHIP Perinatal Program.

Table 2

A Comparison of Women Diagnosed with GDM by Data Source

	Total Individuals	Total GDM		Total PGDM		All diabetes
SFY 2012 Medicaid Screening Data						
Medicaid (TP 40) Diagnosed and enrolled	294,878	22,425	7.6%	---	---	---
Medicaid (TP 30) Diagnosed and Enrolled	73,629	5,495	7.5%	---	---	---
CHIP Perinatal Diagnosed and Enrolled	96,949	11,110	11.5%	---	---	---
SFY 2012THCIC Data						
Medicaid Discharges	175,658	10,468	6.0%	2,050	1.2%	7.1%
Non-Medicaid Discharges	182,290	10,976	6.0%	1,950	1.1%	7.1%
SFY 2012 Birth Certificate						
All Live Births (unlinked to Medicaid)	380,025	16,447	4.3%	2,830	0.7%	5.0%
Medicaid Live Births	204,982	8,795	4.3%	1,744	0.9%	5.1%
Non-Medicaid Live Births	175,043	7,652	4.4%	1,086	0.6%	5.0%
Births Linked to Medicaid Data	199,917	18,035	9.0%	8,192	4.1%	13.1%

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database, DSP.CHIP_HX . CHIP Enrollment file, HHSC. Texas Live Birth Certificate File, CHS, Tx DSHS; Hospital Discharge Data, THCIC.

[††††] This includes women in Emergency Medicaid (TP 30), the Pregnant Women Program (TP 40), eligible women in the CHIP Perinatal program, and all other Medicaid programs providing services to pregnant women.

DIABETES PERINATAL OUTCOMES

Key Points:

- ***Women diagnosed with GDM experience slightly lower pre-delivery hospitalizations than non-diabetic women, but have longer lengths of stay.***
- ***Over one-third of women with PGDM are hospitalized prior to delivery.***
- ***Lengths of stay after delivery for women with GDM are, on average, one half day longer than non-diabetic women; women with PGDM experience stays that are one and a half to two days longer – likely due to a greater chance of C-section delivery.***
- ***Women diagnosed with GDM are, on average, twice as likely to experience adverse pregnancy outcomes than non-diabetic women. Women with PGDM have a risk four times greater than non-diabetic women.***
- ***A clear relationship between a woman's BMI and diabetes exists. Diabetic women with higher BMI's are more likely to experience adverse pregnancy outcomes relative to normal weight diabetic women.***
- ***Children of diabetic women are also at risk of poor birth outcomes. Children born to women with GDM have intermediate rates of health risks compared to non-diabetic and PGDM infants (e.g., non-diabetic health risks < GDM health risks < PGDM health risks).***

Gestational diabetes mellitus, as a disease, has multiple potential outcomes which impact two individuals – mother and child. **(6)** The public health implications of increasing obesity and GDM are significant due to the potential for adverse effects on infant outcomes and increased risks to the mother of developing obesity later in life. **(15)**

Maternal age and family history are documented risk factors for developing GDM. **(17)** Pre-gestational body mass index (BMI) is a predictor of neonatal hypoglycemia in infants born to women with GDM. **(18)** Maternal obesity (increased BMI), gestational weight gain, and diabetes are independent risk factors for newborn macrosomia. **(19, 20, 21)** In particular, pre-pregnancy BMI and weight gain during pregnancy may predict newborn weight in women with gestational diabetes. **(28)** BMI may have a dose-dependent effect on the risk of macrosomia and C-section. **(22)** Overweight, obese, and severely obese women are two, four, and eight times more likely to develop GDM than normal weight women. **(15)‡‡‡‡**

The development of GDM is directly related to an increased BMI. **(12)** Study results indicate that women with high BMI are at increased risk of delivering a large for gestational age (LGA) infant. **(9)** Women with large fetuses are at higher risk for perinatal complications including infection, C-section, and pre-eclampsia. **(9)**

Independent of BMI, issues with glucose metabolism, in the form of diabetes mellitus, present a spectrum of health issues to mother, fetus, and newborn that impact pregnancy, post-partum, and postnatal health

‡‡‡‡ BMI values used in this report are 1) normal < 25, 2) overweight = 25 to 30, and 3) obese ≥ 30.

outcomes. Glucose control and limiting weight gain during pregnancy has been demonstrated to be effective at lowering the risk of perinatal adverse outcomes among obese women but not among normal weight women. [(12)] Studies have indicated that treatment and management of GDM diagnosed after 24 weeks gestation reduced the risk of adverse neonatal outcomes. Screening and early treatment of GDM may reduce macrosomia. However, evidence for early screening and treatment for GDM is insufficient to demonstrate maternal or fetal complications can be averted. [(6)]

The influence of DM, whether pre-gestational in origin (type 1 or 2), or arising during pregnancy (GDM), may be measured well before delivery occurs. Women with GDM are at an increased risk of developing a wide range of complications including hypertension and an increased probability of C-section. [(5)]

Pre-delivery outcomes (hospital discharge data)

Approximately 37,975 (9%) discharges among pregnant women in Texas admitted to a hospital during 2012 occurred without a delivery. The number of non-delivery discharges among women diagnosed with GDM was slightly lower (approximately 8%) compared to women without diabetes (9%). One-third of women diagnosed with PGDM experienced a non-delivery related hospital admission during SFY2012 **(Table 3)**.

Table 3

SFY 2012 Hospitalizations Reported by THCIC

Inpatient Visits of Non-delivering Pregnant Women Reported to the THCIC

	No Diabetes		GDM		PGDM		Total	
	Number of Hospitalizations	% of	Number of Hospitalizations	% of	Number of Hospitalizations	% of	Number of Hospitalizations	% of
Medicaid	17,011	9.4%	978	8.5%	1,196	36.8%	19,185	9.8%
Non-Medicaid	17,211	9.2%	845	7.1%	734	27.3%	18,790	9.3%
Total Diabetes Status	34,222	9.3%	1,823	7.8%	1,930	32.5%	37,975	9.6%

Inpatient Deliveries Reported to the THCIC

	None	GDM	PGDM	Total
Medicaid	163,140	10,468	2,050	175,658
Non-Medicaid	169,364	10,976	1,950	182,290
Total Diabetes Status	332,504	21,444	4,000	357,948

Data Source: Hospital Discharge Data, THCIC.

When the principal diagnosis for admission is examined, one third of the pre-delivery hospital visits among women diagnosed with GDM were diabetes related, while more than half of admissions among women with PGDM were diabetes related. An additional 9 to 15% of principal diagnoses among diabetic

women were related to hypertension. On average, pre-delivery lengths of stay (LOS) among women with diabetes were over half a day longer than individuals not diagnosed with the disease (Table 4).

Almost half of all women who delivered with GDM or PGDM had a principal diagnosis at discharge relating to diabetes or hypertension (Table 5). Women with diabetes who delivered tended to stay in the hospital, on average, half a day longer than women diagnosed with GDM and a full day longer than women presenting with PGDM. These differences may be explained, in part, by the greater likelihood of diabetic women to deliver by C-section which would increase their length of stay to 3-4 days, compared to 1-2 days typical of a vaginal delivery.

Table 4

Most Frequent Principal Diagnoses Reported to THCIC Hospital Discharge Data System by Diabetes Type: NO DELIVERY

MEDICAID

		None			GDM			PGDM		
CCS Diagnosis*	**Description**	**Count**	**%**	**LOS**	**Count**	**%**		**Count**	**%**	**LOS**
186	**DM in preg**	--	--	--	342	35.0%	3.13	698	58.4%	3.79
183	**HTN in preg**	1,280	7.5%	2.93	137	14.0%	3.71	109	9.1%	3.59
181	**Ot preg comp**	7,183	42.2%	2.91	178	18.2%	2.76	234	19.6%	3.74
184	**Early labor**	3,160	18.6%	3.63	163	16.7%	4.43	--	--	--
195	**Ot compl bir**	2,371	13.9%	4.29	75	7.7%	9.20	52	4.3%	4.00
	Total Diagnoses / Average LOS		82.3%	**3.17**		91.5%	**3.89**		91.4%	**3.77**

NON-MEDICAID

		None			GDM			PGDM		
CCS Diagnosis*	**Description**	**Count**	**%**	**LOS**	**Count**	**%**	**LOS**	**Count**	**%**	**LOS**
186	**DM in preg**	--	--	--	197	23.3%	2.48	318	43.3%	3.42
183	**HTN in preg**	1,585	9.2%	2.68	130	15.4%	3.48	105	14.3%	3.93
181	**Ot preg comp**	6,220	36.1%	2.81	135	16.0%	3.38	144	19.6%	3.76
184	**Early labor**	2,725	15.8%	4.12	178	21.1%	4.47	48	6.5%	3.69
195	**Ot compl bir**	2,997	17.4%	4.25	97	11.5%	14.43	51	6.9%	7.49
182	**Hemorr preg**	513	3.0%	3.87	--	--	--	--	--	--
	Total Diagnoses / Average LOS		81.6%	**3.20**		87.2%	**4.99**		90.7%	**3.91**

*Clinical Classification Software (CCS) single level diagnosis codes 177-195 (see page 77)
Data Source: Hospital Discharge Data, THCIC.

Table 5

Most Frequent Principal Diagnoses Reported to THCIC Hospital Discharge Data System by Diabetes Type: DELIVERY

MEDICAID

		None			GDM			PGDM		
CCS Diagnosis*	**Description**	**Count**	**%**	**LOS**	**Count**	**%**	**LOS**	**Count**	**%**	**LOS**
186	**DM in preg**	--	--	--	3,922	37.5%	2.61	632	30.8%	4.58
183	**HTN in preg**	10,593	6.5%	3.69	1,015	9.7%	4.64	369	18.0%	6.38
189	**Prev c-sectn**	23,140	14.2%	2.52	1,722	16.5%	2.69	328	16.0%	3.30
195	**Ot compl bir**	--	--	--	1,082	10.3%	3.31	265	12.9%	4.20
181	**Ot preg comp**	21,945	13.5%	2.31	310	3.0%	3.31	51	2.5%	4.04
184	**Early labor**	17,500	10.7%	3.13	383	3.7%	4.34	105	5.1%	5.31
193	**OB-related perin trauma**	25,468	15.6%	2.02	434	4.1%	2.20	--	--	--
196	**Nml preg/del**	16,485	10.1%	1.94	--	--	--	--	--	--
185	**Long pregncy**	9,611	5.9%	2.49	--	--	--	--	--	--
191	**Amnios dx**	9,496	5.8%	3.25	599	5.7%	4.76	115	5.6%	5.85
192	**Umbil cord**	7,110	4.4%	1.98	--	--	--	--	--	--
190	**Fetal distrs**	6,718	4.1%	2.67	--	--	--	--	--	--
	Total Diagnoses / Average LOS		90.8%	**2.52**		90.4%	**3.13**		91.0%	**4.76**

NON-MEDICAID

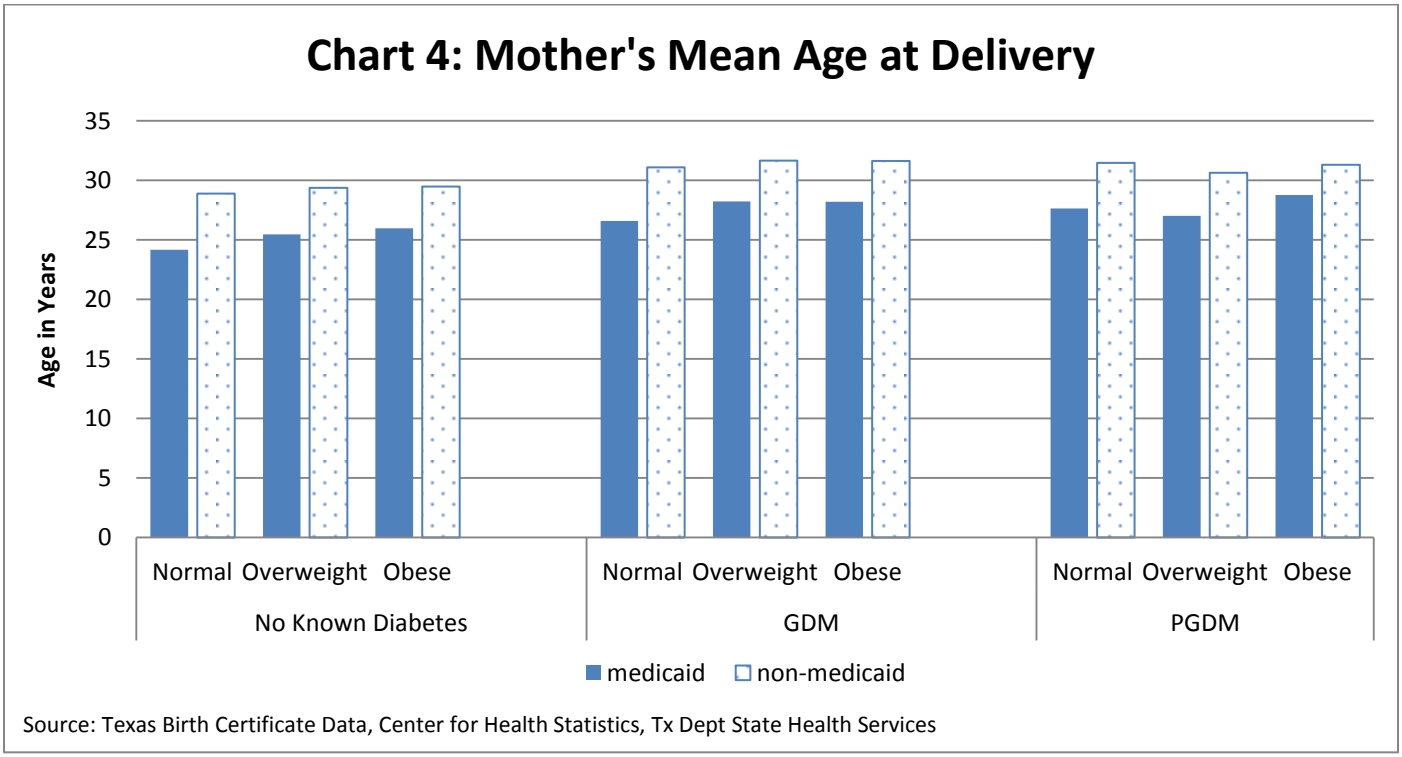
		None			GDM			PGDM		
CCS Diagnosis*	**Description**	**Count**	**%**	**LOS**	**Count**	**%**	**LOS**	**Count**	**%**	**LOS**
186	**DM in preg**	--	--	--	3,868	35.2%	2.49	533	27.3%	3.31
183	**HTN in preg**	11,769	6.9%	3.75	985	9.0%	4.42	354	18.2%	5.93
196	**Nml preg/del**	12,219	7.2%	2.02	--	--	--	--	--	--
195	**Ot compl bir**	25,692	15.2%	2.69	1,372	12.5%	3.55	243	12.5%	4.12
189	**Prev c-sectn**	24,401	14.4%	2.58	1,690	15.4%	2.73	321	16.5%	2.97
181	**Ot preg comp**	15,922	9.4%	2.32	--	--	--	--	--	--
184	**Early labor**	--	--	--	330	3.0%	5.40	81	4.2%	4.16
193	**OB-related perin trauma**	31,960	18.9%	2.05	684	6.2%	2.20	74	3.8%	2.24
191	**Amnios dx**	8,989	5.3%	3.41	592	5.4%	5.43	134	6.9%	5.34
185	**Long pregncy**	7,676	4.5%	2.54	--	--	--	--	--	--
190	**Fetal distrs**	7,333	4.3%	2.93	--	--	--	--	--	--
192	**Umbil cord**	6,812	4.0%	2.08	--	--	--	--	--	--
187	**Malposition**	--	--	--	342	3.1%	3.44	--	--	--
	Total Diagnoses / Average LOS		90.2%	**2.55**		89.9%	**3.16**		89.2%	**4.04**

*Clinical Classification Software (CCS) single level diagnosis codes 177-195 (see page 77)

Data Source: Hospital Discharge Data, THCIC.

Maternal Demographic and Prenatal Characteristics (see also Tables A4-A7; Supplemental Data)

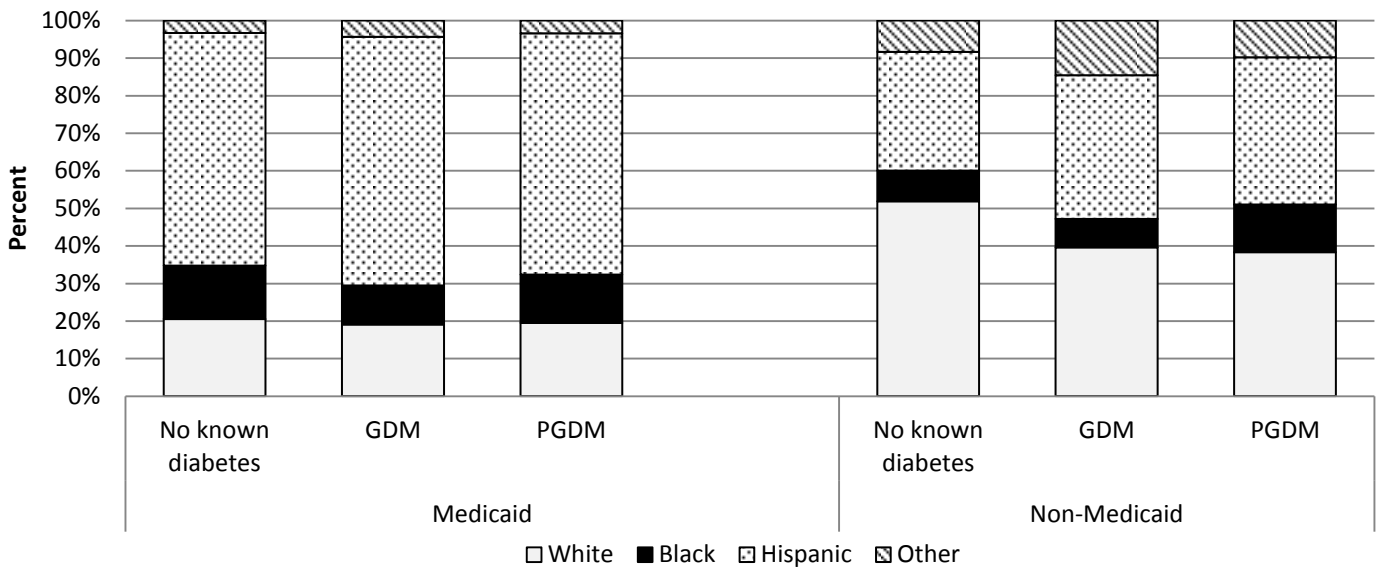
Medicaid participants[§§§§] who give birth are, on average, younger than non-Medicaid mothers. As maternal age increases, so does the risk of diabetes and obesity (Chart 4). Medicaid data also reflect the disproportionate race/ethnic differences among participants in the program when compared to pregnancies among women not covered by Medicaid. Almost 75% of Medicaid participants are Hispanic (~60%) or Black (~15%), with similar distribution between non-diabetic and diabetic (Chart 5). Forty percent of non-Medicaid participants are Hispanic (31.7%) or Black (8.3%). Although Hispanics account for 30% of all non-Medicaid non-diabetic births, the fraction of non-Medicaid covered Hispanic women with diabetes (GDM or PGDM) increases to almost 40% of all deliveries.



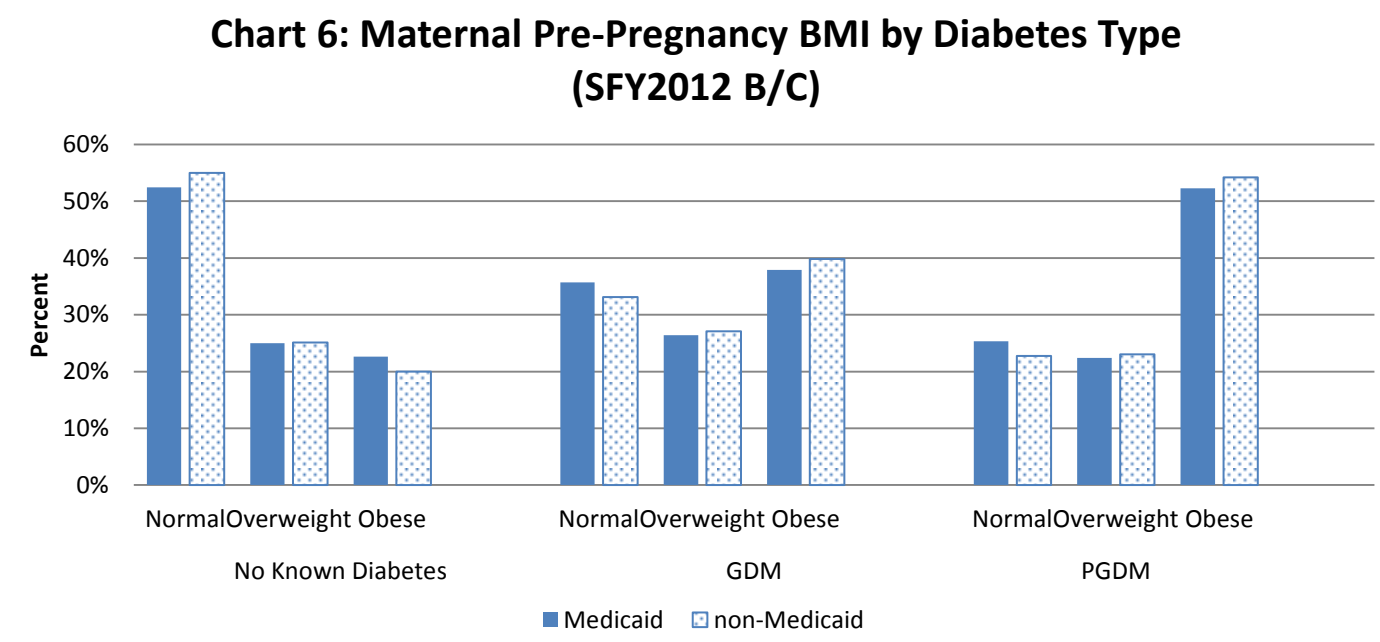
Source: Texas Birth Certificate Data, Center for Health Statistics, Tx Dept State Health Services

Birth certificate anthropometric data (pre-pregnancy maternal weight and stature) demonstrate the strong influence that maternal diabetes type and BMI have on maternal and natal complications. As BMI increases from normal to overweight to obese, risks to overweight and obese women and their infants double and quadruple respectively. Women diagnosed with GDM have intermediate risk levels relative to women entering into the pregnancy with pre-existing type 1 or 2 diabetes (e.g., non-diabetic health risks < GDM health risks < PGDM health risks; Chart 6).

[§§§§] This includes women in Emergency Medicaid (TP 30), the Pregnant Women Program (TP 40), eligible women in the CHIP Perinatal program, and all other Medicaid programs providing services to pregnant women.



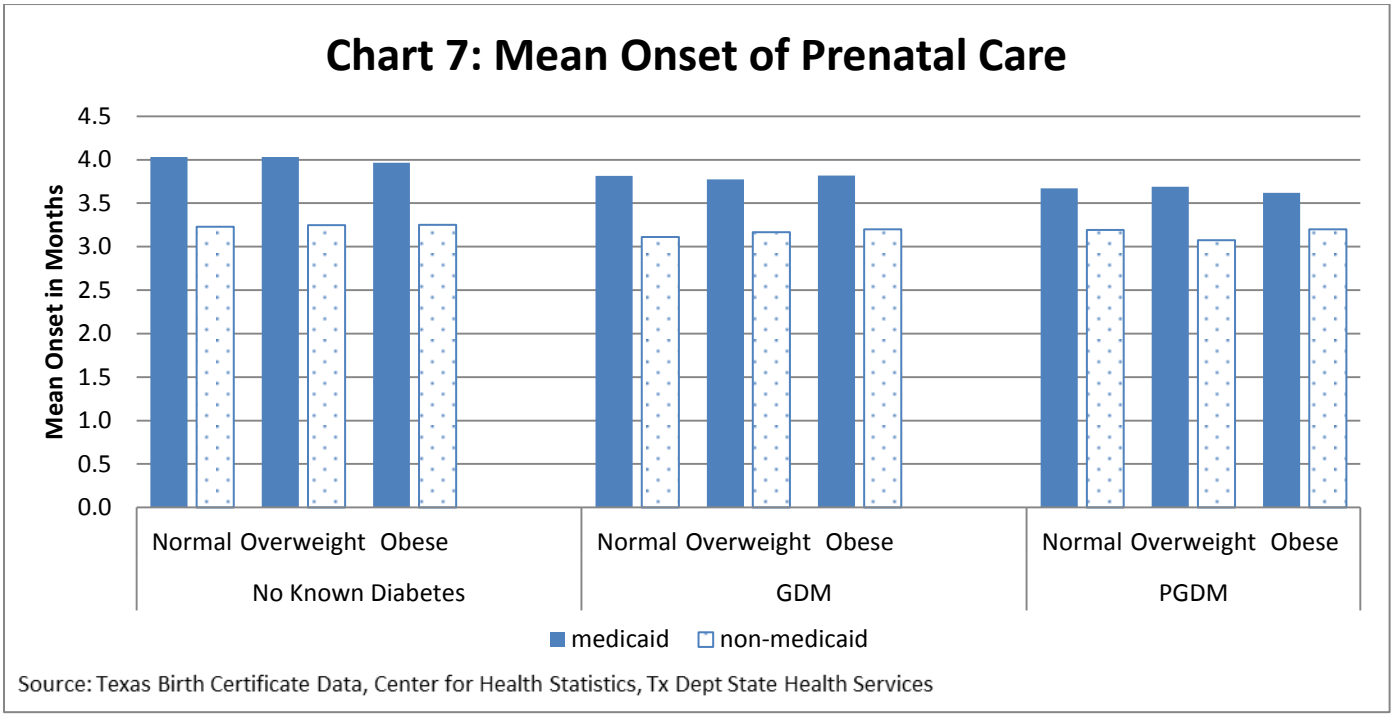
Source: Texas Birth Certificate Data, Center for Health Statistics, Tx Dept State Health Services

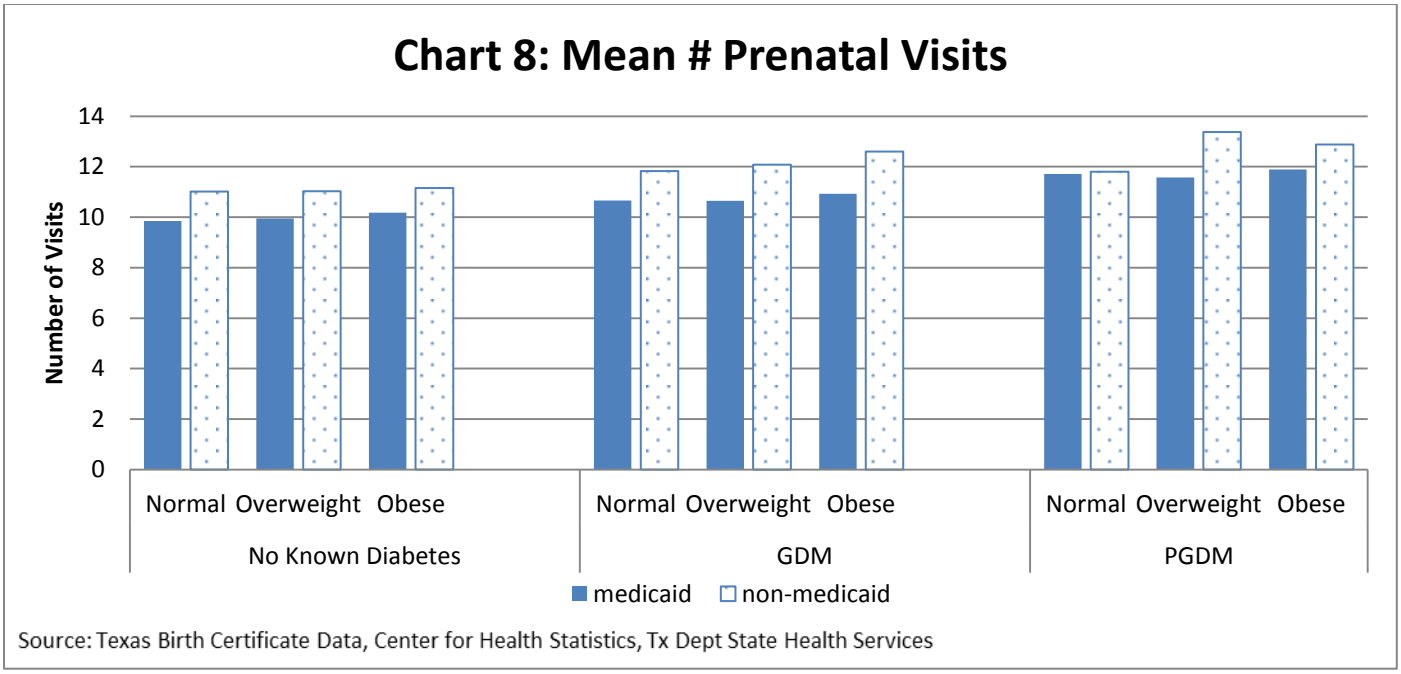


Source: Texas Birth Certificate Data, Center for Health Statistics, Tx Dept State Health Services

The 2010 Pregnancy Risk Assessment Monitoring System (PRAMS) survey [(23)] found that Medicaid participants began prenatal care significantly later than other women. However, for Medicaid participants, type of diabetes appears to be associated with earlier prenatal care (PGDM < GDM<none). The birth certificate data for SFY 2012 show similar results. The difference in onset of care is between two to four weeks (beginning at 14 to 16 weeks gestation; Chart 7) and also accounts for the decrease of

prenatal visits by one over the course of the pregnancy, except for the normal weight PGDM women (Chart 8). Also, diabetics tended to have more pre-natal visits than non-diabetics for both Medicaid and non-Medicaid participants. However, non-emergency Medicaid participants are fully in prenatal care before the 24 to 28 week milestone for diagnosing gestational diabetes. Further, Medicaid participants diagnosed with GDM or PGDM tend to have entered into prenatal care earlier than their non-diabetic counterparts.





Maternal Outcome Measures

In general, overweight women, regardless of diabetes type, have an approximate two-fold risk (odds ratios[*****] in Table 6) of poor neonatal outcomes than normal weight women. Women with PGDM have a three to four times greater risk of delivering a child with a poor neonatal outcome. In addition, these women also have a three-fold greater risk of hypertension.

The frequency of C-section deliveries, and early gestation (<37 weeks) tend to follow a gradient with percentages increasing both by type of diabetes (non-diabetic < GDM < PGDM) and by BMI (normal BMI < Overweight < Obese). Interestingly, non-Medicaid participants had higher frequencies of adverse delivery outcomes than did Medicaid participants. These trends are more marked for chronic and gestational hypertension (Charts 9 - 13).

Table 6

Medicaid Population (SFY) Outcomes by Diabetic condition and BMI

	Gestational Diabetes								Prepregnancy Diagnosed Diabetes							
	Overweight				Obese				Overweight				Obese			
	OR	L CI	U CI	p	OR	L CI	U CI	p	OR	L CI	U CI	p	OR	L CI	U CI	p
TOTAL LIVE BIRTHS	**1.55**	1.49	1.61	***	**2.23**	2.15	2.31	***	**1.86**	1.74	1.98	***	**4.34**	4.11	4.58	***
MATERNAL DEMOGRAPHICS																
No Prenatal Care	**1.50**	1.12	2.00	**	**2.08**	1.59	2.70	***	**1.42**	0.91	2.23	N/S	**3.56**	2.49	5.09	***
MATERNAL LABOR & DELIVERY OUTCOMES																
Frequency C-Section Births	**1.55**	1.45	1.65	***	**2.74**	2.58	2.90	***	**1.79**	1.63	1.97	***	**5.14**	4.75	5.56	***
Hypertension																
Prepregnancy (Chronic)	**1.65**	1.11	2.46	N/S	**3.96**	2.78	5.63	***	**1.31**	0.88	1.97	N/S	**7.32**	5.29	10.13	***
Gestational (PIH preclampsia)	**1.40**	1.20	1.63	***	**2.99**	2.61	3.42	***	**1.76**	1.42	2.18	***	**6.20**	5.19	7.41	***
Deliveries with any Maternal Morbidity	**1.18**	0.74	1.87	N/S	**1.75**	1.17	2.62	**	**0.99**	0.51	1.94	N/S	**2.80**	1.75	4.50	***
Mothers Admitted to ICU	**0.99**	0.38	2.61	N/S	**2.38**	1.19	4.79	**	**2.26**	0.94	5.41	N/S	**4.20**	2.06	8.57	***
NEONATAL OUTCOMES																
Early Gestation (<37 weeks)	**1.62**	1.46	1.79	***	**2.49**	2.26	2.73	***	**1.95**	1.69	2.25	***	**4.84**	4.29	5.46	***
Low Birth Weight (<2500 g)	**1.45**	1.27	1.67	***	**2.17**	1.92	2.46	***	**1.91**	1.58	2.30	***	**4.52**	3.87	5.28	***
Large for Gestational Age	**1.70**	1.51	1.92	***	**3.22**	2.89	3.59	***	**2.00**	1.69	2.37	***	**6.31**	5.48	7.26	***
Number of Births with Fetal Intolerance of Labor	**1.31**	1.06	1.62	*	**2.34**	1.97	2.79	***	**2.14**	1.62	2.84	***	**4.11**	3.26	5.18	***
Any Congenital Defect	**1.13**	0.53	2.40	N/S	**1.13**	0.53	2.40	N/S	**3.04**	1.10	8.37	*	**4.05**	1.55	10.58	**
Newborns with Any Abnormal Condition	**1.60**	1.42	1.81	***	**2.71**	2.43	3.02	***	**1.92**	1.65	2.24	***	**5.02**	4.42	5.69	***
Infants Admitted to NICU	**1.65**	1.44	1.90	***	**2.84**	2.51	3.21	***	**1.88**	1.59	2.21	***	**5.04**	4.37	5.77	***
Fetal Deaths	**0.87**	0.28	2.70	N/S	**4.33**	1.94	9.66	**	**0.89**	0.34	2.33	N/S	**2.66**	1.29	5.65	*
Infant Deaths	**1.31**	0.56	3.07	N/S	**2.99**	1.53	5.84	**	**1.70**	0.51	5.63	N/S	**3.40**	1.22	9.47	*

* p < .05

** p < .01

*** p < .0001

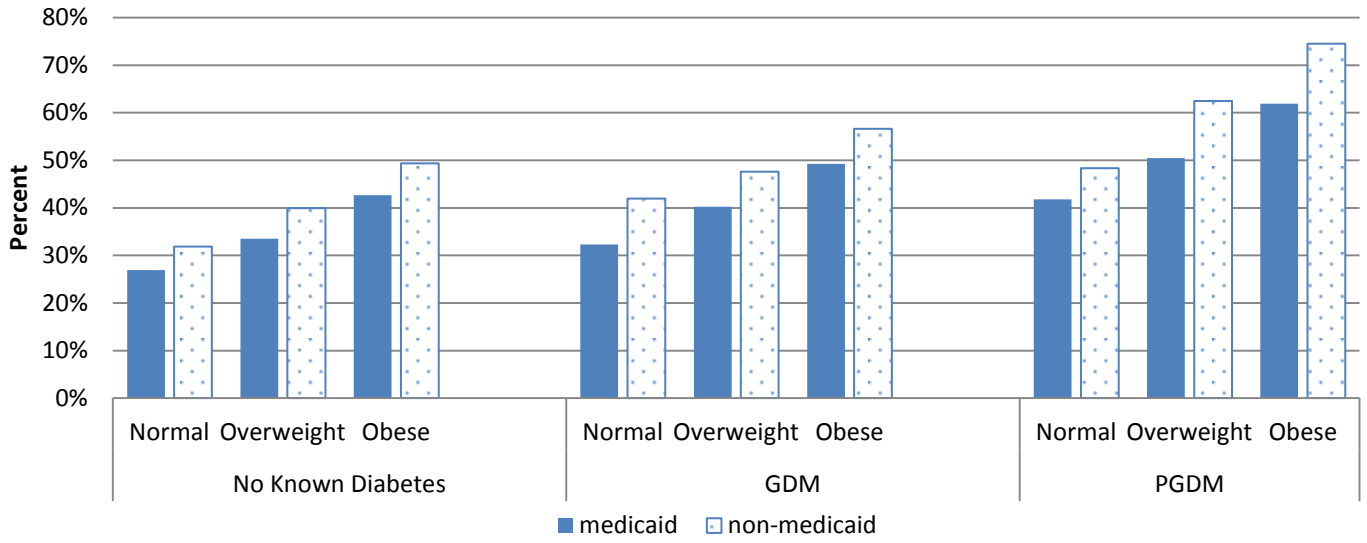
N/S not statistically significant

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database, DSP.CHIP_HX . CHIP Enrollment file, HHSC. Texas Live Birth, Fetal Death, and Linked Birth-Infant Death Certificate Files, CHS, Tx DSHS.

MedCalc easy-to-use statistical software. Version 13.2.2 – Last modified: May 22, 2014; © 1993-2014 MedCalc Software bvba; MedCalc Software, Acacialaan 22, B-8400 Ostend, Belgium. http://www.medcalc.org/index.php.

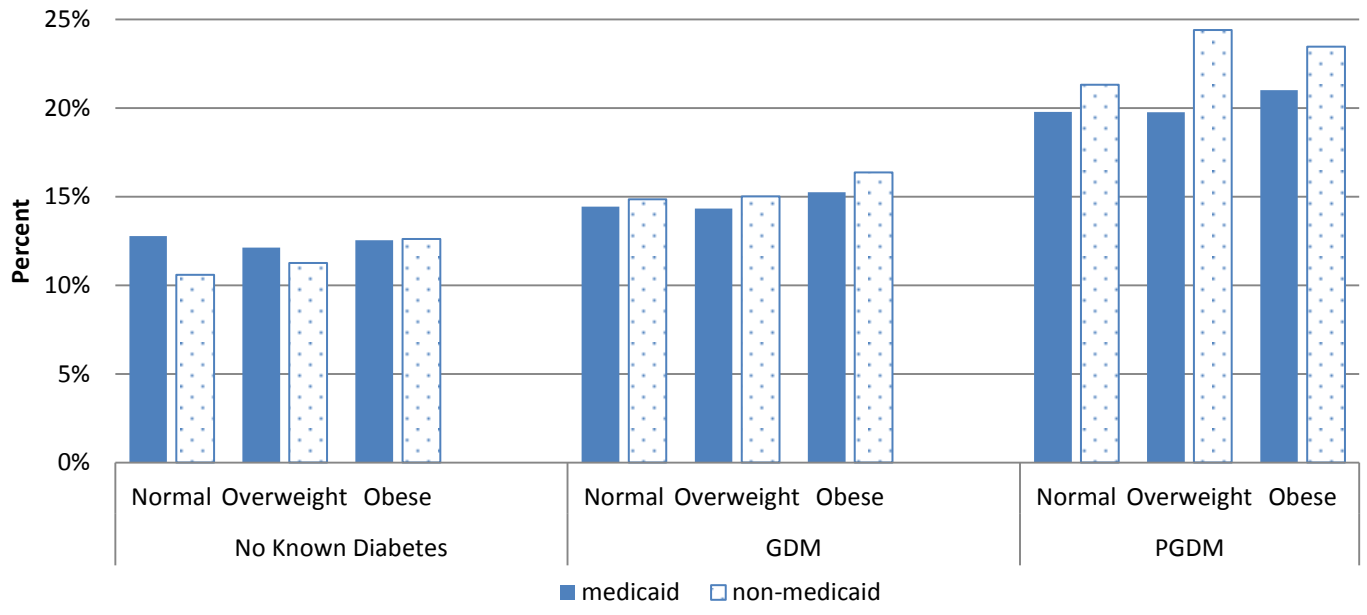
[*****] See page 44 for a discussion of odds ratios.

Chart 9: Frequency C-Section Births



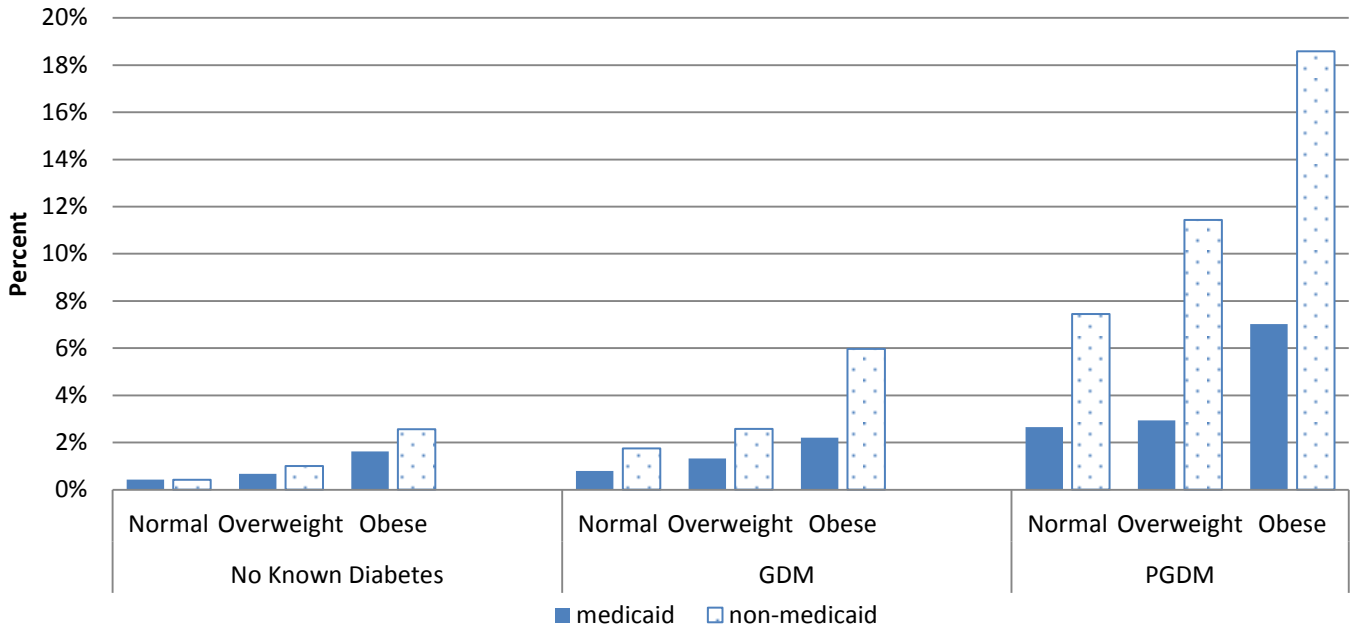
Source: Texas Birth Certificate Data, Center for Health Statistics, Tx Dept State Health Services

Chart 10: Early Gestation (<37 weeks)



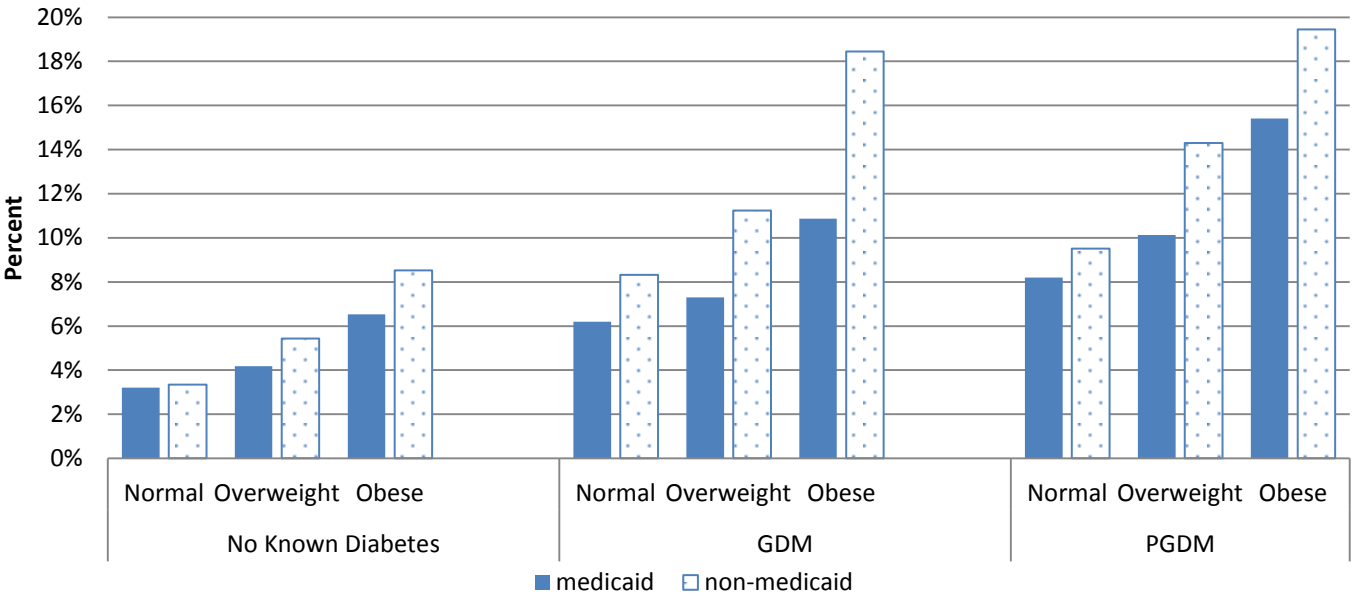
Source: Texas Birth Certificate Data, Center for Health Statistics, Tx Dept State Health Services

Chart 11: Prepregnancy (Chronic) Hypertension

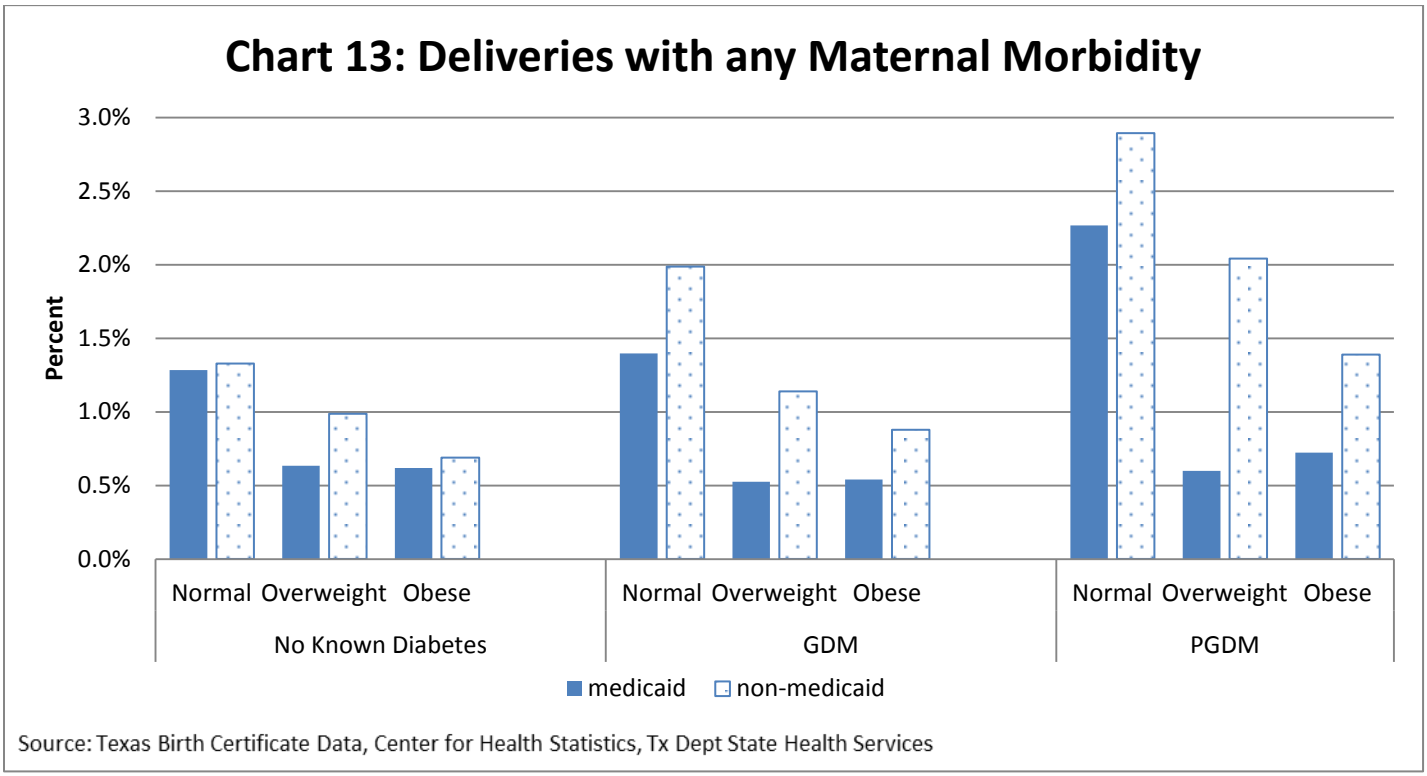


Source: Texas Birth Certificate Data, Center for Health Statistics, Tx Dept State Health Services

Chart 12: Gestational (PIH preclampsia) Hypertension



Source: Texas Birth Certificate Data, Center for Health Statistics, Tx Dept State Health Services



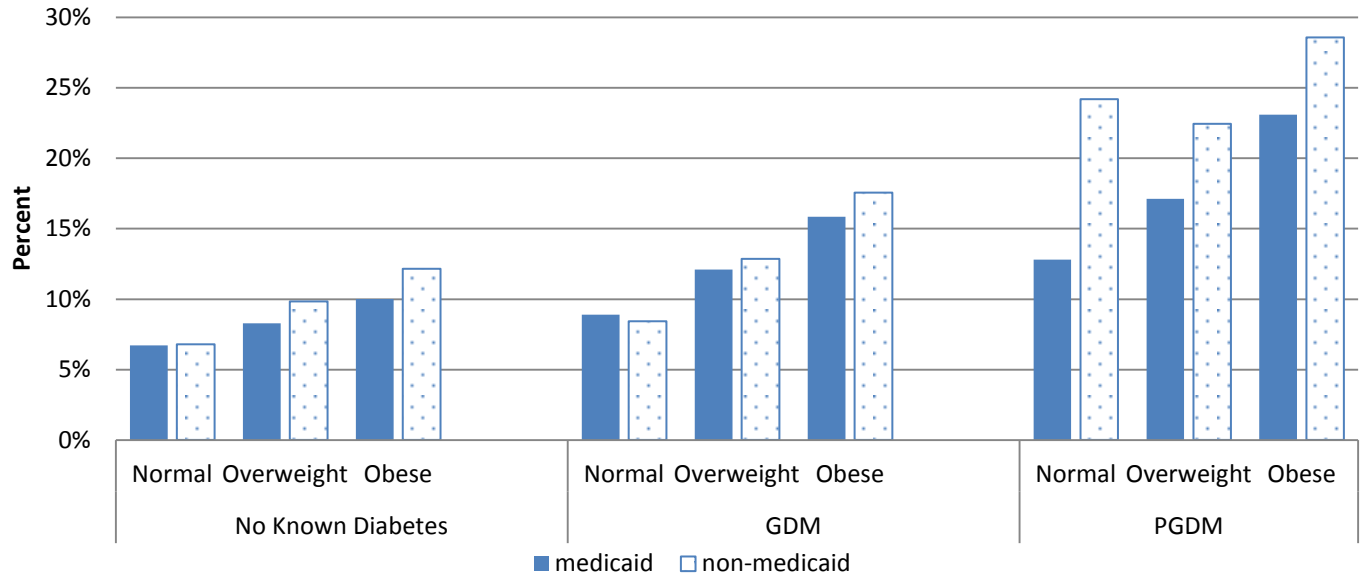
Infant Outcome Measures

GDM has the potential to adversely affect the development of the fetal and neonatal nervous system. [24] Offspring of women with GDM are also at an increased risk of developing a broad range of complications including macrosomia, birth trauma and neonatal hypoglycemia, intracranial hemorrhage, shoulder dystocia, jaundice, and respiratory distress. [5, 9]

Obese women with PGDM are five times more likely to deliver an infant with neonatal complications and four to seven times more likely to suffer poor maternal outcomes (Table 6). GDM shows only a slight increase in risk compared to non-diabetic deliveries for newborns born with any abnormal condition or infants admitted to the NICU. However, infants of women with PGDM show a significantly elevated risk for both of these outcomes.

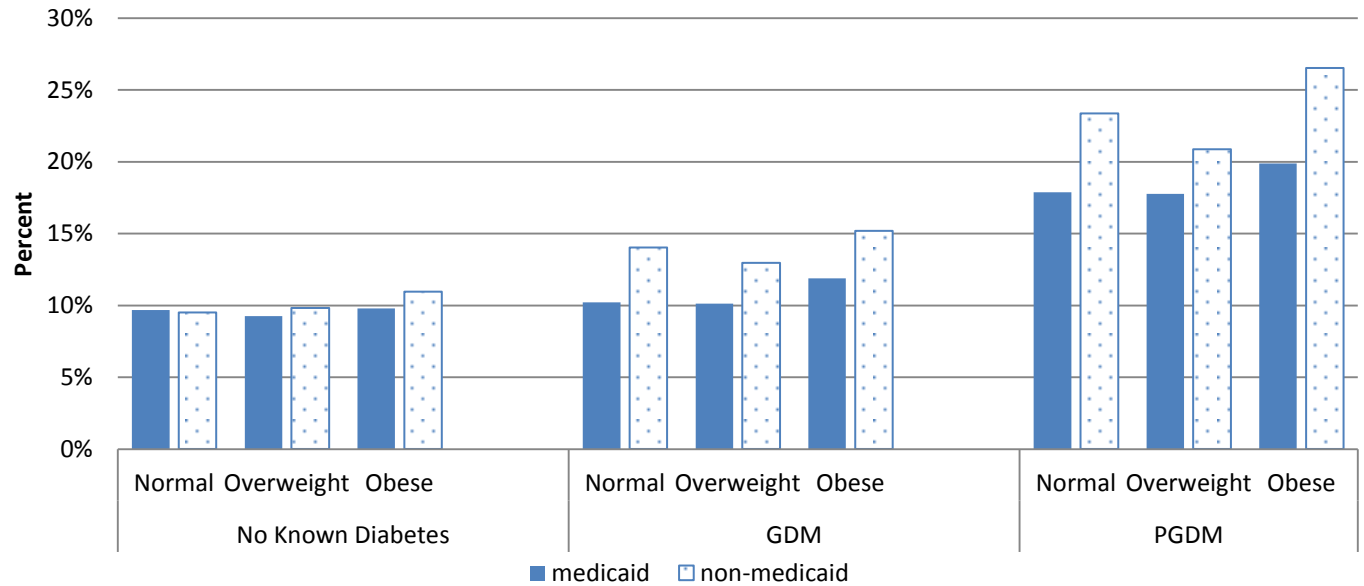
Large for gestational age infants and infants born with any abnormal condition are impacted by mother's weight (Charts 14-15). Similar to trends found for maternal morbidity, these conditions follow a gradient with percentages increasing both by type of diabetes (non-diabetic < GDM < PGDM) and by mother's BMI (normal BMI < Overweight < Obese).

Chart 14: Large for Gestational Age Infants
by Mother's BMI and Diabetes Status

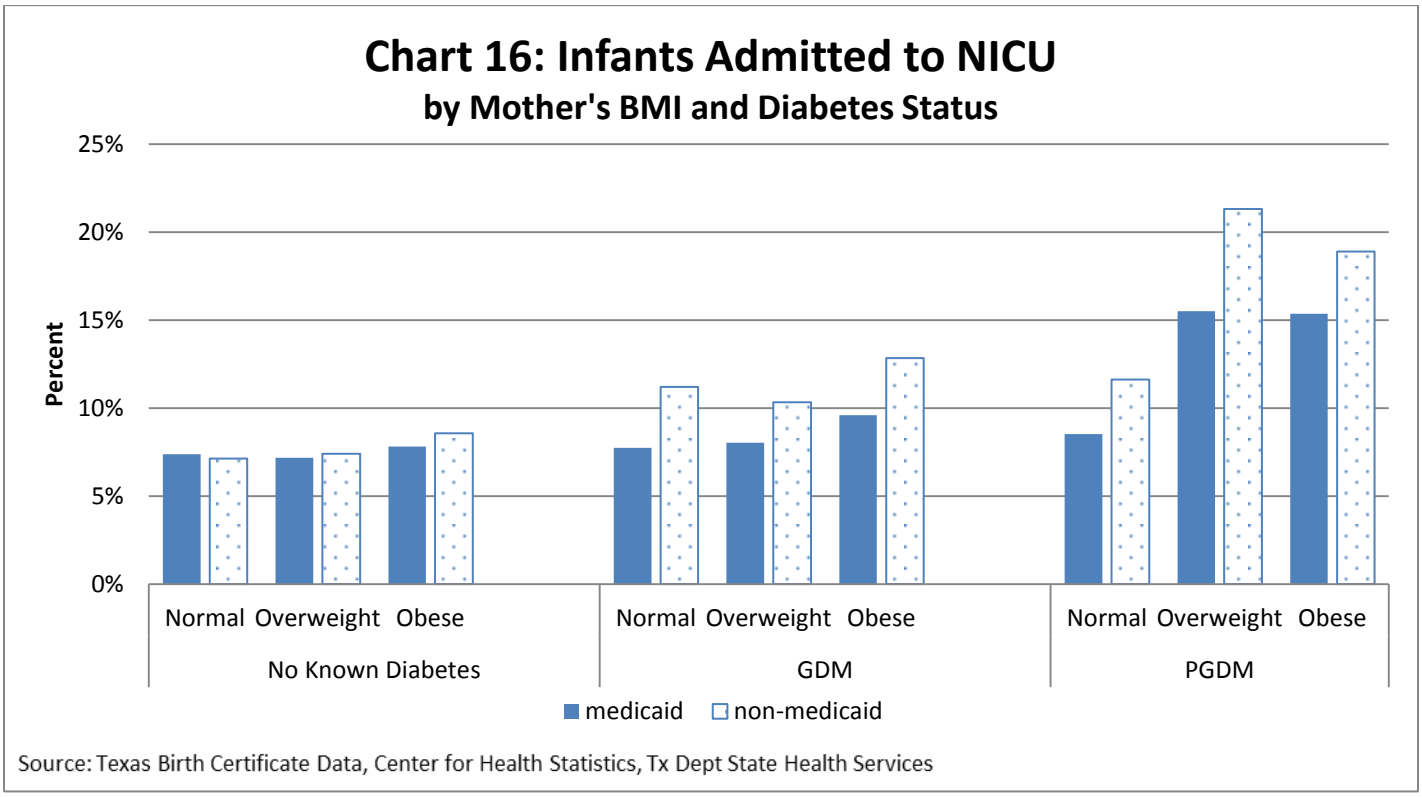


Source: Texas Birth Certificate Data, Center for Health Statistics, Tx Dept State Health Services

Chart 15: Newborns with Any Abnormal Condition
by Mother's BMI and Diabetes Status



Source: Texas Birth Certificate Data, Center for Health Statistics, Tx Dept State Health Services



On average, 12.5% of all neonates reported by the birth certificate are admitted to the NICU (Chart 16). This is consistent with the fraction reported from Medicaid claims and encounters (Table 12). This difference is likely due to the nature of each reporting system: vital records must be completed and submitted to the state within 5 days after delivery, whereas Medicaid data reflect the episode of care provided to the newborn and is used for administrative billing.

While the rate of admission for infants of GDM mothers was similar to infants of non-diabetic mothers, the likelihood of NICU admission appears to double if the mother had PGDM during pregnancy.

The CY 2010 *Healthy Texas Babies: Databook* indicated that diabetes related infant and fetal mortality were associated with pre-pregnancy health and the health of the mother during pregnancy. The r-FIMR risk during the 'Maternal Care' period among ALL diabetic women reported by PRAMS was approximately 3.5 fold greater than among non-diabetic mothers. [(23)] This risk is consistent with the findings presented here and reiterates the impact that diabetes has on a woman's pregnancy and fetus. For Medicaid participants, fetal death rates were 33% lower for women who develop GDM during pregnancy (2.4/1,000) but 50% higher for women with PGDM (4.7/1,000) than for non-diabetic Medicaid deliveries (3.6/1,000). Fetal death rates among deliveries to women not participating in Medicaid were higher than Medicaid participants for both non-diabetic and GDM women (5.6/1,000) and substantially (five times) higher among PGDM pregnancies (26.7/1,000; Table 7).

Infant deaths born to women without diabetes during pregnancy (6.3/1,000 live births – Medicaid; 4.6/1,000 – non-Medicaid) were almost double those of women diagnosed with GDM (2.6/1,000 – Medicaid; 3.0/1,000 – non-Medicaid). However, infant mortality among infants born to women diagnosed with PGDM was lower at 2.5/1,000 for Medicaid participants but doubled (9.2/1,000) among non-Medicaid paid deliveries.

Table 7

Infant Mortality and Fetal Death Rates by Mother's Diabetic Condition and BMI, SFY 2012

	No Diabetes				GDM				PGDM			
	Normal	Overweight	Obese	TOTAL	Normal	Overweight	Obese	TOTAL	Normal	Overweight	Obese	TOTAL
Medicaid Infant Deaths	529	259	316	1,104	14	9	25	48	6	5	10	21
Infant Mortality Rate*	5.8	5.9	7.9	6.3	2.1	1.9	3.6	2.6	2.8	2.7	2.3	2.5
non-Medicaid Infant Deaths	351	212	198	761	7	5	11	23	3	1	6	10
Infant Mortality Rate*	3.8	5.1	6.0	4.6	2.7	2.4	3.6	3.0	12.3	3.9	10.2	9.2
Medicaid Fetal Deaths	245	176	212	633	8	5	30	43	11	7	21	39
Fetal Mortality Rate*	2.7	4.0	5.3	3.6	1.2	1.0	4.3	2.3	5.2	3.7	4.8	4.7
non-Medicaid Fetal Deaths	384	258	292	934	7	11	25	43	6	9	14	29
Fetal Mortality Rate*	4.2	6.1	8.7	5.6	2.7	5.3	8.2	5.6	24.0	34.2	23.3	26.0
Medicaid Live Births	91,952	43,926	39,860	175,738	6,523	4,824	6,961	18,308	2,108	1,862	4,353	8,323
non-Medicaid Live Births	91,371	41,716	33,218	166,305	2,553	2,070	3,029	7,652	244	254	588	1,086

* Infant Mortality and Fetal Death Rates are expressed as # of deaths per 1,000 live births.
Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Texas Live Birth, Fetal Death, and Linked Birth-Infant Death Certificate Files, CHS, Tx DSHS.

GDM related maternal deaths are rare and represent a small fraction of all maternal deaths in any year reported over the past decade (Table 8). No long term trend can be discerned at this time regardless if the maternal death was directly or indirectly related to GDM. However, there has been a small increase in the maternal death rate specific to any diabetes cause (most of which are unidentified by type) since CY 2003.

Table 8

Maternal Deaths due to Diabetes Mellitus In Pregnancy*, Texas Residents, 1999-2012 (2012 death data are preliminary)

	Underlying Cause-of-Death Analysis						Multiple Cause-of-Death Analysis							
Year	Type 1 O24.0	Type 2 O24.1	Gestational O24.4	O24.9	Total	Year	Type 1 O24.0	Type 2 O24.1	Gestational O24.4	O24.9	Total	All Reported Maternal Deaths	Total Live Births
1999	0	0	0	0	0	**1999**	0	0	0	0	0	34	349,157
2000	0	0	0	0	0	**2000**	0	0	0	0	0	30	363,325
2001	0	0	0	0	0	**2001**	0	0	0	0	0	40	365,092
2002	0	0	0	0	0	**2002**	0	0	0	0	0	34	372,369
2003	0	0	0	1	1	**2003**	0	0	0	2	2	60	377,374
2004	0	0	0	2	2	**2004**	0	0	0	2	2	47	381,441
2005	0	0	0	0	0	**2005**	0	0	0	0	0	60	385,537
2006	0	0	0	2	2	**2006**	1	0	0	3	4	90	399,309
2007	0	0	1	0	1	**2007**	0	0	2	1	3	75	407,453
2008	0	0	0	1	1	**2008**	0	0	0	1	1	90	405,242
2009	0	0	0	0	0	**2009**	0	0	0	2	2	116	401,599
2010	0	0	0	3	3	**2010**	0	0	0	6	6	95	385,746
2011	0	0	0	4	4	**2011**	0	0	2	6	8	116	377,274
2012	0	0	0	6	6	**2012**	0	0	0	8	8	121	380,025
Total	**0**	**0**	**1**	**19**	**20**	**Total**	**1**	**0**	**4**	**31**	**36**		

Data Scenario: Texas County Level ICD-10 Underlying Cause Deaths
*Includes : in pregnancy, childbirth and the puerperium
Preexisting diabetes mellitus, insulin-dependent (O24.0),
Preexisting diabetes mellitus, noninsulin-dependent (O24.1),

Data Scenario: Texas County Level ICD-10 Multiple Cause Deaths
Diabetes mellitus arising in pregnancy (O24.4),
Diabetes mellitus in pregnancy, unspecified (O24.9)

Death data source: Texas Department of State Health Services, Center for Health Statistics
Run: April 23, 2014

THE COSTS OF DIABETES DURING PREGNANCY AND INFANCY

Key Points:

- ***Women (and their children) diagnosed with GDM have per capita costs that are slightly higher than non-diabetic women.***
- ***Per capita costs among women with PGDM are approximately 50% higher than non-diabetic and GDM diagnosed women and their children.***
- ***Excess Medicaid costs among GDM related pregnancies and infants were approximately 10 million dollars during SFY 2012. These costs are higher (approximately 17 million dollars) if high risk infants suffering from congenital anomalies or other abnormalities that may be unrelated to diabetes are removed from analysis.***
- ***PGDM related pregnancies and infants have a total excess cost of approximately 63 million dollars***

Because the majority of Texas pregnancies are paid for by Medicaid (53.8% during SFY 2012), complications arising during pregnancy, labor, and delivery care may require costly perinatal medical care as part of the state's public health safety net. Post-natal disease management in the form of extended NICU stays or complicated infant care are potentially preventable Medicaid cost drivers. Further, diabetes, regardless of its form, has long-term health implications.

The impact of GDM on health outcomes has significant implications on the costs for maternal and post-natal Medicaid services. Interventions that prevent the onset of GDM have the potential to yield substantial economic as well as clinical benefits. **(16)**

One third of the pre-delivery hospital visits among women diagnosed with GDM are diabetes related, while more than half of admissions among women with PGDM were diabetes related. A third of all deliveries, regardless of diabetes type, were discharged with a principal diagnosis related to diabetes in pregnancy. On average, pre-delivery and delivery lengths of stay (LOS) among women with GDM were over half a day longer than individuals not diagnosed with the disease (Tables 4-5). Women without diabetes who delivered tended to stay in the hospital, on average, one and a half to two days less than women presenting with PGDM. This may be partly accountable for higher C-section rates (see ORs in Table 6).

Nine percent of total SFY 2012 Medicaid medical and drug related costs were among women who were diagnosed with GDM and their infants (Table 9). An additional seven percent of Medicaid maternal and infancy related costs were among women diagnosed with PGDM. Because, linked Medicaid and birth certificate data indicate that 9% of women enrolled in Texas Medicaid had GDM and another 4.1% women had a diagnosis of PGDM during SFY 2012, costs for PGDM are approximately 68% higher than expected 68% (6.9% of costs vs 4.1% of individuals), whereas GDM is not (9.1% of costs vs. 9.0% of individuals).

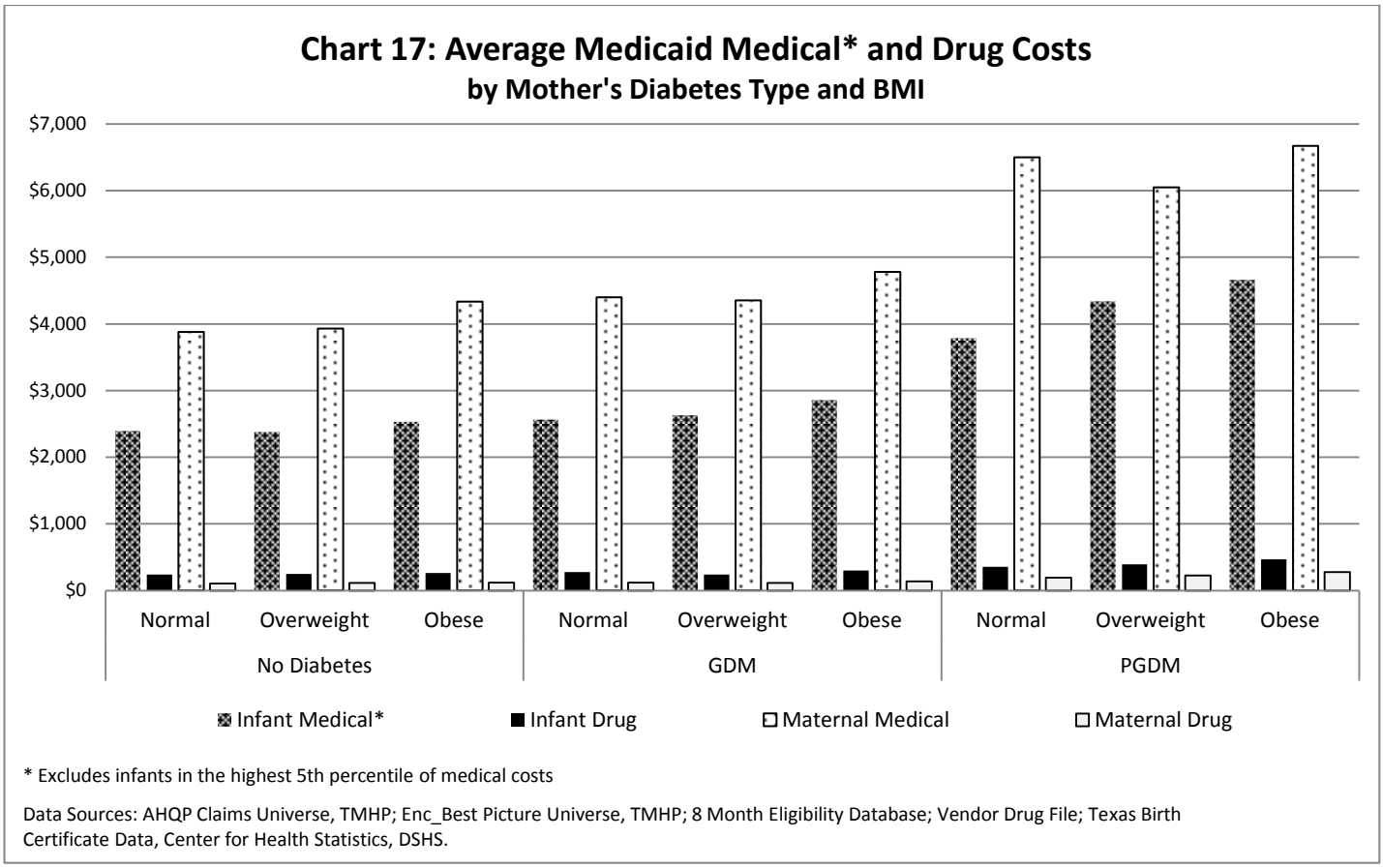
Table 9

Medicaid Medical and Vendor Drug Expenditures by Mother's Diabetes Type

		Infant Medical	Infant Drug	Maternal Medical	Maternal Drug	Total by Diabetes Type
No Diabetes	**Expenditures**	$1,026,209,125	$24,695,349	$692,695,349	$9,786,943	$1,753,386,766
	% of Total	84.9%	82.7%	83.7%	78.5%	84.0%
GDM	**Expenditures**	$103,873,505	$2,956,378	$81,656,851	$1,260,596	$189,747,330
	% of Total	7.8%	9.9%	9.9%	10.1%	9.1%
PGDM	**Expenditures**	$88,357,052	$2,192,920	$53,077,941	$1,419,794	$145,047,707
	% of Total	7.3%	7.3%	6.4%	11.4%	6.9%
Total by Expenditure Type	**Expenditures**	$1,218,439,682	$29,844,647	$827,430,141	$12,467,333	$2,088,181,803

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Live Birth Certificate File, CHS, Tx DSHS.

Medicaid expenditures broken out by diabetes type and maternal pre-pregnancy BMI demonstrate a cost correlation related to the type of diabetes and maternal weight (Chart 17). There is a negligible difference in overall GDM costs when compared to costs among pregnancies without diabetes complications. However, as a woman's pre-pregnancy weight increases, Medicaid expenditures also increase. This trend is more pronounced among women entering into a pregnancy with diabetes and is exacerbated among overweight and obese women. Obese women, regardless of diabetes status, tend to have the costliest maternal care and post-natal expenses. For example, non-diabetic obese maternal costs range between 5 to 10% higher than normal weight non-diabetic mothers.



* Excludes infants in the highest 5th percentile of medical costs

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Birth Certificate Data, Center for Health Statistics, DSHS.

The impact of diabetes on the costs of labor and delivery are made clear by data in Table 10. Women with diabetes during pregnancy are not only more likely to experience a C-section during delivery, but the overall fraction of costs due to C-section (compared to vaginal deliveries) among diabetic women is much greater than among non-diabetic women. In addition, women with PGDM are more than twice as likely (44%) to experience a complicating condition during delivery than non-diabetic mothers (16%) or women with GDM (21%).

Table 10

MEDICAID DELIVERY CLAIMS BY DRG CODE AND MOTHER'S DIABETES STATUS - SFY2012

DRG Code and Description		Summary-No Diabetes		Summary-GDM		Summary-PGDM	
		Claims	Percent	Claims	Percent	Claims	Percent
765	Cesarean Section with CC	12,938	9.6%	1,863	13.6%	1,907	31.1%
766	Cesarean Section without CC	31,939	23.6%	3,926	28.6%	1,689	27.5%
774	Vaginal Delivery w Complicating Diagnoses	9,103	6.7%	1,007	7.3%	772	12.6%
775	Vaginal Delivery w/o Complicating diagnoses	76,128	56.3%	6,218	45.2%	1,469	23.9%
767	Vaginal Delivery w Steril. &/or D&C	5,023	3.7%	729	5.3%	300	4.9%
768	Vaginal Delivery w OR Proc., excl. Steril. D&C	54	0.0%	5	0.0%	1	0.0%
Total Patients		**130,924**		**13,196**		**5,727**	

DRG Code and Description		Summary-No Diabetes		Summary-GDM		Summary-PGDM	
		Delivery Cost	Percent	Delivery Cost	Percent	Delivery Cost	Percent
765	Cesarean Section with CC	$47,534,014	16%	$6,849,701	22%	$6,919,067	43%
766	Cesarean Section without CC	$78,719,269	27%	$9,601,385	31%	$3,936,027	25%
774	Vaginal Delivery w Complicating Diagnoses	$23,479,526	8%	$2,685,293	9%	$2,004,464	12%
775	Vaginal Delivery w/o Complicating diagnoses	$130,043,605	45%	$10,788,125	35%	$2,578,858	16%
767	Vaginal Delivery w Steril. &/or D&C	$8,871,119	3%	$1,274,915	4%	$611,922	4%
768	Vaginal Delivery w OR Proc., excl. Steril. D&C	$236,650	0%	$21,161	0%	$3,795	0%
Total Cost & Average Cost/Patient		**$288,884,183**	**$2,207**	**$31,220,580**	**$2,366**	**$16,054,133**	**$2,803**

PREPARED BY: Health Plan Outcomes and Epidemiology Team, Strategic Decision Support, HHSC, 6/9/2014.

DATA SOURCES: AHQP Claims Universe, TMHP; Encounters Best Picture Universe, TMHP; Mother's Medicaid ID and diabetes status from Vital Records match against

NOTES:

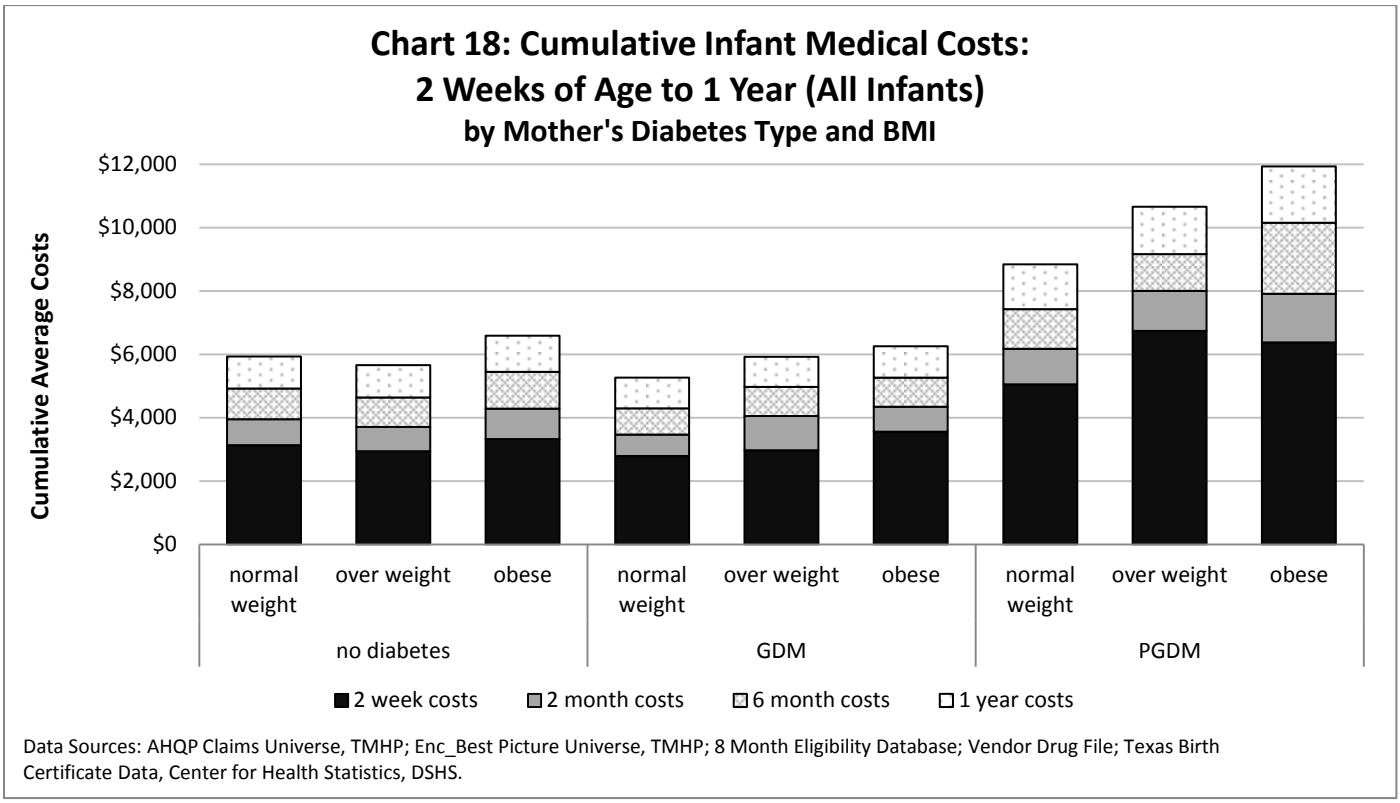
--Delivery claims were identified using MS-DRG codes 765-768 and 774-775. Total claims may include multiple claims per delivery and multiple deliveries per patient. When compared to Medicaid delivery payment data, the delivery data in this report underrepresent the total number of deliveries in Texas Medicaid. MCOs are paid for deliveries through a separate process and may report deliveries in administrative data under DRG codes or under a variety of other codings.

--Deliveries are reported as the total number of unique delivery events per patient per delivery date (date of service). Patients with multiple delivery claims on the same date of service are counted as having one delivery on that date. Patients with multiple delivery dates (dates of service) are counted as having more than one delivery.

--Delivery patients are reported as the total number of unique patients with deliveries. Patients with multiple claims and/or multiple deliveries in the same fiscal year were counted once.

--Data are for claims and encounters for services with begin dates in SFY2012. The Medicaid Managed Care (HMO) program was expanded on March 1, 2012 to incorporate all PCCM clients. State fiscal year represents the period from September 1 to August 31 of the following year.

More than half of all Medical costs during infancy occur within the first two weeks of delivery (Chart 18). Initial costs tend to be higher among infants of overweight and obese women relative to offspring of normal weight mothers. Infants of women diagnosed with PGDM incur considerably higher two week medical costs relative to other infants. The infants of GDM obese mothers tend to have expenses 20 to 25% higher than normal weight GDM mothers. Infants of mothers diagnosed with PGDM have medical care costs that are double that of infants with non-diabetic and GDM mothers.



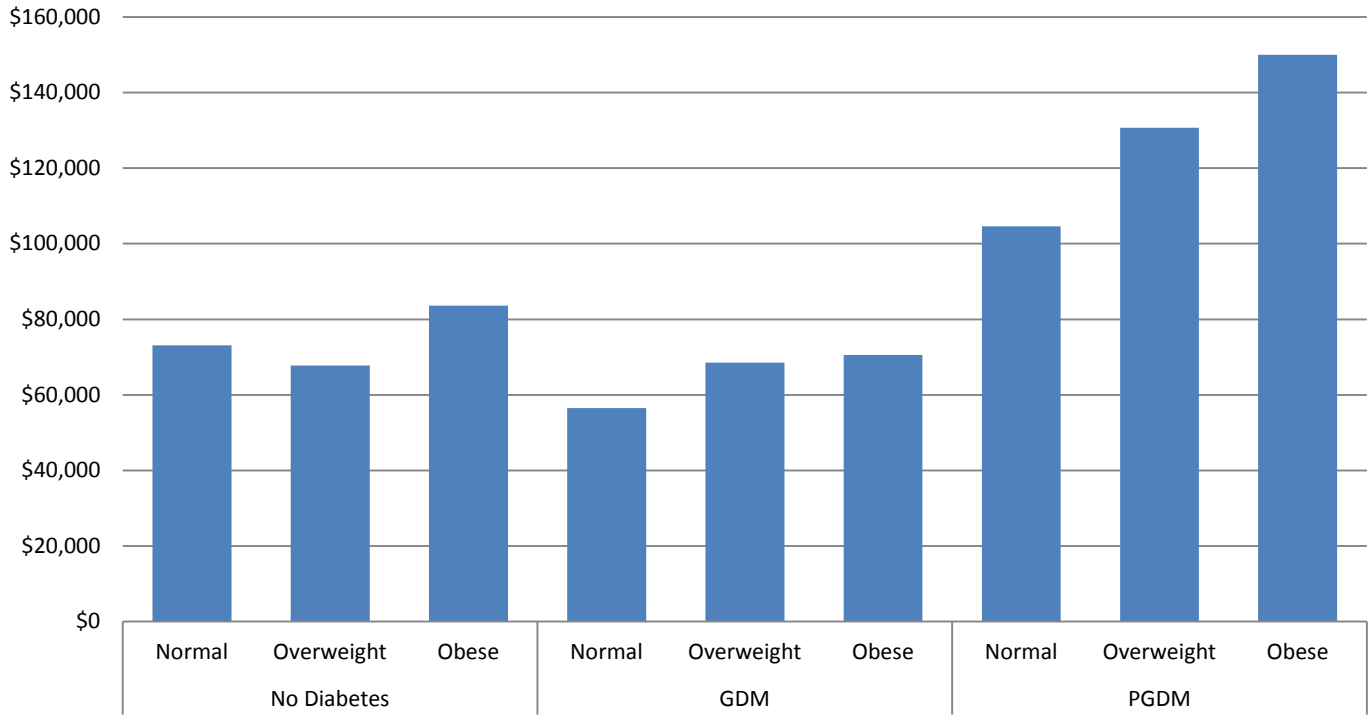
Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Birth Certificate Data, Center for Health Statistics, DSHS.

Over half of all costs are incurred by less than five percent of all infants, regardless of diabetes status, with conditions that require extended NICU and related medical care (Tables 11-12). Although they are less than 5% of all births, infants diagnosed with extreme prematurity account for almost half of all infant medical costs. Numerically, high cost infants of non-diabetic women (greater than the 5th percentile in costs) outnumber similar high costs infants among GDM and PGDM women by a factor of approximately 10 to 1 (Table 12).

The likelihood of NICU utilization increased by type of diabetes; 15% of infants born to women with GDM are place in a NICU for some period after birth. This is 25% higher (15% vs 12%) than the fraction of infants of non-diabetic mothers placed in a NICU. Infants of women with PGDM have double the risk of being placed in a NICU, 25%, compared to infants of non-diabetic women. However the average length of stay (16 days) and the average cost per infant ($18,000) is substantially less for infants of GDM women then non-diabetics. Infants of PGDM women also stay, on average, 2 days less than children of non-diabetic women, although their overall costs are approximately $2,000 higher per infant.

Because of this, Medicaid infancy cost estimates appear to be biased and may not give an accurate picture of cost differentials by diabetes status. In particular, this causes the average infant medical costs of GDM to appear much lower than comparable non-diabetic costs. Adjusting the data by removing the costliest 5% of all infants from the analyses, we see that the average GDM costs are slightly greater than those found among non-diabetic but far less than the PGDM (Tables 13-14).

Chart 19: Average Medicaid Medical Costs
by Mother's Diabetes Type and BMI (Costliest 5% of All Infants)



Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Birth Certificate Data, Center for Health Statistics, DSHS.

Table 11

Medicaid Newborn Claims bt DRG Code and Mother's Diabetes Status for SFY2012

DRG Code and Description		Summary-No Diabetes		Summary-GDM		Summary-PGDM	
		Number	Percent	Number	Percent	Number	Percent
	Clients						
385 / 789	Neonates, Died/Transf to other Acute Care Facility	1,655	1.4%	144	1.2%	168	3.1%
386 / 790	Extreme Immaturity	2,750	2.3%	301	2.5%	280	5.1%
387 / 791	Prematurity W Major Problems	2,144	1.8%	259	2.1%	221	4.1%
388 / 792	Prematurity W/O Major Problems	4,673	3.9%	683	5.6%	448	8.2%
389 / 793	Full Term Neonate W Major Problems	4,921	4.1%	495	4.1%	348	6.4%
390 / 794	Neonate W Other Significant Problems	17,227	14.3%	2,381	19.6%	1,164	21.4%
391 / 795	Normal Newborn	87,391	72.4%	7,903	65.0%	2,812	51.7%
	Total Unduplicated Clients	**119,110**		**12,002**		**5,282**	
	Cost						
385 / 789	Neonates, Died/Transf to other Acute Care Facility	$27,925,271	7.5%	$1,236,841	3.3%	$1,864,081	5.6%
386 / 790	Extreme Immaturity	$171,874,653	46.3%	$15,585,312	41.2%	$16,989,274	51.1%
387 / 791	Prematurity W Major Problems	$44,714,423	12.0%	$5,735,785	15.2%	$4,565,474	13.7%
388 / 792	Prematurity W/O Major Problems	$23,335,675	6.3%	$4,279,474	11.3%	$2,653,951	8.0%
389 / 793	Full Term Neonate W Major Problems	$37,120,962	10.0%	$3,633,358	9.6%	$3,733,093	11.2%
390 / 794	Neonate W Other Significant Problems	$23,831,920	6.4%	$3,650,158	9.7%	$1,947,871	5.9%
391 / 795	Normal Newborn	$42,643,513	11.5%	$3,682,677	9.7%	$1,521,226	4.6%
	Total Cost	**$371,446,417**	**100.0%**	**$37,803,605**	**100.0%**	**$33,274,970**	**100.0%**
	Average Cost per Client						
385 / 789	Neonates, Died/Transf to other Acute Care Facility	$16,873		$8,589		$11,096	
386 / 790	Extreme Immaturity	$62,500		$51,778		$60,676	
387 / 791	Prematurity W Major Problems	$20,856		$22,146		$20,658	
388 / 792	Prematurity W/O Major Problems	$4,994		$6,266		$5,924	
389 / 793	Full Term Neonate W Major Problems	$7,543		$7,340		$10,727	
390 / 794	Neonate W Other Significant Problems	$1,383		$1,533		$1,673	
391 / 795	Normal Newborn	$488		$466		$541	
	Average Cost per Unduplicated Client	**$3,119**		**$3,150**		**$6,300**	

PREPARED BY: Health Plan Outcomes and Epidemiology Team, Strategic Decision Support, HHSC, 6/5/2014.

DATA SOURCES: AHQP Claims Universe, TMHP; Encounters Best Picture Universe, TMHP; Infant Medicaid ID and mother's diabetes status from Vital Records.

FILE: Newborn DRG Costs and Counts by Mother's Diabetes Status FY12.xls

NOTES:

--Newborn claims were identified using MS-DRG codes 789-795. When compared to delivery data, the newborn data in this report underrepresents the total number of newborns in

--Total clients are reported as the total number of unduplicated newborns with claims for each DRG code.

--Total unduplicated clients are reported as the total number of unduplicated newborns born during the fiscal year with any DRG code. Some clients had claims for two or more

--Data are for claims and encounters for services with begin dates in SFY2012, and do not extend for the infant's full first year.

State fiscal year represents the period from September 1 to August 31 of the following year.

Table 12

Unduplicated Medicaid NICU Newborns Costs by Mother's Diabetes Status SFY2012

NICU Measures	Unduplicated Newborns - No Diabetes	Unduplicated Newborns - GDM	Unduplicated Newborns - PGDM
Unduplicated Newborns with a NICU CPT or Revenue Code	21,024	2,698	2,171
Total Unduplicated Newborns by Mother's Diabetes Status	172,330	17,983	8,210
Percentage of Newborns with a NICU Revenue or CPT Code	12%	15%	26%
Average Inpatient NICU Length-of-Stay (LOS) for Newborns with NICU Revenue Codes 174-175	20.3	16.2	18.7
Cost for Newborns w NICU CPT or Revenue Code 174 or 175	$497,808,801	$48,327,503	$54,409,644
Average Cost Newborns with NICU CPT or Revenue Code	$23,678	$17,912	$25,062

PREPARED BY: HHSC, Strategic Decision Support, Health Plan Outcome and Epidemiology Team, 6/24/2014.

DATA SOURCES: AHQP Claims Universe, TMHP; Encounters Best Picture Universe, TMHP; Infant Medicaid ID and mother's diabetes status from matched vital records data, HHSC (n=198,523).

FILENAME: Newborn Client Costs with NICU Services and Diabetes Status SFY2012.xlsx

NOTES:

-Medicaid FFS/PCCM and HMO encounter professional NICU services were identified using Procedure codes 99468, 99469, 99471, 99472, 99477, 99478, 99479, and 99480.

-Medicaid FFS/PCCM and HMO encounter inpatient NICU accommodation services were identified using Revenue codes 174 and 175. Some NICU patients were served in more than one month.

-The total inpatient NICU length-of-stay (LOS) was computed as the number of complete inpatient days (last day - first day) during the period for patients with Revenue Codes 174 - 175. NICU patients who were admitted and discharged on the same day had a total LOS of 0.

-The unduplicated number of NICU newborns per month was computed as the total number of NICU patients with a NICU CPT code of 99295-99300, 99468-99469, 99477-99480, or a NICU Revenue code of 174-175.

-Total Unduplicated Newborns by Mother's Diabetes Status was calculated as number of Medicaid newborns born in SFY 2012, matched against Vital Statistics records for mother's diabetes status.

-NICU Newborns were defined as NICU patients who were born between 9/1/2011 and 8/31/2012 and who had a NICU inpatient or NICU professional service before their first birthday. NICU services that occurred after the client's first birthday were excluded.

The Excess Costs of Diabetes (see also Tables A8-A12 and Chart A1; Supplemental Data)

Excess Medicaid costs due to GDM were estimated to be ten million dollars over the cost of a non-diabetic normal weight woman in SFY 2012.

If high risk (top 5 percentile) infants are excluded from this estimate, the excess cost of GDM is over 17 million dollars (Table 13). PGDM excess costs are considerably higher. In SFY 2012, PGDM cost the state approximately 63 million additional Medicaid dollars when compared to the non-diabetic normal weight index value. Even with the costliest 5% infants removed from the estimate, PGDM cost Medicaid over 38 million dollars (Table 14).

Table 13

EXCESS COSTS OF GESTATIONAL DIABETES MELLITUS

	Total Costs*	Individuals	Average Costs	Cost Difference No Diabetes - Normal Weight	Excess Costs of GDM
Maternal Medical	$81,656,851	18,028	$4,529	$651	**$11,738,181**
Maternal Vendor Drug	$1,260,596	10,014	$126	$20	**$203,212**
Infant Medical*	$45,739,831	16,984	$2,693	$302	**$5,132,099**
Infant Vendor Drug	$2,956,378	10,730	$276	$35	**$374,889**
GDM costs (excluding costliest 5% of all infants)	$131,613,656	--	--	--	**$17,448,381**
Infant medical (including top 5 percentile)	$58,133,675	894	$65,026	-$8,035	**-$7,183,722**
Total costs of GDM (includes all infants)	$189,747,330	--	--	--	**$10,264,659**

*excludes the costliest 5% of all infants

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Birth Certificate Data, Center for Health Statistics, DSHS.

Table 14

EXCESS COSTS OF PRE-GESTATIONAL DIABETES MELLITUS

	Total Costs*	Individuals	Average Costs	Cost Difference No Diabetes - Normal Weight	Excess Costs of PGDM
Maternal Medical	$53,077,941	8,183	$6,486	$2,608	**$21,341,504**
Maternal Vendor Drug	$1,419,794	5,742	$247	$142	**$813,493**
Infant Medical*	$33,737,990	7,727	$4,366	$1,975	**$15,263,194**
Infant Vendor Drug	$2,192,920	5,156	$425	$185	**$952,458**
GDM costs (excluding costliest 5% of all infants)	$90,428,645	--	--	--	**$38,370,649**
Infant medical (including top 5 percentile)	$54,619,062	407	$134,199	$61,137	**$24,882,842**
Total costs of GDM (includes all infants)	$145,047,707	--	--	--	**$63,253,491**

*excludes the costliest 5% of all infants

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Birth Certificate Data, Center for Health Statistics, DSHS.

EPILOGUE AND IMPLICATIONS

The true prevalence of gestational diabetes mellitus (GDM) worldwide, nationally, and at the state level is highly variable and likely under reported. The Texas rate, based on readily accessible vital records indicated that fewer than 5% of pregnant Texas women were diagnosed with the disease. More recent analyses based on THCIC discharge data increased the estimated prevalence to 6%. This report, although focusing on Medicaid enrollees only, suggests that as many as 9% of all pregnant women may develop GDM prior to delivery.

This higher rate, and the likelihood that it will continue to increase over time, has significant implications on the health of not just the pregnant woman, but the immediate and long term consequences to her newborn. Like pre-gestational diabetes, chronic hyperglycemia as a result of GDM contributes to higher risks for C-section, and other adverse maternal outcomes, macrosomia, dystocia and other abnormal conditions of the newborn that may also lead to a greater likelihood of NICU admission. The onset of GDM during pregnancy leads to a greater risk of both the mother and her child developing type 2 diabetes later in life.

However, unlike PGDM, the risk for gestational diabetes if identified before or early during pregnancy may be preventable, thereby reducing the likelihood of poor pregnancy outcomes. One avenue that seems to be indicated by this report is reducing the risk of adverse pregnancy outcome via weight management. It is clear from the linked birth certificate / Medicaid data that women with normal body mass indices (BMI) are less likely to be at risk for poor perinatal outcomes than overweight and obese women.

The financial costs of GDM are less clear. Maternal costs (medical + drug) for gestational diabetic women enrolled in the Medicaid program cost the health care system about 12 million dollars more than their non-diabetic counterparts (Table 13). The cost among GDM infants is another 5.5 million dollars over the cost of infants of non-diabetic mothers. (Because there are many more complicated births among non-diabetic newborns – and their costs overwhelm the total costs of similar infants born to GDM mothers, the costliest 5% of all infants were excluded from this calculation).

Although the focus of Rider 75, which mandated this report, is gestational diabetes the impact of pre-gestational diabetes on pregnant Medicaid enrollees cannot be ignored. Pregnant women with PGDM are 4 to 5 times more likely to suffer adverse pregnancy outcomes, as are their infants. These poor outcomes translate to considerably higher per capita costs compared to GDM affected pregnancies. The health and financial costs among PGDM pregnancies may not be completely avoidable. However, as made clear by data presented within this report, the relationship of BMI to PGDM indicated that interventions reducing these costs are possible.

MODELING PREGNANCIES AND DELIVERIES OUTCOMES

The results included in this model are the product of logistic regression. Logistic regression is a form of analysis in which explanatory (independent) variables explain a yes/no outcome (dependent) variable.

Regression favors the use of simpler models that can explain all or most of the variation in the data. Statistical tests are used to evaluate if one model is more explanatory than another. Sometimes the tests will show that statistically speaking, the models are identical. In the event that two models are statistically similar, the simpler model is preferred. The statistical models used in the analysis were compared to a "null" model as a measure of the model's "fit." Each model performed better than the "null" model and "fits" the data.

The decision on whether or not to include an explanatory variable into a model is based on an evaluation of the variable's statistical worth in the model, prior scientific knowledge, and biological plausibility. Variables that don't explain the outcome variable well are generally removed from the regression model.[†††††]

Odds Ratios Calculations

Odds ratios and standard errors used to compare various outcomes by risk group were obtained using the MedCalc program. [(101)] Logistic regression model results were calculated using R version 3.0.3. [(33)] An odds ratio is the ratio of the odds of having an outcome of interest and the risk factor and the odds of not having the outcome of interest and not having the risk factor. [(32)] An odds ratio of greater than 1 indicates an increase in the odds of having the outcome when also having the risk factor. When an odds ratio is less than 1, the risk factor is commonly regarded as protective as it decreases the odds of having the outcome. An odds ratio of exactly 1 indicates that the presence of the risk factor does not change the odds of having the outcome. In statistics, if the interval between the lower and upper confidence limits includes 1, the resulting odds ratio is not significant. [(32)]

The mathematical formula for the odds ratio:

$$OR = \frac{\pi(1)/[1-\pi(1)]}{\pi(0)/[1-\pi(0)]}$$

The odds ratio is commonly used in epidemiology as a measure of association. When the probability of having a disease is rare, the odds ratio approximates the relative risk. When interpreting the odds ratio as a relative

[†††††] The regression model used the following variables: 1) Diabetes status as determined from a combination of Medicaid claims and birth certificate data categorized into three categories [No diabetes, Gestational diabetes, Pre-pregnancy diagnosed diabetes], 2) Maternal pre-pregnancy weight categorized into 3 BMI categories [Normal/Underweight, Overweight, Obese], 3) Maternal Age, 4) Maternal Race/Ethnicity categorized into four groups [Anglo, Black, Hispanic, Other], and 5) An interaction term between diabetes status and weight.

risk, it is possible to say that the OR is a measure of the likelihood of developing a disease given the presence or absence of a risk factor.

Pregnancies

A common regression model was developed using the variables listed above to examine any effects that the variables may have on pregnancy outcomes. The pregnancy outcomes of interest were C-section utilization, the presence of any form of hypertension, the presence of any maternal morbidity, and the admittance of a mother into the Intensive Care Unit (ICU). A model was created for each outcome variable for a total of four models.

Pre-pregnancy diagnosed diabetes, weight, age, and race/ethnicity were all statistically significant predictors of the outcome variables in each model. Increases in maternal age and the presence of PGDM resulted in increased odds of having an outcome of interest in each model. Increasing BMI level results in increased odds of a C-section or having hypertension, but is reduces the odds of having a maternal morbidity or ICU admittance.

The number of pregnancies resulting in ICU admittance or any form of maternal morbidity was small compared to the total number of pregnancies. Consequently, the regression models were less reliable for use in analysis. In these models, gestational diabetes was not a statistically significant predictor.

Each model indicated that the interaction term between BMI and diabetes status does not statistically add to the predictive qualities of the model.

Deliveries

A common regression model was developed using the variable listed above to examine the effects that the variables may have on delivery outcomes. The delivery outcomes of interest were infants with large for gestational age, births with fetal intolerance of labor, births with any congenital defect, births with any abnormal condition, and admittance of an infant into the Neonatal Intensive Care Unit (NICU). A model was created for each outcome variable for a total of four models.

Age was the only predictive variable with statistical significance in each model. In the models with NICU admissions and births congenital defects, the interaction term between diabetes and BMI category was not statistically important. The term can be removed without changing the predictive qualities of the model. Although individual models were developed for specific outcomes, it becomes clear that several commonalities exist when looking at maternal or neonatal outcomes in general. The presence of PGDM, maternal BMI, and race/ethnicity are independent variables which predict maternal outcomes (**Table 15).**

Maternal age and race/ethnicity provide much of the predictive power of neonatal outcomes relative to other independent variables. However PGDM, maternal weight (BMI), and the interaction of GDM with obesity provide additional predictive power among various neonatal outcomes **(Table 15).**

Table 15 (see also Tables A13-A19; Supplemental Data)

Variable Significance by Model

	Neonatal Outcomes					Maternal Outcomes			
Independent Variable	**Large for Gestational Age**	**NICU Admission**	**Newborn with Any Congenital Defect**	**Newborn with Any Abnormal Condition**	**Delivery with Fetal Intolerance of Labor**	**C-Section**	**Any Hypertension**	**Any Maternal Morbidity**	**Admittance to ICU**
Intercept	***	***	***	***	***	***	***	***	***
Diabetes Status									
GDM	***					***	***		.
PDGM	***	***		***		***	***	***	***
BMI									
Overweight	***	.		**	***	***	***	***	***
Obese	***		*		***	***	***	***	***
Mother's Age	***	***	**	***	***	***	***	***	***
Race/Ethnicity									
Black	***	***	*	***	***	***	***	**	***
Hispanic	.	***		***	***	***	***	**	***
Other	***	*			***	***	***	**	*
Interaction									
GDM*Overweight					.				
PDGM*Overweight								.	
GDM*Obese	***	**		**	.		*		
PDGM*Obese	***			.	**	.		*	*
Number of observations with outcome of interest:	17,756	16,157	518	20,605	9,942	68,906	12,145	1,970	729
Number of observations without outcome of interest:	170,794	187,187	202,826	182,739	193,402	134,423	191,199	201,374	202,615

Notes:
The reference category for diabetes status is: No Diabetes
The reference category for BMI is: Normal/Underweight
The reference category for Race/Ethnicity is: Anglo
The reference category for the interaction is: No Diabetes*Normal/Underweight
Significance Codes: "***" <0.001 "**" <0.01 "**" <0.05 "." <0.1
Data source: Texas Live Birth Certificate, Center for Health Statistics, DSHS

METHODS AND APPENDICES

Data Sources

Live birth and Fetal death data cover SFY2012 (Sept 2011-August 2012). Birth-infant death data are for CY2011. These are the most current data available as of 4/2/2014. The source of these data is the Center for Health Statistics, Texas Department of State Health Services (DSHS).

Hospital discharge data are for CY2012. The source of these data is the Center for Health Statistics, Texas Department of State Health Services (DSHS)

BRFSS CY2002-2012 data were provided by the Center for Health Statistics (CHS). *Texas Behavioral Risk Factor Surveillance System Survey Data*. Austin, Texas: Texas Health and Human Services System, Texas Department of State Health Services,

Medicaid and CHIP data cover SFY2012. The source of these data is the Center for Strategic Decision Support, Texas Health and Human Services Commission. Specific data universes utilized for this report include:

AHQP Claims Universe, TMHP.
Enc_Best Picture Universe, TMHP.
8 Month Eligibility Database, HHSC.
DSP.CHIP_HX . CHIP Enrollment file 2013 (Risk Group Codes: 305 & 306), HHSC.

Description of Medicaid and CHIP programs

Emergency Medicaid, Type Program 30 (TP 30), is a federally required program that is jointly funded by the federal and state government. TP 30 provides Medicaid coverage, limited to emergency medical conditions including childbirth and labor, for non-citizens as well as undocumented immigrants living in the US. (Source: http://www.hhsc.state.tx.us/reports/2010/Rider59Report_2010.pdf). TP40 is 133 to 185 of FPL vs other Medicaid categories which is up to 133% of FPL.

Pregnant Women, Medicaid, Type Program 40 (TP 40) - Pregnancy and perinatal services (including labor and delivery) provided to financially eligible women based on a family's income level compared to the Federal Poverty Level (FPL). The FPL is intended to identify the minimum amount of income a family would need to meet certain, very basic, family needs. FPLs indicate annual income levels by family size and are updated each year by the US Department of Health and Human Services.

CHIP Perinatal Program– The Children's Health Insurance Program (CHIP) Perinatal Program provides CHIP perinatal benefits for 12 months to the unborn children of non-Medicaid-eligible women. This program allows pregnant women who are ineligible for Medicaid because of income (186 to 200 percent of the FPIL) or immigration status (with an income at or below 200 percent of FPIL) to receive prenatal care and provides CHIP benefits to the child upon delivery for the duration of the coverage period. Continuous Medicaid coverage for 12 months is provided from birth to CHIP Perinatal newborns whose mothers are at or below 185 percent of FPIL and received Emergency Medicaid for the labor and delivery. The 12 months of continuous Medicaid coverage for the newborn is available *only* if the mother received Medicaid for labor and delivery.

Newborns: (under 12 months) - born to mothers who are Medicaid certified at the time of the child's birth are automatically eligible for Medicaid and remain eligible until their first birthday as long as the child resides in Texas. Children up to age 1 whose family income and resources are above the current requirements for Temporary Assistance for Needy Families (TANF), but not above 185 percent of the federal poverty level (FPL). The Children's Health Insurance Program (CHIP) covers newborns up to 200 percent of the federal poverty level (FPL).

Protocol for linking vital record data with Medicaid data for Infants and Mothers

Link Plus (Version 2.0),[31] a free program developed by the CDC to link Cancer Registry and other data, was used to link Medicaid data for infants and mothers to live birth certificate data and linked birth-infant death data in Texas. Link Plus uses probabilistic record linkage algorithms to identify matching records across two files. Match scores are assigned for each potential match pair based on the defined linkage algorithm; higher scores indicate greater probability of a match. The table below defines basic terms and concepts used in the linkage process, and summarizes our use of them for our project in Texas.

	Description	Infant Data Linkage Protocol	Maternal Data Linkage Protocol
Data files	Medicaid data files for infants and mothers were linked separately to the birth certificate file. This same procedure was used to match Medicaid data with the linked birth-infant death file.	Medicaid newborns were identified as those infants whose first enrollment month in Medicaid was the month of their birth. To allow for all Medicaid retroactivity to be included, 8 months were allowed to elapse before Medicaid eligibility data for any given month were considered complete.	Medicaid mothers were identified as those mothers whose deliveries were paid by Medicaid. Fee-for-service (FFS) delivery claims were identified using MS-DRG codes 765-768 and 774-775. Health Maintenance Organization (HMO) delivery encounters were selected from the Delivery Supplemental Payment (DSP) program based on diagnosis and procedure codes.
Blocking	An initial step to reduce the number of record comparisons and increase efficiency of linkage. At least one blocking variable must match *exactly* between the two records being compared; subsequent comparisons are made only within blocks.	Blocking variables and phonetic system: • Infant's first name (NYSIIS‡‡‡‡‡) • Infant's last name • Infant's date of birth	Blocking variables and phonetic system: • Mother's first name (NYSIIS) • Mother's last name (NYSIIS) • Mother's date of birth • Infant's date of birth was used in Round 3 of matching
Matching	Within a block, matching variables are compared to generate a	Matching variables and matching method:	Matching variables and matching method:

‡‡‡‡‡ New York State Identification and Intelligence System (NYSIIS) offers an improvement to the Soundex algorithm, with a reported accuracy increase of 2.7% over Soundex. NYSIIS is more distinctive than Soundex; people are more likely to have the same Soundex than the same NYSIIS. Some studies suggest NYSIIS performs better than Soundex when Spanish names are used. Given the large proportion of Spanish names in the Texas birth data, NYSIIS was used for the current project.

	match score for each record pair.	• Infant's first name (first name) • Infant's last name (last name) • Infant's date of birth (date) • Infant's residence ZIP code (ZIP code) • Infant's middle name (middle name) • Infant's sex	• Mother's first name (first name) • Mother's last name (last name) • Mother's date of birth (date) • Mother's residence ZIP code (ZIP code) • Mother's Medicaid number (exact) • Infant's birth hospital (generic string) • Mother's middle name (middle name) • Infant's month of birth (exact)
Match score	The total probability weight assigned to each record pair; equal to the sum of scores generated by comparing each match field. Based on software-calculated M probability (sensitivity) and U probability (specificity).	The range of match scores was examined to determine upper and lower cut-off values. High match scores are designated true matches and scores below 10.0 are automatically designated false matches. Record pairs between cut-off values are clerically reviewed.	The range of match scores was examined to determine upper and lower cut-off values. High match scores are designated true matches and scores below 10.0 are automatically designated false matches. Record pairs between cut-off values are clerically reviewed.
Clerical review	Case-by-case review of uncertain matches that fall between the upper and lower cut-off values. Additional fields were considered to assist in the designation of match status.	Additional variables: • Infant's county of residence	Additional variables: • Mother's street address of residence • Mother's residence city
Result		Infants Medicaid ID numbers were derived.	Mothers Medicaid ID numbers were derived.

Link Plus (Version 2.0) was also used to link fetal death data with Medicaid data for mothers.

	Description	Maternal data linkage protocol
Data files	Medicaid data for mothers were linked to the fetal death certificate file.	Medicaid mothers were identified as those mothers whose deliveries were paid by Medicaid. Fee-for-service (FFS) delivery claims were identified using MS-DRG codes 765-768 and 774-775. Health Maintenance Organization (HMO) delivery encounters were selected from the Delivery Supplemental Payment (DSP) program based on diagnosis and procedure codes.
Matching	Within a block, matching variables are compared to generate a match score for each record pair.	Matching variables and matching method: • Mother's first name (first name) • Mother's last name (last name) • Mother's date of birth (date) • Mother's date of delivery (date) • Mother's middle name (middle name)
Match score	The total probability weight assigned to each record pair; equal to the sum of scores generated by comparing each match field. Based on software-calculated M probability (sensitivity) and U probability (specificity).	The range of match scores was examined to determine upper and lower cut-off values. High match scores are designated true matches and scores below 10.0 are automatically designated false matches. Record pairs between cut-off values are clerically reviewed.
Result		Mothers Medicaid ID numbers were derived.

Medicaid Eligibility Data Preparation

The Medicaid eligibility file differs from the birth certificate file in the following respects:

- Infant's ZIP code in the Medicaid eligibility file could sometimes represent his/her first ZIP code as listed in the 8-month enrollment. In the birth certificate data, the ZIP code is the mother's ZIP code of usual residence.
- Infants who die soon after birth may not be included in the Medicaid eligibility file. The birth certificate file has data on all live births to Texas residents regardless of how long the baby lived.
- The CHIP Perinatal Program began in January 2007 in Texas. Beginning September 2010, newborns under 185% of the Federal Poverty Level (FPL) began moving out of the CHIP Perinatal Program and into Medicaid due to changes in eligibility. This may explain the

trends in the Medicaid caseload for infants. (Texas Medicaid and CHIP in Perspective, 9th edition; HHSC, January 2013).[25]

Medicaid Delivery Data Preparation

Medicaid delivery data files were prepared by the Center for Strategic Decision Support, Texas Health and Human Services Commission. Fee-For-Service (FFS) and Primary Care Case Management (PCCM) delivery claims were identified using CMS-DRG codes 370-375 for discharge dates before 10/1/2007 and MS-DRG codes 765-768 and 774-775 for discharge dates on or after 10/1/2007. Health Maintenance Organization (HMO) delivery encounters were selected from the Delivery Supplemental Payment (DSP) program based on diagnosis and procedure codes.

For FFS/PCCM claims, the mother's physical address was as reported on the claim form. For DSP claims, the address data represent the mother's physical address as listed on the Medicaid eligibility files. The DSP file was matched to Medicaid Eligibility data to get the mother's most recent physical address because the DSP file did not include her address.

For SFY2012 there were 205,080 records in the Medicaid delivery file. These represented 204,563 women whose deliveries were paid by Medicaid in SFY2012. Since mothers can give birth more than once in a fiscal year, the Medicaid delivery file was de-duplicated using mother's Medicaid ID number, infant's month, and infant's year of birth. This de-duplication resulted in 205,023 rows in the Medicaid delivery file.

The Medicaid delivery file differs from the birth certificate file in the following respects:

- Multiple births (e.g., twins, triplets, etc.) are counted as one delivery episode in the Medicaid delivery file but as separate births in the birth certificate data.
- Mother's physical address in the Medicaid delivery file could sometimes represent her most recent address from the Medicaid Eligibility data and not her address at the time of delivery. In the birth certificate data, the mother's physical address is her place of usual residence.
- The Medicaid delivery file includes data for deliveries that resulted in live births and still births. The birth certificate file is limited to live births only.
- The Medicaid delivery file could have more than one claim for an infant's delivery and if the claims were separated by more than a month, they were counted as more than one delivery. In the birth certificate file, each infant is counted only once.
- Deliveries to undocumented immigrants and non-citizens who qualify for Emergency Medicaid (TP 30) are included in the Medicaid delivery data. For these mothers, Texas may not always be reported as their state of residence on their infants' birth certificates which would result in these records being excluded from the birth certificate data for Texas residents.

Table M1: Crosstab of SFY Linked Pairs Concordance: Birth vs Medicaid Data

		Linked Birth-Infant Records Using Birth-Month Medicaid Data		
		Not linked	Linked	Total
Linked Birth-Infant Records Using Mother's Medicaid Delivery Data	Not linked	141,350	35,184	176,534
	Linked	4,848	198,643	203,491
	Total	146,198	233,827	380,025

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Birth Certificate Data, Center for Health Statistics, DSHS.

Analysis of the Birth Certificate

Most analyses of SFY 2012 birth vital records used only information on the birth certificate except for the MOM_PCN field which was created by linking a file of Medicaid paid births to the birth certificate. If MOM_PCN was not empty, the birth is considered to be a Medicaid paid birth and included in analysis of the Medicaid population.

The birth certificate was the only source of information for the non-Medicaid population, so mother's BMI and diabetes status were derived from fields on the birth certificate for that population. BMI was calculated based on the woman's pre-pregnancy weight and height. Information on BMI calculation is available on the CDC website (http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/). Diabetes status was calculated based on fields which asked if the mother had gestational diabetes or pre-pregnancy diagnosed diabetes. If the birth certificate indicated that a woman had both gestational and pre-pregnancy (type 1 or 2) diabetes then the pregnancy was considered to have occurred to a woman with pre-pregnancy diabetes.

For women in a Medicaid program, additional information is available by studying claims records. ICD-9 diagnosis codes for any medical claims were used to identify women with diabetes at any time 180 days prior to delivery through 30 days after delivery. Medicaid data was combined with information from the birth certificate to identify additional women with gestational, type 1, or type 2 diabetes. If either Medicaid claims or the birth certificate indicated a diagnosis of diabetes (gestational, type 1 or type 2), the pregnancy was classified as occurring to a woman with diabetes. When comparisons were made between deliveries paid by Medicaid and another payor source, diabetes status was calculated only using fields on the birth certificate.

Analysis of Deliveries:

Analyses of birth outcomes in which the infant's condition was the outcome of interest were developed by studying individual deliveries. The birth certificate provided infant characteristics (weight, estimated gestational age, NICU admission, etc…) for individual deliveries at the time of birth. Medicaid status was based on whether or not the delivery was paid for by Medicaid.

Large for gestational age calculations are derived from an infant's estimated gestational age and birth weight. Growth charts are available for male and female infants (http://pediatrics.aappublications.org/content/125/2/e214.long).

Analysis of Pregnancies:

A woman may have multiple deliveries, but only one maternal condition (hypertension, weight, ICU admission, etc…), so maternal outcomes were analyzed by looking at individual pregnancies. This poses a problem because 1) birth records for multiples can have data inconsistencies for maternal conditions and 2) a woman can have more than one pregnancy during a 12 month period.

To address issue 1, a choice was made to utilize the most clinically significant outcome for all multiples. For example, if a woman had two different pre-pregnancy weights, the largest was used. To address the second issue, a field that indicates a birth with multiples was used to separate singleton births from pregnancies with multiple births. All singleton births were considered to be separate pregnancies. Multiple deliveries were combined into individual pregnancies based on the time of the year for the birth, mother's zipcode, and mother's date of birth.

The Medicaid data provides information on individual pregnancies, not deliveries. This resulted in less data preprocessing. However, the data does not provide easy methods to separate an individual woman's multiple pregnancies. A linkage was made between the Medicaid claims data and the birth certificate by mother's PCN. A birth window was created around each birth of 180 days prior to the birth and 30 days afterwards. If a claim fell within the window, then it was considered a pregnancy/birth claim. In this way, multiple pregnancies were separated based on the window. The window of claims was used to determined diabetes status.

ICD-9 Diagnosis Codes

Code	ICD-9 Codes
648.0	Pregnancy with diabetes complication
648.8	Gestational Diabetes

Analysis of The THCIC Public Use Data Files

File Preparation

Quarterly public use data files from 2012 were combined to form a complete annual data file. Some third quarter claims were removed per technical update instructions on the THCIC website.

Variable Definitions

Delivery claims were identified as having a DRG code of 765,766,767,768,774, or 775.

Pregnancies were identified by using Clinical Classification Software (CCS) single level diagnosis codes 177-195. CCS is a system for separating thousands of ICD-9 diagnosis and procedure codes into smaller, clinically significant groups. The 19 CCS codes used to identify a pregnancy map to 1,110 ICD-9 diagnosis codes. Non-delivery pregnancy claims were identified as having a pregnancy related CCS code, but did not have a delivery claim DRG code.

Medicaid paid claims were determined by having "MC" as the first payment source.

Gestational diabetes status was determined by having any diagnosis code of 648.8. Identification of the presence of type 1 or type 2 diabetes was determined by having any diagnosis code of 648.0.

SUPPLEMENTAL DATA: Prevalence

Table A1

Texas Medicaid (TP 40) Pregnant Women with Gestational Diabetes, FY 2012

Public Health Region	Number of TP 40 Women Diagnosed with Gestational Diabetes (All diagnosis ICD-9 code	Number of TP 40 Medicaid Patients Screened for Gestational Diabetes**	Number of Pregnant Women Enrolled in Texas Medicaid***	Percentage of Pregnant Women Screened for Gestational Diabetes	Percentage of Pregnant Women Diagnosed with Gestational Diabetes
1	817	4,586	12,311	37.25%	6.64%
2	326	2,822	7,341	38.44%	4.44%
3	4,448	26,677	67,824	39.33%	6.56%
4	1,149	5,745	14,734	38.99%	7.80%
5	538	4,130	10,592	38.99%	5.08%
6	4,398	27,274	64,953	41.99%	6.77%
7	1,750	10,434	28,043	37.21%	6.24%
8	2,941	15,086	35,480	42.52%	8.29%
9	526	4,040	9,251	43.67%	5.69%
10	974	5,444	12,916	42.15%	7.54%
11	4,416	17,486	37,101	47.13%	11.90%
unduplicated total	22,425	123,951	294,878	42.03%	7.60%

* Note: Gestational Diabetes was defined as ICD-9 code 648.8 listed as any diagnosis on the claim/encounter during FY 2012.

**Note: Gestational Diabetes Screenings were defined as procedure codes:

82947= ASSAY, GLUCOSE, BLOOD QUANT
82950= GLUCOSE TEST
82951= GLUCOSE TOLERANCE TEST (GTT)
82962= GLUCOSE BLOOD TEST

***Note: Pregnant Women were defined as Medicaid Clients enrolled in Type Program 40 during FY 2012.

Source: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database, HHSC.
Prepared by Strategic Decision Support, HHSC. May 2014 (ta).
Filename: TX Medicaid Gestational Diabetes by Region FY 2012_final.xls

Table A2

Texas Medicaid for TP30 Women Age 14-50 with Gestational Diabetes, FY 2012

Public Health Region	Number of TP30 Diagnosed Women with Gestational Diabetes*	Number of TP30 Women Screened for Gestational Diabetes**	Number of TP30 Women Enrolled in Texas Medicaid***	Percentage of TP30 Women Screened for Gestational Diabetes	Percentage of TP30 Women Diagnosed with Gestational Diabetes
1	84	1	1,146	0.09%	7.33%
2	12	6	318	1.89%	3.77%
3	1,588	43	21,252	0.20%	7.47%
4	145	16	1,948	0.82%	7.44%
5	84	6	1,109	0.54%	7.57%
6	1,785	44	22,326	0.20%	8.00%
7	540	10	6,420	0.16%	8.41%
8	382	16	3,517	0.45%	10.86%
9	34	8	690	1.16%	4.93%
10	180	6	2,211	0.27%	8.14%
11	661	95	12,707	0.75%	5.20%
unduplicated total	5,495	251	73,629	0.34%	7.46%

* Note: Gestational Diabetes was defined as ICD-9 code 648.8 listed as any diagnosis on the claim/encounter during FY 2012.

** Note: Gestational Diabetes Screenings were defined as procedure codes:

82947= ASSAY, GLUCOSE, BLOOD QUANT
82950= GLUCOSE TEST
82951= GLUCOSE TOLERANCE TEST (GTT)
82962= GLUCOSE BLOOD TEST

*** Note: Pregnant Women were defined as Medicaid Clients for FFS enrolled in Type Program 30 during FY 2012.

Source: AHQP Claims Universe, TMHP; 8 Month Eligibility Database, HHSC.
Prepared by Strategic Decision Support, HHSC. May 2014 (ta).
Filename: TX Medicaid Gestational Diabetes by Region FY 2012_final.xls

Table A3

Texas CHIP Pregnant Women with Gestational Diabetes, FY 2012

Public Health Region	Number of CHIP Perinate Women Diagnosed with Gestational Diabetes (All diagnosis ICD-9 code 648.8)*	Number of CHIP Perinate Women Screened for Gestational Diabetes**	Number of CHIP Perinate Women Enrolled in Texas CHIP***	Percentage of CHIP Perinate Women Screened for Gestational Diabetes	Percentage of CHIP Perinate Women Diagnosed with Gestational Diabetes
1	216	774	1,737	44.56%	12.44%
2	36	156	481	32.43%	7.48%
3	3,382	14,895	28,602	52.08%	11.82%
4	322	1,128	2,763	40.83%	11.65%
5	193	866	1,670	51.86%	11.56%
6	3,527	16,753	29,406	56.97%	11.99%
7	808	4,518	9,193	49.15%	8.79%
8	676	2,424	5,150	47.07%	13.13%
9	52	435	953	45.65%	5.46%
10	330	1,283	2,946	43.55%	11.20%
11	1,452	6,219	14,397	43.20%	10.09%
unduplicated total	11,110	49,905	96,949	51.48%	11.46%

* Note: Gestational Diabetes was defined as ICD-9 code 648.8 listed as any diagnosis on the CHIP during FY 2012.

** Note: Gestational Diabetes Screenings were defined as procedure codes:

82947= ASSAY, GLUCOSE, BLOOD QUANT
82950= GLUCOSE TEST
82951= GLUCOSE TOLERANCE TEST (GTT)
82962= GLUCOSE BLOOD TEST

*** Note: Pregnant Women were defined as CHIP Clients enrolled in Type Program 40 during FY 2012.

Source: TMHP; Enc_Best Picture Universe, TMHP; DSP.CHIP_HX . CHIP Enrollment file 2013(Risk_Group Codes: 305 & 306), HHSC.
Prepared by Strategic Decision Support, HHSC. March 2014 (wl).
Filename: TX Medicaid Gestational Diabetes by Region FY 2012_final.xls

SUPPLEMENTAL DATA: Outcomes

Table A4

Medicaid Population (SFY 2012) Demographics by Diabetic condition and BMI

No Known Diabetes	Normal		Overweight		Obese		Total non-Diabetic	
Total Pregnancies	91,046	52.4%	43,384	25.0%	39,260	22.6%	173,690	86.9%
MATERNAL DEMOGRAPHICS								
Race/Ethnicity (by BMI)								
Anglo	19,551	21.5%	8,273	19.1%	7,853	20.0%	35,677	20.5%
Black	12,109	13.3%	5,952	13.7%	6,571	16.7%	24,632	14.2%
Hispanic	55,277	60.7%	28,087	64.7%	24,168	61.6%	107,532	61.9%
Other	4,109	4.5%	1,072	2.5%	668	1.7%	5,849	3.4%
Mother's Educational Status								
Less than high school	32,271	35.5%	15,908	36.7%	12,269	31.3%	60,448	34.8%
High School Diploma	33,411	36.7%	14,315	33.0%	14,178	36.1%	61,904	35.7%
Some College/Associate's Degree	21,177	23.3%	11,258	26.0%	11,286	28.8%	43,721	25.2%
Bachelor's Degree+	4,109	4.5%	1,865	4.3%	1,498	3.8%	7,472	4.3%
Place of Birth								
Hospital	90,909	99.9%	43,325	99.9%	39,202	99.9%	173,436	99.9%
Licensed Birth Center	113	0.1%	46	0.1%	47	0.1%	206	0.1%
Clinic/Doctor's Office		0.0%		0.0%		0.0%		0.0%
Home Birth	20	0.0%	13	0.0%	10	0.0%	43	0.0%
Metropolitan County Births*	87,323	95.9%	41,375	95.4%	37,210	94.8%	165,908	95.6%
Non-Metropolitan County Births*	3,697	4.1%	1,989	4.6%	2,035	5.2%	7,721	4.4%
Frequency of Unmarried Mothers	59,254	65.1%	26,221	60.4%	23,199	59.1%	108,674	62.6%
Mean Mother's Age*	24.17		25.45		25.97		24.90	
Previous Live Births								
Mean Number Now Living	1.05		1.35		1.45		1.22	
Mean Number Now Dead	0.01		0.01		0.01		0.01	
Mean Number of 'Other' Pregnancy Outcomes	0.26		0.31		0.34		0.29	
Mean Onset of Prenatal Care*	4.03		4.03		3.96		4.02	
Mean # Prenatal Visits*	9.85		9.95		10.18		9.95	
Prenatal Care	86,440	94.9%	41,415	95.5%	37,688	96.0%	165,543	95.3%
No Prenatal Care	3,331	3.7%	1,498	3.5%	1,120	2.9%	5,949	3.4%
Unknown Prenatal Care	1,275	1.4%	471	1.1%	452	1.2%	2,198	1.3%
Mean Prepregnancy BMI*	21.68		27.26		35.39		26.17	
Mean Weight Change*	31.92		29.45		24.62		29.65	

Gestational Diabetes (GDM)	Normal		Overweight		Obese		Total GDM	
Total Pregnancies	6,440	35.7%	4,758	26.4%	6,837	37.9%	18,035	9.0%
MATERNAL DEMOGRAPHICS								
Race/Ethnicity (by BMI)								
Anglo	1,350	21.0%	795	16.7%	1,284	18.8%	3,429	19.0%
Black	610	9.5%	462	9.7%	809	11.8%	1,881	10.4%
Hispanic	4,007	62.2%	3,315	69.7%	4,616	67.5%	11,938	66.2%
Other	473	7.3%	186	3.9%	128	1.9%	787	4.4%
Mother's Educational Status								
Less than high school	2,151	33.4%	1,803	37.9%	2,222	32.5%	6,176	34.3%
High School Diploma	2,364	36.7%	1,452	30.5%	2,318	33.9%	6,134	34.0%
Some College/Associate's Degree	1,574	24.5%	1,245	26.2%	1,988	29.1%	4,807	26.7%
Bachelor's Degree+	348	5.4%	257	5.4%	305	4.5%	910	5.0%
Place of Birth								
Hospital	6,433	99.9%	4,758	100.0%	6,830	99.9%	18,021	99.9%
Licensed Birth Center	4	0.1%	0	0.0%	7	0.1%	11	0.1%
Clinic/Doctor's Office		0.0%		0.0%		0.0%		0.0%
Home Birth	2	0.0%	0	0.0%	0	0.0%	2	0.0%
Metropolitan County Births*	6,128	95.2%	4,549	95.6%	6,503	95.1%	17,180	95.3%
Non-Metropolitan County Births*	311	4.8%	209	4.4%	334	4.9%	854	4.7%
Frequency of Unmarried Mothers	3,749	58.2%	2,487	52.3%	3,469	50.7%	9,705	53.8%
Mean Mother's Age*	26.59		28.21		28.21		27.64	
Previous Live Births								
Mean Number Now Living	1.23		1.55		1.61		1.46	
Mean Number Now Dead	0.01		0.01		0.02		0.01	
Mean Number of 'Other' Pregnancy Outcomes	0.32		0.37		0.38		0.36	
Mean Onset of Prenatal Care*	3.82		3.78		3.82		3.81	
Mean # Prenatal Visits*	10.66		10.65		10.93		10.75	
Prenatal Care	6,232	96.8%	4,613	97.0%	6,661	97.4%	17,506	97.1%
No Prenatal Care	120	1.9%	81	1.7%	112	1.6%	313	1.7%
Unknown Prenatal Care	88	1.4%	64	1.3%	64	0.9%	216	1.2%
Mean Prepregnancy BMI*	21.92		27.40		36.15		28.76	
Mean Weight Change*	31.69		28.93		22.88		27.62	

Prepregnancy Diagnosed Diabetes (PGDM)	Normal		Overweight		Obese		Total PGDM	
Total Pregnancies	2,073	25.3%	1,836	22.4%	4,283	52.3%	8,192	4.1%
MATERNAL DEMOGRAPHICS								
Race/Ethnicity (by BMI)								
Anglo	506	24.4%	331	18.0%	760	17.7%	1,597	19.5%
Black	239	11.5%	204	11.1%	607	14.2%	1,050	12.8%
Hispanic	1,191	57.5%	1,228	66.9%	2,844	66.4%	5,263	64.2%
Other	137	6.6%	73	4.0%	72	1.7%	282	3.4%
Mother's Educational Status								
Less than high school	627	30.3%	625	34.1%	1,242	29.0%	2,494	30.5%
High School Diploma	810	39.1%	625	34.1%	1,503	35.1%	2,938	35.9%
Some College/Associate's Degree	535	25.8%	497	27.1%	1,343	31.4%	2,375	29.0%
Bachelor's Degree+	98	4.7%	88	4.8%	194	4.5%	380	4.6%
Place of Birth								
Hospital	2,073	100.0%	1,836	100.0%	4,282	100.0%	8,191	100.0%
Licensed Birth Center	0	0.0%	0	0.0%	1	0.0%	1	0.0%
Clinic/Doctor's Office		0.0%		0.0%		0.0%		0.0%
Home Birth	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Metropolitan County Births*	1,996	96.4%	1,775	96.7%	4,057	94.8%	7,828	95.6%
Non-Metropolitan County Births*	75	3.6%	61	3.3%	224	5.2%	360	4.4%
Frequency of Unmarried Mothers	1,198	57.8%	939	51.1%	2,117	49.4%	4,254	51.9%
Mean Mother's Age*	27.01		28.75		29.49		28.71	
Previous Live Births								
Mean Number Now Living	1.28		1.64		1.59		1.52	
Mean Number Now Dead	0.02		0.02		0.02		0.02	
Mean Number of 'Other' Pregnancy Outcomes	0.39		0.44		0.47		0.44	
Mean Onset of Prenatal Care*	3.67		3.69		3.62		3.65	
Mean # Prenatal Visits*	11.72		11.57		11.89		11.77	
Prenatal Care	1,988	95.9%	1,782	97.1%	4,161	97.2%	7,931	96.8%
No Prenatal Care	50	2.4%	32	1.7%	80	1.9%	162	2.0%
Unknown Prenatal Care	35	1.7%	22	1.2%	42	1.0%	99	1.2%
Mean Prepregnancy BMI*	22.12		27.51		37.54		31.39	
Mean Weight Change*	32.22		29.45		25.11		27.88	

* Excludes unknowns

Data source: Texas Live Birth Certificate, Center for Health Statistics, DSHS

Non-Medicaid Population (SFY 2012) Demographics by Diabetic condition and BMI

	No Known Diabetes								Gestational Diabetes (GDM)								Prepregnancy Diagnosed Diabetes (PGDM)							
	Normal		Overweight		Obese		Total non-Diabetic		Normal		Overweight		Obese		Total GDM		Normal		Overweight		Obese		Total PGDM	
Total Pregnancies	89,553	55.0%	40,865	25.1%	32,512	20.0%	162,930	95.0%	2,467	33.1%	2,020	27.1%	2,966	39.8%	7,453	4.3%	242	22.8%	245	23.0%	576	54.2%	1,063	0.6%
MATERNAL DEMOGRAPHICS																								
Race/Ethnicity (by BMI)																								
Anglo	49,762	55.6%	19,667	48.1%	14,999	46.1%	84,428	51.8%	1,033	41.9%	780	38.6%	1,135	38.3%	2,948	39.6%	132	54.5%	92	37.6%	183	31.8%	407	38.3%
Black	5,601	6.3%	3,895	9.5%	3,939	12.1%	13,435	8.2%	126	5.1%	152	7.5%	289	9.7%	567	7.6%	14	5.8%	21	8.6%	100	17.4%	135	12.7%
Hispanic	24,376	27.2%	14,627	35.8%	12,453	38.3%	51,456	31.6%	682	27.6%	810	40.1%	1,360	45.9%	2,852	38.3%	54	22.3%	102	41.6%	261	45.3%	417	39.2%
Other	9,814	11.0%	2,676	6.5%	1,121	3.4%	13,611	8.4%	626	25.4%	278	13.8%	182	6.1%	1,086	14.6%	42	17.4%	30	12.2%	32	5.6%	104	9.8%
Mother's Educational Status																								
Less than high school	7,937	8.9%	4,327	10.6%	3,390	10.4%	15,654	9.6%	202	8.2%	269	13.3%	371	12.5%	842	11.3%	20	8.3%	31	12.7%	65	11.3%	116	10.9%
High School Diploma	12,896	14.4%	6,754	16.6%	6,450	19.9%	26,100	16.0%	354	14.4%	342	17.0%	593	20.0%	1,289	17.3%	38	15.7%	45	18.4%	118	20.5%	201	18.9%
Some College/Associate's Degree	23,763	26.6%	12,795	31.4%	11,988	37.0%	48,546	29.9%	639	26.0%	539	26.7%	1,070	36.1%	2,248	30.2%	65	26.9%	77	31.6%	218	37.9%	360	33.9%
Bachelor's Degree+	44,795	50.1%	16,919	41.5%	10,614	32.7%	72,328	44.5%	1,263	51.4%	865	42.9%	931	31.4%	3,059	41.1%	119	49.2%	91	37.3%	174	30.3%	384	36.2%
Place of Birth																								
Hospital	87,042	97.2%	40,029	98.0%	32,037	98.6%	159,108	97.7%	2,438	98.9%	2,003	99.2%	2,946	99.3%	7,387	99.1%	242	100.0%	244	99.6%	576	100.0%	1,062	99.9%
Licensed Birth Center	1,241	1.4%	459	1.1%	219	0.7%	1,919	1.2%	20	0.8%	10	0.5%	13	0.4%	43	0.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Clinic/Doctor's Office	1	0.0%	0	0.0%	0	0.0%	1	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Home Birth	1,228	1.4%	363	0.9%	244	0.8%	1,835	1.1%	8	0.3%	7	0.3%	7	0.2%	22	0.3%	0	0.0%	1	0.4%	0	0.0%	1	0.1%
Metropolitan County Births*	82,793	92.7%	37,051	90.9%	28,822	89.0%	148,666	91.5%	2,340	95.0%	1,868	92.7%	2,661	89.8%	6,869	92.3%	225	93.8%	223	91.0%	520	90.4%	968	91.3%
Non-Metropolitan County Births*	6,479	7.3%	3,698	9.1%	3,578	11.0%	13,755	8.5%	123	5.0%	148	7.3%	303	10.2%	574	7.7%	15	6.3%	22	9.0%	55	9.6%	92	8.7%
Frequency of Unmarried Mothers	17,495	19.5%	8,530	20.9%	7,897	24.3%	33,922	20.8%	315	12.8%	313	15.5%	619	20.9%	1,247	16.7%	35	14.5%	51	20.8%	123	21.4%	209	19.7%
Mean Mother's Age*	28.90		29.38		29.50		29.15		31.10		31.66		31.64		31.47		30.66		31.33		32.40		31.76	
Previous Live Births																								
Mean Number Now Living	0.88		1.05		1.11		0.97		0.97		1.20		1.21		1.12		1.04		0.94		1.21		1.11	
Mean Number Now Dead	0.01		0.01		0.01		0.01		0.01		0.02		0.02		0.02		0.01		0.02		0.02		0.02	
Mean Number of 'Other' Pregnancy Outcomes	0.29		0.33		0.36		0.31		0.36		0.42		0.46		0.41		0.31		0.47		0.57		0.49	
Mean Onset of Prenatal Care*	3.23		3.25		3.25		3.24		3.11		3.17		3.20		3.16		3.19		3.08		3.20		3.17	
Mean # Prenatal Visits*	11.01		11.02		11.15		11.04		11.83		12.09		12.59		12.21		11.80		13.37		12.88		12.83	
Prenatal Care	86,900	97.0%	39,712	97.2%	31,558	97.1%	158,170	97.1%	2,422	98.2%	1,989	98.5%	2,907	98.0%	7,318	98.2%	237	97.9%	241	98.4%	563	97.7%	1,041	97.9%
No Prenatal Care	1,744	1.9%	768	1.9%	638	2.0%	3,150	1.9%	14	0.6%	18	0.9%	33	1.1%	65	0.9%	3	1.2%	3	1.2%	6	1.0%	12	1.1%
Unknown Prenatal Care	909	1.0%	385	0.9%	316	1.0%	1,610	1.0%	31	1.3%	13	0.6%	26	0.9%	70	0.9%	2	0.8%	1	0.4%	7	1.2%	10	0.9%
Mean Prepregnancy BMI*	21.70		27.19		35.34		25.80		22.05		27.43		36.31		29.18		22.11		27.42		37.58		31.72	
Mean Weight Change*	32.97		31.28		24.64		30.88		30.64		27.13		22.19		26.32		32.88		30.30		22.87		26.86	

* Excludes unknowns

Data source: Texas Live Birth Certificate, Center for Health Statistics, DSHS

Medicaid Population (SFY 2012) Outcomes by Diabetic condition and BMI

	No Known Diabetes								Gestational Diabetes (GDM)								Prepregnancy Diagnosed Diabetes (PGDM)							
	Normal		Overweight		Obese		Total non-Diabetic		Normal		Overweight		Obese		Total GDM		Normal		Overweight		Obese		Total PGDM	
MATERNAL LABOR & DELIVERY OUTCOMES																								
Women Who Previously Had a C-Section	9,945	10.9%	6,844	15.8%	8,069	20.6%	24,858	14.3%	834	13.0%	918	19.3%	1,666	24.4%	3,418	19.0%	361	17.4%	435	23.7%	1,239	28.9%	2,035	24.8%
Frequency C-Section Births	24763	26.9%	14725	33.5%	17019	42.7%	56507	32.2%	2106	32.3%	1942	40.3%	3430	49.3%	7478	40.8%	881	41.8%	940	50.5%	2694	61.9%	4515	54.2%
Hypertension																								
Prepregnancy (Chronic)	389	0.4%	291	0.7%	637	1.6%	1,317	0.8%	51	0.8%	63	1.3%	151	2.2%	265	1.5%	55	2.7%	54	2.9%	301	7.0%	410	5.0%
Gestational (PIH preclampsia)	2,917	3.2%	1,816	4.2%	2,565	6.5%	7,298	4.2%	399	6.2%	347	7.3%	743	10.9%	1,489	8.3%	170	8.2%	186	10.1%	660	15.4%	1,016	12.4%
Eclampsia	82	0.1%	39	0.1%	54	0.1%	175	0.1%	3	0.0%	5	0.1%	12	0.2%	20	0.1%	3	0.1%	1	0.1%	13	0.3%	17	0.2%
Deliveries with any Maternal Morbidity	1,169	1.3%	275	0.6%	243	0.6%	1,687	1.0%	90	1.4%	25	0.5%	37	0.5%	152	0.8%	47	2.3%	11	0.6%	31	0.7%	89	1.1%
Births to Women with Other Previous Poor Pregnancy Outcomes	1,247	1.4%	305	0.7%	357	0.9%	1,909	1.1%	114	1.8%	29	0.6%	68	1.0%	211	1.2%	71	3.4%	21	1.1%	46	1.1%	138	1.7%
Mothers Admitted to ICU	465	0.5%	45	0.1%	74	0.2%	584	0.3%	52	0.8%	5	0.1%	12	0.2%	69	0.4%	32	1.5%	7	0.4%	13	0.3%	52	0.6%
Number of Births In Which Mother Was Transferred	159	0.2%	90	0.2%	68	0.2%	317	0.2%	19	0.3%	10	0.2%	13	0.2%	42	0.2%	2	0.1%	9	0.5%	19	0.4%	30	0.4%
NEONATAL OUTCOMES																								
Total Births	91,952		43,926		39,860		175,738		6,523		4,824		6,961		18,308		2,108		1,862		4,353		8,323	
Mean Length of Gestation*	39.38		39.51		39.48		39.48		39.17		39.19		39.15		39.19		38.81		38.95		38.97		39.00	
Early Gestation (<37 weeks)	11,752	12.8%	5,330	12.1%	5,002	12.5%	22,084	12.6%	942	14.4%	691	14.3%	1,062	15.3%	2,695	14.7%	417	19.8%	368	19.8%	915	21.0%	1,700	20.4%
Mean Birth Weight (g)	3,160		3,234		3,265		3,202		3,183		3,287		3,355		3,275		3,152		3,238		3,325		3,261	
Low Birth Weight (<2500 g)	8,403	9.1%	3,411	7.8%	3,191	8.0%	15,005	8.5%	605	9.3%	357	7.4%	534	7.7%	1,496	8.2%	266	12.6%	206	11.1%	488	11.2%	960	11.5%
Large for Gestational Age	6,173	6.7%	3,643	8.3%	3,987	10.0%	13,803	7.9%	581	8.9%	584	12.1%	1,104	15.9%	2,269	12.4%	270	12.8%	319	17.1%	1,005	23.1%	1,594	19.2%
Number of Births with Fetal Intolerance of Labor	6,105	6.6%	1,263	2.9%	1,418	3.6%	8,786	5.0%	433	6.6%	117	2.4%	210	3.0%	760	4.2%	167	7.9%	74	4.0%	142	3.3%	383	4.6%
Births With a Significant Birth Injury	52	0.1%	31	0.1%	30	0.1%	113	0.1%	0	0.0%	0	0.0%	5	0.1%	5	0.0%	2	0.1%	0	0.0%	3	0.1%	5	0.1%
Any Congenital Defect	253	0.3%	107	0.2%	82	0.2%	442	0.3%	23	0.4%	11	0.2%	11	0.2%	45	0.2%	7	0.3%	9	0.5%	12	0.3%	28	0.3%
Newborns with Any Abnormal Condition	8,895	9.7%	4,068	9.3%	3,905	9.8%	16,868	9.6%	667	10.2%	489	10.1%	827	11.9%	1,983	10.8%	377	17.9%	331	17.8%	865	19.9%	1,573	18.9%
Births In Which Infant Was Transferred	757	0.8%	377	0.9%	342	0.9%	1,476	0.8%	52	0.8%	49	1.0%	66	0.9%	167	0.9%	25	1.2%	31	1.7%	82	1.9%	138	1.7%
Infants Admitted to NICU	6,785	7.4%	3,159	7.2%	3,118	7.8%	13,062	7.4%	505	7.7%	388	8.0%	668	9.6%	1,561	8.5%	327	15.5%	286	15.4%	767	17.6%	1,380	16.6%
Infants Still Living at Time of Report																								
No	457	0.5%	225	0.5%	244	0.6%	926	0.5%	19	0.3%	23	0.5%	30	0.4%	72	0.4%	19	0.9%	13	0.7%	32	0.7%	64	0.8%
Transferred	9	0.0%	5	0.0%	2	0.0%	16	0.0%	1	0.0%	2	0.0%	1	0.0%	4	0.0%	0	0.0%	0	0.0%	2	0.0%	2	0.0%

* Excludes unknowns

Data source: Texas Live Birth Certificate, Center for Health Statistics, DSHS

Non-Medicaid Population (SFY 2012) Outcomes by Diabetic condition and BMI

	No Known Diabetes								Gestational Diabetes (GDM)								Prepregnancy Diagnosed Diabetes (PGDM)							
	Normal		Overweight		Obese		Total non-Diabetic		Normal		Overweight		Obese		Total GDM		Normal		Overweight		Obese		Total PGDM	
MATERNAL LABOR & DELIVERY OUTCOMES																								
Women Who Previously Had a C-Section	10,439	11.7%	6,599	16.1%	6,548	20.1%	23,586	14.5%	368	14.9%	382	18.9%	695	23.4%	1,445	19.4%	49	20.2%	54	22.0%	177	30.7%	280	26.3%
Frequency C-Section Births	28,485	31.8%	16,311	39.9%	16,047	49.4%	60,843	37.3%	1,035	42.0%	961	47.6%	1,678	56.6%	3,674	49.3%	117	48.3%	153	62.4%	429	74.5%	699	65.8%
Hypertension																								
Prepregnancy (Chronic)	380	0.4%	411	1.0%	833	2.6%	1,624	1.0%	43	1.7%	52	2.6%	177	6.0%	272	3.6%	18	7.4%	28	11.4%	107	18.6%	153	14.4%
Gestational (PIH preclampsia)	2,989	3.3%	2,221	5.4%	2,770	8.5%	7,980	4.9%	205	8.3%	227	11.2%	547	18.4%	979	13.1%	23	9.5%	35	14.3%	112	19.4%	170	16.0%
Eclampsia	49	0.1%	35	0.1%	29	0.1%	113	0.1%	5	0.2%	3	0.1%	4	0.1%	12	0.2%	0	0.0%	0	0.0%	2	0.3%	2	0.2%
Deliveries with any Maternal Morbidity	1,188	1.3%	403	1.0%	224	0.7%	1,815	1.1%	49	2.0%	23	1.1%	26	0.9%	98	1.3%	7	2.9%	5	2.0%	8	1.4%	20	1.9%
Births to Women with Other Previous Poor Pregnancy Outcomes	721	0.8%	318	0.8%	274	0.8%	1,313	0.8%	28	1.1%	23	1.1%	46	1.6%	97	1.3%	8	3.3%	7	2.9%	15	2.6%	30	2.8%
Mothers Admitted to ICU	116	0.1%	54	0.1%	50	0.2%	220	0.1%	14	0.6%	3	0.1%	5	0.2%	22	0.3%	2	0.8%	1	0.4%	5	0.9%	8	0.8%
Number of Births In Which Mother Was Transferred	261	0.3%	122	0.3%	125	0.4%	508	0.3%	6	0.2%	3	0.1%	8	0.3%	17	0.2%	0	0.0%	1	0.4%	1	0.2%	2	0.2%
NEONATAL OUTCOMES																								
TOTAL LIVE BIRTHS	91,371		41,716		33,218		166,305		2,553		2,070		3,029		7,652		244		254		588		1,086	
Mean Length of Gestation*	39.7		39.6		39.5				39.7		39.2		39.3				38.8		38.2		39.1			
Early Gestation (<37 weeks)	9,676	10.59%	4,694	11.25%	4,188	12.61%	18,558	11.16%	379	14.85%	311	15.02%	496	16.38%	1,186	15.50%	52	21.31%	62	24.41%	138	23.47%	252	23.20%
Mean Birth Weight (g)	3,242.4		3,310.3		3,321.5				3,175.4		3,258.4		3,354.7				3,304.0		3,237.4		3,331.5			
Low Birth Weight (<2500 g)	7,137	7.81%	3,069	7.36%	2,713	8.17%	12,919	7.77%	281	11.01%	214	10.34%	269	8.88%	764	9.98%	24	9.84%	45	17.72%	85	14.46%	154	14.18%
Large for Gestational Age	6,201	6.8%	4,103	9.8%	4,039	12.2%	14,343	8.6%	215	8.4%	266	12.9%	532	17.6%	1,013	13.2%	59	24.2%	57	22.4%	168	28.6%	284	26.2%
Number of Births with Fetal Intolerance of Labor	2,913	3.2%	1,425	3.4%	1,337	4.0%	5,675	3.4%	147	5.8%	110	5.3%	178	5.9%	435	5.7%	10	4.1%	18	7.1%	35	6.0%	63	5.8%
Births With a Significant Birth Injury	61	0.1%	30	0.1%	23	0.1%	114	0.1%	2	0.1%	1	0.0%	3	0.1%	6	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Any Congenital Defect	225	0.2%	88	0.2%	75	0.2%	388	0.2%	7	0.3%	5	0.2%	11	0.4%	23	0.3%	1	0.4%	0	0.0%	3	0.5%	4	0.4%
Newborns with Any Abnormal Condition	8,677	9.5%	4,092	9.8%	3,639	11.0%	16,408	9.9%	358	14.0%	268	12.9%	460	15.2%	1,086	14.2%	57	23.4%	53	20.9%	156	26.5%	266	24.5%
Births In Which Infant Was Transferred	822	0.9%	455	1.1%	375	1.1%	1,652	1.0%	21	0.8%	20	1.0%	44	1.5%	85	1.1%	5	2.0%	6	2.4%	11	1.9%	22	2.0%
Infants Admitted to NICU	6,523	7.1%	3,087	7.4%	2,843	8.6%	12,453	7.5%	286	11.2%	214	10.3%	389	12.8%	889	11.6%	52	21.3%	48	18.9%	138	23.5%	238	21.9%
Infants Still Living at Time of Report																								
No	595	0.7%	281	0.7%	249	0.7%	1,125	0.7%	10	0.4%	11	0.5%	21	0.7%	42	0.5%	9	3.7%	3	1.2%	3	0.5%	15	1.4%
Transferred	17	0.0%	8	0.0%	10	0.0%	35	0.0%	1	0.0%	1	0.0%	0	0.0%	2	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

* Excludes unknowns

Data source: Texas Live Birth Certificate, Center for Health Statistics, DSHS

SUPPLEMENTAL DATA: Costs

Table A8

Excess Maternal Medical Costs of Diabetes Among Texas Medicaid Participants

Diabetes Type	Maternal BMI	Total Costs	Participant	Average Costs/ Woman	Cost Difference from No Diabetes - Normal Weight	Excess Costs of Diabetes
No Diabetes	**Normal**	$352,591,307	90,913	$3,878	--	--
	Overweight	$170,196,634	43,327	$3,928	--	--
	Obese	$169,907,408	39,204	$4,334	--	--
	TOTAL	**$692,695,349**	**173,444**	**$3,994**	**--**	**--**
GDM	**Normal**	$28,303,006	6,437	$4,397	$519	$3,338,147
	Overweight	$20,697,087	4,755	$4,353	$474	$2,255,592
	Obese	$32,656,758	6,836	$4,777	$899	$6,144,442
	TOTAL	**$81,656,851**	**18,028**	**$4,529**	**$651**	**$11,738,181**
PGDM	**Normal**	$13,441,844	2,069	$6,497	$2,618	$5,417,563
	Overweight	$11,091,631	1,835	$6,044	$2,166	$3,974,881
	Obese	$28,544,466	4,279	$6,671	$2,792	$11,949,059
	TOTAL	**$53,077,941**	**8,183**	**$6,486**	**$2,608**	**$21,341,504**
All Medicaid		**$827,430,141**	**199,655**	**$4,144**	--	--

*costs of providing care to individuals 180 days before birth - 30 days after birth by diabetes status. calculated by adding up all header claim costs for individuals by their diabetes status. Individuals with multiple pregnancies during the fiscal year are counted as having one pregnancy in this calculation if they had the same diabetes status in both pregnancies.

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Live Birth Certificate Files, CHS, Tx DSHS..

Table A9

Excess Maternal Vendor Drug Costs by Diabetes Type and BMI

Diabetes Type	Maternal BMI	Total Costs	Participant	Average Costs/ Woman	Cost Difference from No Diabetes - Normal Weight	Excess Costs of Diabetes
No Diabetes	**Normal**	$4,587,697	43,448	$106	**--**	**--**
	Overweight	$2,506,483	21,896	$114	**--**	**--**
	Obese	$2,692,764	22,411	$120	**--**	**--**
	TOTAL	**$9,786,943**	**87,755**	**$112**	**--**	**--**
GDM	**Normal**	$406,200	3,464	$117	$117	$406,200
	Overweight	$292,397	2,525	$116	$116	$292,397
	Obese	$561,999	4,025	$140	$140	$561,999
	TOTAL	**$1,260,596**	**10,014**	**$126**	**$126**	**$1,260,596**
PGDM	**Normal**	$254,252	1,308	$194	$194	$254,252
	Overweight	$277,939	1,229	$226	$226	$277,939
	Obese	$887,602	3,205	$277	$277	$887,602
	TOTAL	**$1,419,794**	**5,742**	**$247**	**$247**	**$1,419,794**
All Medicaid		**$12,467,333**	**103,511**	**$120**	**--**	**--**

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Live Birth Certificate Files, CHS, Tx DSHS..

Table A10

Excess Infant Vendor Drug Costs by Mother's Diabetes Type and BMI

Diabetes Type	Maternal BMI	Total Costs*	Infants*	Average Costs/Infant	Cost Difference from No Diabetes - Normal Weight	Excess Costs of Diabetes
No Diabetes	**Normal**	$12,220,815.22	50,796	$241	--	--
	Overweight	$6,275,316.92	25,210	$249	--	--
	Obese	$6,199,216.57	23,474	$264	--	--
	TOTAL	**$24,695,349**	**99,480**	**$248**	--	--
GDM	**Normal**	$1,017,773.13	3,692	$276	$35	$129,529
	Overweight	$687,899.98	2,859	$241	$0	$64
	Obese	$1,250,705.05	4,179	$299	$59	$245,295
	TOTAL	**$2,956,378**	**10,730**	**$276**	$35	**$374,889**
PGDM	**Normal**	$442,396.41	1,242	$356	$116	$143,588
	Overweight	$463,664.37	1,176	$394	$154	$180,735
	Obese	$1,286,859.67	2,738	$470	$229	$628,135
	TOTAL	**$2,192,920**	**5,156**	**$425**	$185	**$952,458**
All Medicaid		**$29,844,647**	**115,366**	**$259**	--	--

* Costs are cumulative through one year of age.

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Live Birth Certificate Files, CHS, Tx DSHS..

Table A11

Excess First Year Infant Costs by Mother's Diabetes Type and BMI (Costliest 5% of all infants only)

Diabetes Type	Maternal BMI	Total Costs*	Infants*	Average Costs/Infant	Cost Difference from No Diabetes - Normal Weight	Excess Costs of Diabetes
No Diabetes	**Normal**	$326,294,734	4466	**$73,062**	--	--
	Overweight	$144,815,509	2136	**$67,798**	--	--
	Obese	$162,314,770	1941	**$83,624**	--	--
	TOTAL	**$633,425,013**	**8,543**	**$74,146**	--	--
GDM	**Normal**	$17,970,418	318	**$56,511**	-$16,551	-$5,263,287
	Overweight	$16,096,382	235	**$68,495**	-$4,567	-$1,073,179
	Obese	$24,066,874	341	**$70,577**	-$2,485	-$847,256
	TOTAL	**$58,133,675**	**894**	**$65,026**	-$8,035	-$7,183,722
PGDM	**Normal**	$10,774,662	103	**$104,608**	$31,546	$3,249,280
	Overweight	$11,892,249	91	**$130,684**	$57,622	$5,243,610
	Obese	$31,952,151	213	**$150,010**	$76,948	$16,389,952
	TOTAL	**$54,619,062**	**407**	**$134,199**	$61,137	$24,882,842
All Medicaid		**$746,177,749**	**9,844**	**$75,800**	--	--

* Excludes infants under the 5th percentile of costs. Costs are cumulative through one year of age.

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Live Birth Certificate Files, CHS, Tx DSHS..

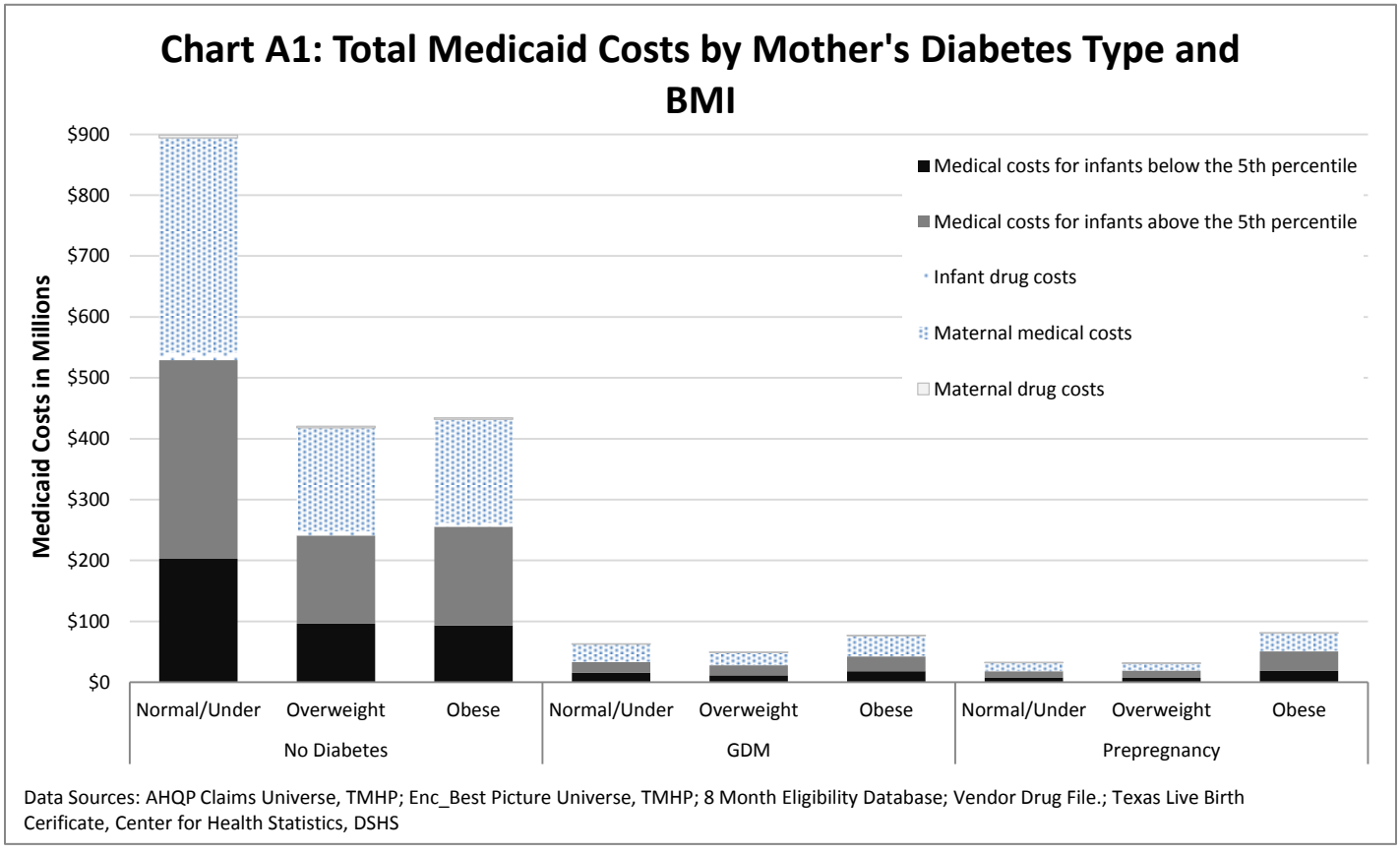
Table A12

Excess First Year Infant Costs by Mother's Diabetes Type and BMI (Excluding costliest 5% of all infants)

Diabetes Type	Maternal BMI	Total Costs*	Infants*	Average Costs/Infant	Cost Difference from No Diabetes - Normal Weight	Excess Costs of Diabetes
No Diabetes	**Normal**	$202,902,374	84,863	$2,391	--	--
	Overweight	$96,528,850	40,579	$2,379	--	--
	Obese	$93,352,887	36,867	$2,532	--	--
	TOTAL	**$392,784,112**	**162,309**	**$2,420**	--	--
GDM	**Normal**	$15,472,012	6,034	$2,564	$173	$1,045,078
	Overweight	$11,778,396	4,479	$2,630	$239	$1,069,374
	Obese	$18,489,422	6,471	$2,857	$466	$3,017,647
	TOTAL	**$45,739,831**	**16,984**	**$2,693**	$302	**$5,132,099**
PGDM	**Normal**	$7,388,366	1,952	$3,785	$1,394	$2,721,250
	Overweight	$7,487,255	1,727	$4,335	$1,944	$3,358,101
	Obese	$18,862,370	4,048	$4,660	$2,269	$9,183,843
	TOTAL	**$33,737,990**	**7,727**	**$4,366**	$1,975	**$15,263,194**
All Medicaid		**$472,261,932**	**187,020**	**$2,525**	--	--

* Excludes infants in the top 5 percentile of costs. Costs are cumulative through one year of age.

Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File; Texas Live Birth Certificate Files, CHS, Tx DSHS..



Data Sources: AHQP Claims Universe, TMHP; Enc_Best Picture Universe, TMHP; 8 Month Eligibility Database; Vendor Drug File.; Texas Live Birth Cerificate, Center for Health Statistics, DSHS

SUPPLEMENTAL DATA: Delivery Outcome Models

Table A13: Delivery Outcome: Large for Gestational Age

Variable	Odds Ratio	Odds Ratio Lower Limit	Odds Ratio Upper Limit	P-value	Statistical Significance
Intercept	0.044857	0.041583	0.048383	< 0.01	***
Diabetes Status					
GDM	1.281399	1.170305	1.400546	< 0.01	***
PDGM	1.909419	1.670794	2.173837	< 0.01	***
BMI					
Overweight	1.209232	1.158231	1.262314	< 0.01	***
Obese	1.489678	1.427943	1.553926	< 0.01	***
Mother's Age	1.024115	1.021415	1.026817	< 0.01	***
Race/Ethnicity					
Black	0.727973	0.68647	0.771757	< 0.01	***
Hispanic	1.036989	0.996841	1.078988	0.072171	.
Other	0.673163	0.606075	0.745937	< 0.01	***
Interaction					
GDM*Overweight	1.096204	0.963082	1.247766	0.164355	
PDGM*Overweight	1.107667	0.923286	1.329674	0.271629	
GDM*Obese	1.231542	1.097759	1.382744	< 0.01	***
PDGM*Obese	1.300563	1.117324	1.517842	< 0.01	***

Number of observations with outcome of interest: 17,756 Number of observations without outcome of interest: 170,794

Table A14: Delivery Outcome: NICU Admission

Variable	Odds Ratio	Odds Ratio Lower Limit	Odds Ratio Upper Limit	P-value	Statistical Significance
Intercept	0.064903	0.06001	0.070188	< 0.01	***
Diabetes Status					
GDM	1.048121	0.952617	1.150734	0.329	
PDGM	2.258799	1.998433	2.545334	< 0.01	***
BMI					
Overweight	0.961167	0.919623	1.004388	0.07824	.
Obese	1.033399	0.988228	1.080419	0.14875	
Mother's Age	1.009152	1.006328	1.011977	< 0.01	***
Race/Ethnicity					
Black	1.332965	1.264598	1.404964	< 0.01	***
Hispanic	0.910337	0.873363	0.949093	< 0.01	***
Other	0.896306	0.812442	0.986958	0.0274	*
Interaction					
GDM*Overweight	1.071375	0.926639	1.237955	0.35068	
PDGM*Overweight	1.020251	0.853436	1.219159	0.82554	
GDM*Obese	1.195717	1.051479	1.360453	0.00652	**
PDGM*Obese	1.096264	0.945895	1.272675	0.2246	

Number of observations with outcome of interest: 16,157 Number of observations without outcome of interest: 187,187

Notes: **The reference category for diabetes status is: No Diabetes**
The reference category for BMI is: Normal/Underweight
The reference category for Race/Ethnicity is: Anglo
The reference category for the interaction is: No Diabetes*Normal/Underweight
Significance Codes: "***" <0.001 "**" <0.01 "*" <0.05 "." <0.1

Table A14: Delivery Outcome: Newborn with Any Congenital Defect

Variable	Odds Ratio	Odds Ratio Lower Limit	Odds Ratio Upper Limit	P-value	Statistical Significance
Intercept	0.001691	0.00112	0.002544	< 0.01	***
Diabetes Status					
GDM	1.206671	0.76435	1.81156	0.391	
PDGM	1.128434	0.480076	2.217672	0.75334	
BMI					
Overweight	0.856276	0.67956	1.071595	0.18126	
Obese	0.719855	0.556837	0.920975	0.01034	*
Mother's Age	1.022995	1.008144	1.037848	0.00214	**
Race/Ethnicity					
Black	0.711336	0.509073	0.981393	0.04147	*
Hispanic	0.973653	0.788404	1.211571	0.807	
Other	0.739935	0.420326	1.216857	0.263	
Interaction					
GDM*Overweight	0.722734	0.328247	1.505494	0.39882	
PDGM*Overweight	1.628077	0.590447	4.671797	0.34679	
GDM*Obese	0.596549	0.269246	1.252327	0.1836	
PDGM*Obese	1.088609	0.422853	3.016116	0.86331	

Number of observations with outcome of interest: 518 Number of observations without outcome of interest: 202,826

Table A15: Delivery Outcome: Newborn with Any Abnormal Condition

Variable	Odds Ratio	Odds Ratio Lower Limit	Odds Ratio Upper Limit	P-value	Statistical Significance
Intercept	0.091003	0.084854	0.097591	< 0.01	***
Diabetes Status					
GDM	1.053293	0.968276	1.143983	0.222	
PDGM	1.98194	1.766217	2.218365	< 0.01	***
BMI					
Overweight	0.946889	0.910411	0.984679	0.00637	**
Obese	0.989695	0.950777	1.03004	0.61209	
Mother's Age	1.009188	1.006654	1.011724	< 0.01	***
Race/Ethnicity					
Black	1.262581	1.204574	1.323317	< 0.01	***
Hispanic	0.849767	0.819117	0.881705	< 0.01	***
Other	1.008902	0.928952	1.094435	0.8.32	
Interaction					
GDM*Overweight	1.042904	0.916167	1.18652	0.52416	
PDGM*Overweight	1.049879	0.887566	1.241449	0.56951	
GDM*Obese	1.182167	1.053597	1.326838	0.00444	**
PDGM*Obese	1.134292	0.986778	1.305666	0.07768	.

Number of observations with outcome of interest: 20,605 Number of observations without outcome of interest: 182,739

Notes: The reference category for diabetes status is: No Diabetes
The reference category for BMI is: Normal/Underweight
The reference category for Race/Ethnicity is: Anglo
The reference category for the interaction is: No Diabetes*Normal/Underweight
Significance Codes: "***" <0.001 "**" <0.01 "*" <0.05 "." <0.1

Table A15: Delivery Outcome: Delivery with Fetal Intolerance of Labor

Variable	Odds Ratio	Odds Ratio Lower Limit	Odds Ratio Upper Limit	P-value	Statistical Significance
Intercept	0.019945	0.017999	0.022092	< 0.01	***
Diabetes Status					
GDM	0.930335	0.839321	1.028621	0.164	
PDGM	1.131785	0.959934	1.325421	0.1323	
BMI					
Overweight	0.390255	0.366631	0.415082	< 0.01	***
Obese	0.481849	0.453814	0.511281	< 0.01	***
Mother's Age	1.029842	1.026359	1.033326	< 0.01	***
Race/Ethnicity					
Black	1.8819	1.739932	2.03578	< 0.01	***
Hispanic	1.997775	1.877735	2.12728	< 0.01	***
Other	1.332926	1.174093	1.509257	< 0.01	***
Interaction					
GDM*Overweight	0.820571	0.658046	1.016071	0.0741	.
PDGM*Overweight	1.115258	0.831776	1.482449	0.4587	
GDM*Obese	0.837654	0.699526	1.000448	0.0522	.
PDGM*Obese	0.715119	0.56311	0.907096	0.0058	**

Number of observations with outcome of interest: 9,942 Number of observations without outcome of interest: 193,402

Table A16: Pregnancy Outcome: C-Section

Variable	Odds Ratio	Odds Ratio Lower Limit	Odds Ratio Upper Limit	P-value	Statistical Significance
Intercept	0.177064	0.16914	0.185352	< 0.01	***
Diabetes Status					
GDM	1.206694	1.142707	1.273891	< 0.01	***
PDGM	1.784983	1.633671	1.949533	< 0.01	***
BMI					
Overweight	1.316465	1.284197	1.349521	< 0.01	***
Obese	1.907253	1.86032	1.955364	< 0.01	***
Mother's Age	1.032982	1.031305	1.034661	< 0.01	***
Race/Ethnicity					
Black	1.074886	1.040758	1.110117	< 0.01	***
Hispanic	0.901457	0.880178	0.923274	< 0.01	***
Other	0.858333	0.8119	0.907189	< 0.01	***
Interaction					
GDM*Overweight	1.025591	0.945129	1.112928	0.5444	
PDGM*Overweight	1.0311	0.906774	1.172708	0.6406	
GDM*Obese	1.017124	0.94409	1.095973	0.6555	
PDGM*Obese	1.104584	0.99028	1.232514	0.0748	.

Number of observations with outcome of interest: 68,906 Number of observations without outcome of interest: 134,423

Notes: The reference category for diabetes status is: No Diabetes
The reference category for BMI is: Normal/Underweight
The reference category for Race/Ethnicity is: Anglo
The reference category for the interaction is: No Diabetes*Normal/Underweight
Significance Codes: "***" <0.001 "**" <0.01 "*" <0.05 "." <0.1

Table A17: Pregnancy Outcome: Any Hypertension

Variable	Odds Ratio	Odds Ratio Lower Limit	Odds Ratio Upper Limit	P-value	Statistical Significance
Intercept	0.027697	0.02528	0.030339	< 0.01	***
Diabetes Status					
GDM	1.927444	1.738645	2.131927	< 0.01	***
PDGM	3.107088	2.691496	3.570748	< 0.01	***
BMI					
Overweight	1.320893	1.2494	1.396192	< 0.01	***
Obese	2.233744	2.124631	2.348437	< 0.01	***
Mother's Age	1.017907	1.014667	1.02115	< 0.01	***
Race/Ethnicity					
Black	1.29262	1.218978	1.370632	< 0.01	***
Hispanic	0.789316	0.753193	0.827391	< 0.01	***
Other	0.649769	0.571869	0.735567	< 0.01	***
Interaction					
GDM*Overweight	0.946446	0.815259	1.098593	0.4694	
PDGM*Overweight	0.908435	0.743855	1.109704	0.3464	
GDM*Obese	0.869361	0.765066	0.988964	0.0325	*
PDGM*Obese	1.012341	0.862282	1.192397	0.882	

Number of observations with outcome of interest: 12,145 Number of observations without outcome of interest: 191,199

Table A18: Pregnancy Outcome: Any Maternal Morbidity

Variable	Odds Ratio	Odds Ratio Lower Limit	Odds Ratio Upper Limit	P-value	Statistical Significance
Intercept	0.007258	0.005851	0.008994	< 0.01	***
Diabetes Status					
GDM	1.029886	0.824564	1.270073	0.7.89	
PDGM	1.690246	1.244694	2.238838	< 0.01	***
BMI					
Overweight	0.475652	0.416226	0.541674	< 0.01	***
Obese	0.467511	0.406445	0.535626	< 0.01	***
Mother's Age	1.018233	1.010552	1.025911	< 0.01	***
Race/Ethnicity					
Black	1.256399	1.073	1.469919	0.00445	**
Hispanic	1.175107	1.044199	1.325839	0.008052	**
Other	1.374822	1.088583	1.720292	0.00633	**
Interaction					
GDM*Overweight	0.782468	0.486851	1.218027	0.292296	
PDGM*Overweight	0.517965	0.251889	0.976891	0.054669	.
GDM*Obese	0.811285	0.536485	1.206315	0.31023	
PDGM*Obese	0.608676	0.373551	0.977715	0.04232	*

Number of observations with outcome of interest: 1,970 Number of observations without outcome of interest: 201,374

Notes: The reference category for diabetes status is: No Diabetes
The reference category for BMI is: Normal/Underweight
The reference category for Race/Ethnicity is: Anglo
The reference category for the interaction is: No Diabetes*Normal/Underweight
Significance Codes: "***" <0.001 "**" <0.01 "*" <0.05 "." <0.1

Table A19: Pregnancy Outcome: Admittance to ICU

Variable	Odds Ratio	Odds Ratio Lower Limit	Odds Ratio Upper Limit	P-value	Statistical Significance
Intercept	0.000251	0.000161	0.000385	< 0.01	***
Diabetes Status					
GDM	1.310947	0.972258	1.730935	0.0652	.
PDGM	2.537124	1.738754	3.574718	< 0.01	***
BMI					
Overweight	0.178639	0.13057	0.238493	< 0.01	***
Obese	0.311198	0.242109	0.394435	< 0.01	***
Mother's Age	1.069389	1.057229	1.081604	< 0.01	***
Race/Ethnicity					
Black	4.607914	3.226063	6.72269	< 0.01	***
Hispanic	4.795821	3.514721	6.746651	< 0.01	***
Other	1.852914	1.045459	3.172757	0.0284	*
Interaction					
GDM*Overweight	0.716602	0.264502	1.640235	0.4665	
PDGM*Overweight	1.094876	0.424417	2.490151	0.8386	
GDM*Obese	0.579877	0.283951	1.103423	0.1126	
PDGM*Obese	0.471507	0.229591	0.920318	0.0325	*

Number of observations with outcome of interest: 729 Number of observations without outcome of interest: 202,615

Notes: The reference category for diabetes status is: No Diabetes
The reference category for BMI is: Normal/Underweight
The reference category for Race/Ethnicity is: Anglo
The reference category for the interaction is: No Diabetes*Normal/Underweight
Significance Codes: "***" <0.001 "**" <0.01 "*" <0.05 "." <0.1

DEFINITIONS

BMI: a measure of relative weight based on an individual's mass and height.

$$\mathrm{BMI} = \frac{\mathrm{mass(kg)}}{(\mathrm{height(m)})^2}$$

Normal < 25, overweight = 25 to 30, obese >= 30. For this report, normal includes a small fraction of underweight (< 18.5) and severely obese (30 and greater) women.

Fee-for-service reimbursement (FFS): The traditional Medicaid health care payment system, under which providers receive a payment for each unit of service they provide.

Fetal death (stillbirth): Death of a product of conception prior to the complete expulsion or extraction from its mother, regardless of the length of gestation. In Texas, fetal death registration is required for any fetus weighing 350 grams or more, or if the weight is unknown, a fetus aged 20 weeks or more.

***Fetal polycythemia*:** a disease state in which the proportion of blood volume that is occupied by red blood cells increases.

Hyperbilirubinaemia: Excess bilirubin at birth. hyperbilirubinaemia in a newborn can lead to accumulation of bilirubin in certain brain regions) with consequent irreversible damage to these areas manifesting as various neurological deficits, seizures, abnormal reflexes and eye movements.

Hyperinsulinemia : a condition in which there are excess levels of insulin circulating in the blood than expected relative to the level of glucose associated with hypertension, obesity, dyslipidemia, and glucose intolerance.

Hypoglysemia: an abnormally diminished content of glucose in the blood. Effects can range from mild dysphoria to more serious issues such as seizures, unconsciousness, and (rarely) permanent brain damage or death.

Infant death: Death of an individual less than one year of age. Infant deaths are further classified as neonatal deaths and post neonatal deaths. (See also *neonatal death* and *post neonatal death*.)

Large for Gestational Age (LGA): An indication of high prenatal growth rate. LGA is often defined as a weight, length, or head circumference that lies above the 90th percentile for that gestational age.

Low birth weight: A birth weight less than 2,500 grams or less than 5 pounds, 9 ounces.

Macrosomia: term used to describe a newborn who's significantly larger than average. A baby diagnosed with fetal macrosomia has a birth weight of more than 8 pounds, 13 ounces (4,000 grams), regardless of his or her gestational age.

***Managed care organization (MCO)*:** An organization that delivers and manages health services under a risk-based arrangement. The MCO usually receives a monthly premium or capitation payment for each person enrolled, which is based on a projection of what the typical patient will cost.

BMI: a measure of relative weight based on an individual's mass and height.

Maternal death: The death of a woman resulting from pregnancy or childbearing, while pregnant or within 42 days of termination of pregnancy.

Metabolic syndrome (MetS): disorder of energy utilization and storage, diagnosed by a co-occurrence of three out of five of the following medical conditions: abdominal (central) obesity, elevated blood pressure, elevated fasting plasma glucose, high serum triglycerides, and low high-density cholesterol (HDL) levels. Metabolic syndrome increases the risk of developing cardiovascular disease, particularly heart failure, and diabetes

Multiple causes of death: All diseases or injuries which led directly to death, or all circumstances of the accident or violence which produced the fatal injury.

Neonatal death: Death of an infant less than 28 days of age.

Odds Ratio (OR): The OR represents the odds that an outcome "A" will occur given a particular exposure "B", compared to the odds of the outcome occurring in the absence of that exposure. If the OR is greater than 1, then having "A" is considered to be "associated" with having "B" in the sense that the having of "B" raises (relative to not-having "B") the odds of having "A".

Perinatal: Period from 20 weeks gestation through 27 days after birth.

Pre-eclampsia: disorder of pregnancy characterized by high blood pressure and large amounts of protein in the urine. If left untreated, preeclampsia can develop into eclampsia, which may cause the occurrence of seizures during pregnancy. Preeclampsia is associated with multiple maternal and fetal adverse effects.

Post neonatal death: Death of an infant at least 28 days of age but less than one year of age.

Preterm birth: Birth at less than 37 completed weeks of gestation.

Prevalence: the proportion of a population found to have a condition. It is arrived at by comparing the number of people found to have the condition with the total number of people studied, and is usually expressed as a fraction, as a percentage or as the number of cases per 10,000 or 100,000 people.

Primary care case management (PCCM): Managed care option in which each participant is assigned to a single primary care provider who must authorize most other services such as specialty physician care before they can be reimbursed by Medicaid.

r-FIMR: Restricted feto-infant mortality rate. A perinatal mortality measure that includes both infant and fetal death. Used to assess pregnancy outcomes as opposed to only birth outcomes.

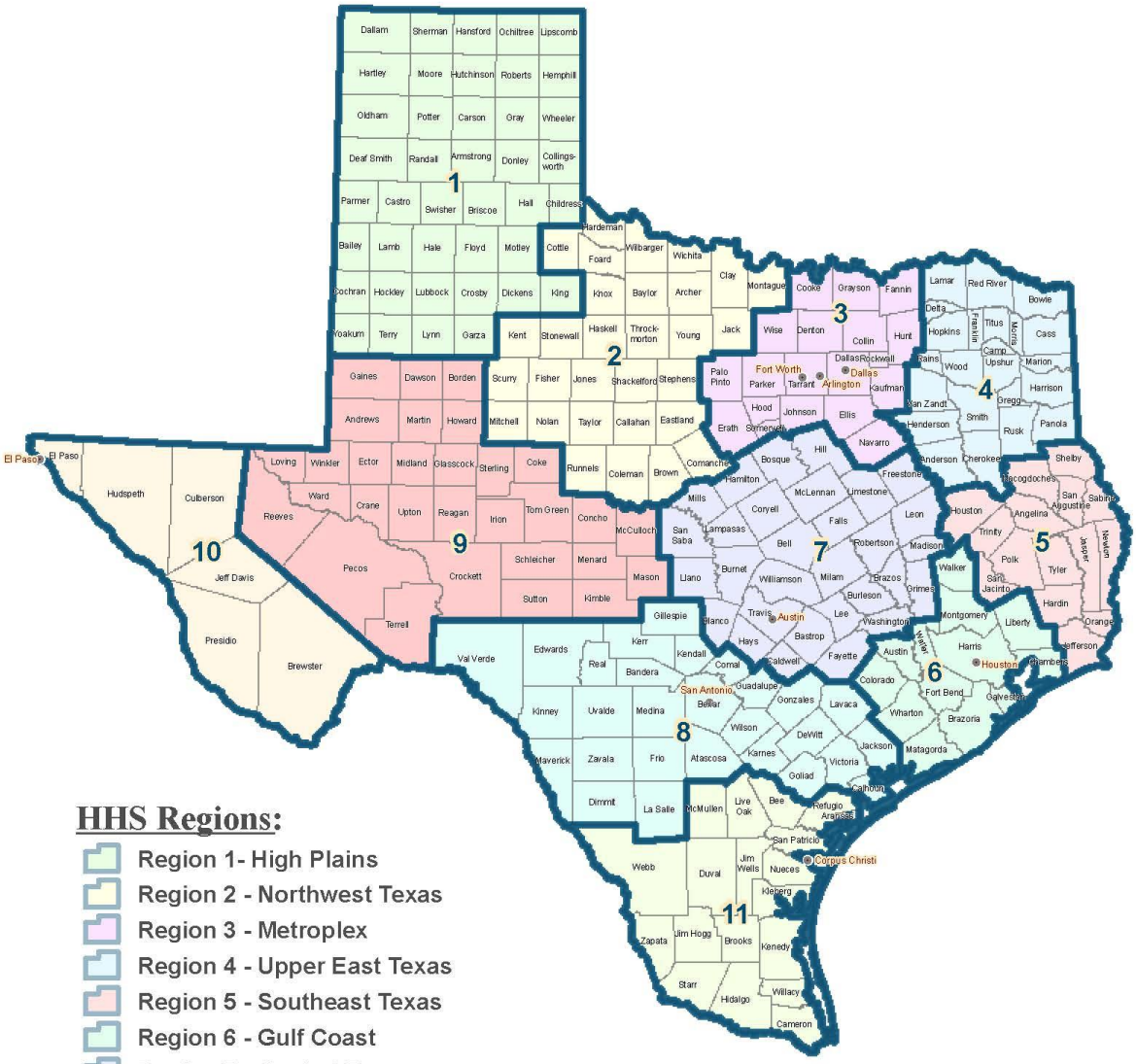
Table A20: Clinical Classification Software (CCS) single level diagnosis codes 177-196*

177	Spontaneous abortion
178	Induced abortion
179	Post-abortion complications
180	Ectopic pregnancy
181	Other complications of pregnancy
182	Hemorrhage during pregnancy; abruptio placenta; placenta previa
183	Hypertension complicating pregnancy; childbirth and the puerperium
184	Early or threatened labor
185	Prolonged pregnancy
186	Diabetes or abnormal glucose tolerance complicating pregnancy; childbirth; or the puerperium
187	Malposition; malpresentation
188	Fetopelvic disproportion; obstruction
189	Previous C-section
190	Fetal distress and abnormal forces of labor
191	Polyhydramnios and other problems of amniotic cavity
192	Umbilical cord complication
193	OB-related trauma to perineum and vulva
194	Forceps delivery
195	Other complications of birth; puerperium affecting management of mother
196	Normal pregnancy and/or delivery

* Clinical Classifications Software (CCS) for ICD-9-CM. The CCS is one of the Healthcare Cost and Utilization Project (HCUP) tools that can be applied to HCUP and other similar databases. These tools are created by AHRQ through a Federal-State-Industry partnership. For more information see http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp (July 29, 2014)

TEXAS

Health and Human Services Regions



HHS Regions:

- Region 1- High Plains
- Region 2 - Northwest Texas
- Region 3 - Metroplex
- Region 4 - Upper East Texas
- Region 5 - Southeast Texas
- Region 6 - Gulf Coast
- Region 7 - Central Texas
- Region 8 - Upper South Texas
- Region 9 - West Texas
- Region 10 - Upper Rio Grande
- Region 11 - Lower South Texas

TEXAS
Health and Human
Services Commission

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