

ABSTRACT

The Impact of Centering Pregnancy on the Rate of Preterm Birth at the Waco Family Health Center

Rachel M. Sabadell

Director: Lauren Barron, M.D.

Centering Pregnancy is a non-traditional model of prenatal care that aims to provide comprehensive care and education to patients with a facilitative approach in a group setting. The goal of this research is to determine whether patient participation in Centering Pregnancy plays a role in reducing the rate of preterm birth among patients at the Waco Family Health Center (FHC). In order to study this, the charts of 435 FHC patients who participated in Centering Pregnancy classes from 2014-2017 were analyzed and screened for eighteen individual risk factors. Patient charts were also screened for a “high-risk” diagnosis. The rate of premature birth was calculated and analyzed for correlations to the risk factors as well as other demographics. The rates of preterm birth among FHC Centering Pregnancy patients were lower than the average Texas and McLennan County rates. Though no conclusions about causation can be drawn, this research shows that Centering Pregnancy is a viable form of prenatal care for patients at the Waco Family Health Center. These results will aid the Family Health Center in assessing the efficacy of the Centering Pregnancy model of prenatal care as well as provide a baseline for future studies.

APPROVED BY DIRECTOR OF HONORS THESIS:

Dr. Lauren Barron, Department of Medical Humanities

APPROVED BY THE HONORS PROGRAM:

Dr. Elizabeth Corey, Director

DATE:_____

THE IMPACT OF CENTERING PREGNANCY ON THE RATE OF PRETERM
BIRTH AT THE WACO FAMILY HEALTH CENTER

A Thesis Submitted to the Faculty of
Baylor University
In Partial Fulfillment of the Requirements for the
Honors Program

By
Rachel M. Sabadell

Waco, Texas

May 2019

TABLE OF CONTENTS

List of Tables	iii
List of Figures	v
Acknowledgments	vi
Chapter One: Purpose and Background	1
Chapter Two: Individual Risk Factors for Preterm Birth	6
Chapter Three: Centering Pregnancy	27
Chapter Four: Results	33
Appendices	44
Appendix A: National Preterm Births	45
Appendix B: Texas Preterm Births	46
Appendix C: McLennan County Preterm Births... ..	48
Bibliography	50

LIST OF TABLES

Table 1. Preterm Births in Texas	3
Table 2. Preterm Births in McLennan County	3
Table 3. Individual Risk Factors for Preterm Birth	6
Table 4. Preterm Births Among FHC Centering Patients	33
Table 5. Preterm Births among FHC Centering Patients by Group	34
Table 6. Preterm Births among FHC Centering Patients by Age	35
Table 7. Preterm Births among FHC Centering Patients by Race/Ethnicity	36
Table 8. Preterm Births among FHC Centering Patients by Number of Risk Factors	37
Table 9. Preterm Births among FHC Centering Patients by Individual Risk Factor	38
Table 10. Comparison of Preterm Birth Rates	39
Table 11. Comparison of Preterm Birth Rates by Race/Ethnicity	40
Table 12. Comparison of Preterm Birth Rates by Age	41
Table A1. Preterm Births in U.S. by Race, 2017	45
Table B1. Preterm Births in Texas by Race, 2015	46
Table B2. Preterm Births in Texas by Race, 2005-2014	46
Table B3. Preterm Births in Texas by Age, 2015	47
Table B4. Preterm Births in Texas by Age, 2005-2014	47
Table C1. Preterm Births in McLennan County by Race, 2015	48
Table C2. Preterm Births in McLennan County by Race, 2005-2014	48

Table C3. Preterm Births in McLennan County by Age, 2015	49
Table C4. Preterm Births in McLennan County by Age, 2005-2014	49

LIST OF FIGURES

Figure 1. Example of Spreadsheet Used to Record Data.....	5
---	---

ACKNOWLEDGMENTS

My time spent conducting research at the Waco Family Health Center proved to be an invaluable experience, and the work I have done would not be possible without a number of incredible people. First, my advisor, Dr. Lauren Barron, has provided guidance and encouragement every step of the way. I would also like to thank Dr. Carena Chai for beginning this project and facilitating my research at the Family Health Center. I am also immensely grateful to Dianna Compton for her support throughout this entire process and for her willingness to answer all of my questions. My thanks also to Dr. Emilie Cunningham for her enthusiasm about my research and for serving on my committee. Finally, I am beyond thankful for my family and friends who have supported me throughout this long and rewarding process and continue to do so.

CHAPTER ONE

Background and Purpose

Preterm birth is defined as one that takes place before 37 weeks of gestation. Infants born prematurely are at risk for low birth weight and other medical complications. Low birth weight is associated with approximately 17% of infant deaths in the United States. Other medical problems associated with preterm birth also have the potential to lengthen an infant's hospital stay, resulting in more expenses for both the family, the hospital, and their insurer. Infants born prematurely may also experience later developmental delays.

The Centers for Disease Control and Prevention (CDC) recognizes the health risks and financial burdens associated with preterm birth and classifies the reduction of the rates of preterm delivery as a national priority.¹ Centering Pregnancy is a non-traditional model of prenatal care that claims to lower the rate of preterm births.² This program focuses on group prenatal care as a way to provide education and support to expectant mothers as well as encourages them to become proactive in their health care. Centering Pregnancy recognizes the importance of social support by allowing women to ask questions and engage in discussions with each other and their physicians in a relaxed environment. The Family Health Center in Waco provides a Centering Pregnancy

¹ Premature Birth. (2018, November 05). Retrieved February 21, 2019, from <https://www.cdc.gov/features/prematurebirth/index.html>

² Why Centering? (n.d.). Retrieved April 24, 2019, from <https://www.centeringhealthcare.org/why-centering>

program. This thesis examines the impact of the Centering Pregnancy program in the reduction of preterm birth rates in McLennan County, specifically among women who receive healthcare from the Family Health Center.

This research is important because not only are preterm births accompanied by initial and subsequent medical risks, but the medical care for babies born prematurely can also create a financial burden. The Centering Healthcare Institute reports that \$26 billion is spent nationally on care for premature infants annually.³ By reducing the rates of preterm delivery, there may be financial incentive for other hospitals and community health centers to implement a similar program.

Background Statistics

Data taken from the Centers for Disease Control and Prevention shows the United States national preterm birth rate in 2017, the latest year data is available, was 9.93%. The CDC notes that there was a steady decrease in these rates from 2007-2014, likely due to the fact that there were fewer teenage mothers. However, the rate began to increase again in 2015 and 2016. There are also still significant disparities among racial and ethnic groups. The rate of premature birth for African American women is typically much higher than the rate for white women in the United States. The rates for Hispanic women and other minorities are generally higher as well (see Table A1). While there is no singular definitive cause for these disparities, many speculate that differences in social support.

³ Improving health by transforming care through Centering groups. (n.d.). Retrieved February 21, 2019, from <https://www.centeringhealthcare.org/>

The Texas Department of State Health Services (TDSHS) only provides data for the years 2005 to 2015. Compared to national averages, the state of Texas generally has higher premature birth rates than most of the country. The CDC ranks Texas as #12 on the list of highest premature birth rates in the United States. According to the TDSHS Center for Health Statistics, the average premature birth rate for the entire state of Texas in 2015 was higher than the national average at 11.75%. This is a reduction from the 12.85% rate in Texas from years 2005-2014.

Table 1. Preterm Births in Texas

Year(s)	Number of Patients	Number of Premature Births	Percentage
2015	403,439	47,390	11.747%
2005-2014	3,931,190	505,061	12.848%

The preterm birth rates in McLennan County, the county in which the Family Health Center is located, are slightly lower than the Texas state average, but are still higher than the national average. The average premature birth rate in McLennan County for the year 2015 was 11.48%. For the years 2005-2014, the average premature birth rate was 12.09%.

Table 2. Preterm Births in McLennan County

Year(s)	Number of Patients	Number of Premature Births	Percentage
2015	3,528	405	11.480%
2005-2014	34,724	4,197	12.087%

Methods

This study focused on patients that attended Centering Pregnancy group visits at the Family Health Center or the Women's Health Center. The women in the study were those expected to deliver from March 2014 to December 2017. In order to be included in the study, the patients had to have attended at least two Centering classes. Women were excluded from the study if their pregnancy did not result in a live birth or if their birth data was not available. I was given access to the attendance logs for each Centering group, which contained a record of patient names, ages, delivery dates, and Medical Record Numbers (MRNs). With this information, I was able to review their charts in the Epic system to identify a high-risk diagnosis or any of the 18 individual risk factors for preterm delivery that Dr. Carena Chai, the Centering Pregnancy Director at the FHC, and I decided to study. Each risk factor has a specific diagnosis code, but we realized that these diagnosis codes were not always recorded in the chart. For each patient, I read through the documentation of every appointment and office visit that occurred during the pregnancy, looking for a high-risk diagnosis or mentions of individual risk factors. Special attention was paid to the diagnosis section, the active problem list, and the assessment and plan section of the physician notes. I created a spreadsheet to record the patient's MRN, age, Centering group, and any risk factors recorded in their charts (see Figure 1). The attendance logs for each Centering group also gave the infant's birth date and gestation age, which I used to record if the patient delivered prematurely.

MRN	GROUP	AGE	AFRICAN AMERICAN RACE	ANXIETY	DEPRESSION	SMOKING	STI	BACTERURIA	HIGH RISK	PRETERM
1	ENG Jan 2017	22	1						1	
2	ENG Jan 2017	29								
3	ENG Jan 2017	17					1	1		
4	ENG Jan 2017	28	1	1					1	
5	ENG Jan 2017	29								
6	ENG Jan 2017	17					1		1	1
7	ENG Jan 2017	32		1						
8	SPA Jan/Feb 2017	29						1		
9	SPA Jan/Feb 2017	24			1					
10	SPA Jan/Feb 2017	22								
11	SPA Jan/Feb 2017	29		1	1					
12	SPA Jan/Feb 2017	33						1		
13	SPA Jan/Feb 2017	22					1	1		
14	SPA Jan/Feb 2017	29						1		
15	SPA Jan/Feb 2017	17		1	1	1		1	1	
16	ENG Feb 2017	22	1						1	1
17	ENG Feb 2017	27								
18	ENG Feb 2017	16					1		1	
19	ENG Feb 2017	22	1				1		1	1
20	ENG Feb 2017	26								
21	ENG Feb 2017	22								
22	ENG Feb 2017	18	1							
23	ENG Feb 2017	28			1					
24	ENG Feb 2017	32				1	1			
25	SPA Feb/Mar 2017	28							1	1

Figure e1. Example of Spreadsheet Used to Record Data

CHAPTER TWO

Individual Risk Factors for Preterm Birth

This chapter provides a brief overview of each of the eighteen individual risk factors for preterm birth for which patient charts were screened. While some of these risk factors (namely uterine anomalies, fetal anomalies, and multiple gestation) are unable to be controlled by healthcare providers, they were included in the results of this study. The risk factors are listed in the table below.

Table 3. Individual Risk Factors for Preterm Birth

African American Race ⁴	Substance Abuse
Anxiety	Smoking
Depression	Maternal Age <18 or >40
Multiple Gestation	Inadequate Prenatal Care
Uterine Anomaly	Fetal Anomaly
Sexually Transmitted Infections	Chronic/Gestational Hypertension
Bacteriuria	Preexisting Diabetes
Periodontal Disease	Gestational Diabetes
Previous Preterm Delivery	Preeclampsia

Pre-existing Diabetes / Diabetes Mellitus

Diabetes is a condition in which there are elevated levels of blood sugar in the body due to either no insulin production (Type 1 Diabetes) or insulin resistance (Type 2

⁴ The risk factor “African American race” refers to the racial discrimination often experienced by African American patients, which has been associated with adverse birth outcomes.

Diabetes).⁵ While there is no singular known cause of diabetes, there are a number of genetic and environmental factors that contribute to the development of diabetes.

Approximately 9% of women in the United States are diagnosed with Type 1 or Type 2 diabetes.⁵ Pre-existing diabetes, unlike gestational diabetes, is diagnosed before pregnancy or within the first twenty weeks of pregnancy.

In order to minimize risks associated with diabetes throughout pregnancy, there should be close monitoring of blood glucose levels (fasting and postprandial) by both the healthcare provider and the expectant mother.^{5,6,4} The American Diabetes Association (ADA) recommends pre-conception family planning for women with pre-existing diabetes involving a multidisciplinary team of providers, including an OB-GYN and an endocrinologist. Because of increased hormone activity during pregnancy, the mother's insulin resistance may increase. The ADA also recommends evaluating medication use to see which are safe for pregnancy and which treatments will need to be modified.^{7,8}

The impact of pre-existing diabetes on the chance of premature birth is very similar to that of gestational diabetes. In addition to premature birth, pre-existing diabetes can also contribute to other pregnancy and birth complications, including preeclampsia, birth defects (specifically concerning the heart and neural tube), miscarriage and

⁵ Preexisting Diabetes. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimess.org/complications/preexisting-diabetes.aspx>

⁶ United States Department of Health and Human Services Centers for Disease Control and Prevention. (n.d.). *Pre-Existing Diabetes and Pregnancy* [PDF file]. Retrieved from https://www.cdc.gov/pregnancy/documents/DiabetesDefects_Cleared.pdf

⁷ Kitzmiller, J. L., Block, J. M., Brown, F. M., Catalano, P. M., Conway, D. L., Coustan, D. R., . . . Kirkman, M. S. (2008, May 01). Managing Preexisting Diabetes for Pregnancy. Retrieved December 3, 2018, from <http://care.diabetesjournals.org/content/31/5/1060>

⁸ Pregnancy and Pre-existing Diabetes. (2010, July 20). Retrieved December 3, 2018, from <http://www.diabetes.org/newsroom/press-releases/2010/pregnancy-and-pre-existing-diabetes.html>

stillbirth, and an increased risk of delivery via cesarean section.⁵ If delivered vaginally, the infant could sustain damage to the shoulder and collar bone as diabetes may contribute to macrosomia or large-for-gestational-age infants.⁶

Gestational Diabetes

The American Diabetes Association defines gestational diabetes as a condition in which blood sugar (glucose) levels are elevated during pregnancy.⁹ While there is no definitively known cause of gestational diabetes, research suggests that insulin resistance may develop as a result of hormonal activity during pregnancy. The hormones that come from the placenta may be inhibiting the mother's insulin. Gestational diabetes can occur in women who have no history of pre-existing diabetes, though a previous diabetes diagnosis is a risk factor for developing gestational diabetes in subsequent pregnancies.¹⁰ Other risk factors include advanced maternal age (over age 35), family history of gestational diabetes, and maternal obesity.¹¹

Both the American Diabetes Association and the Centers for Disease Control and Prevention estimate that the prevalence of gestational diabetes may be as high as 9.2%^{1,2} These women are at risk for preterm delivery because of their increased risk of developing high blood pressure and preeclampsia, the stress of which could cause preterm labor. Premature delivery may also be recommended by the physician in these

⁹ How to Treat Gestational Diabetes. (n.d.). Retrieved December 3, 2018, from <http://www.diabetes.org/diabetes-basics/gestational/how-to-treat-gestational.html>

¹⁰ DeSisto, C. L., Kim, S. Y., & Sharma, A. J. (2014, June 19). Preventing Chronic Disease | Prevalence Estimates of Gestational Diabetes Mellitus in the United States, Pregnancy Risk Assessment Monitoring System (PRAMS), 2007–2010 - CDC. Retrieved December 3, 2018, from https://www.cdc.gov/pcd/issues/2014/13_0415.htm

¹¹ Gestational Diabetes: Testing and Treatment. (2018, November 24). Retrieved December 3, 2018, from <http://americanpregnancy.org/pregnancy-complications/gestational-diabetes/>

cases because of the infant's large size.¹² Spontaneous preterm delivery may also occur. Some physicians speculate that excess fluid in the uterus caused by uncontrolled blood glucose may cause the uterus to stretch and make the body think the pregnancy is farther along than it actually is.¹³

While there are no universal screening guidelines, high-risk mothers are generally tested early on in pregnancy, and average-risk mothers are tested in the second trimester (between 24 and 28 weeks of pregnancy).¹² These tests generally consist of an initial glucose challenge test in which the mother drinks a high-glucose solution (50 g) and has her blood glucose levels evaluated one hour later. If those levels are above the normal limits (130-140 mg/dL), the mother will undergo follow-up glucose tolerance testing. For the follow-up test, the mother fasts overnight, drinks another solution higher in glucose content than the first (100 g), and has her blood sugar levels evaluated fasting and then hourly for three hours. For a diagnosis of gestational diabetes to be made, two of those four evaluations must be higher than accepted standards.¹²

The goal of treatment is not to “cure” gestational diabetes, as it is limited to pregnancy, but to manage blood sugar levels. Treatment includes special meal plans, nutritional counseling, consistent physical activity, and close monitoring of blood glucose levels. Insulin injections may also be prescribed.⁹ Several measures can be taken in an attempt to prevent gestational diabetes, including eating health foods, staying active, and losing excess weight before pregnancy.¹²

¹² Gestational Diabetes. (2017, April 28). Retrieved from <https://www.mayoclinic.org/diseases-conditions/gestational-diabetes/diagnosis-treatment/drc-20355345>

¹³ Schenkenberger, S. S. (2017, November 15). Gestational diabetes increases risk of preterm labor. Retrieved December 3, 2018, from <https://inside.akronchildrens.org/2017/11/14/gestational-diabetes-increases-risk-of-preterm-labor/>

Because gestational diabetes does not affect the pregnancy until after 20 weeks, there is a lower chance of fetal anomalies or birth defects. This is due to the fact that organogenesis is complete. However, gestational diabetes still impacts the child, usually through extra energy stored as fat. Babies born to mothers with gestational diabetes tend to be larger, which can lead to an increased risk for delivery via cesarean section or possible damage to shoulders and collarbone if delivered vaginally. The infant may also have low blood sugar at birth, respiratory problems, and a higher risk for obesity as children and developing diabetes as adults.^{9,12}

Chronic Hypertension

Chronic hypertension is classified as high blood pressure present before 20 weeks of pregnancy, whereas gestational hypertension develops after the 20th week of pregnancy.¹⁴ According to the American College of Obstetricians and Gynecologists, normal blood pressure levels are defined as those less than 120/80 mmHG, elevated blood pressure levels have systolic pressure between 120-129 and diastolic pressure less than 80 mmHG. Stage 1 hypertension is categorized as systolic pressure between 130 - 139 or diastolic pressure between 80-89 mmHg, and Stage 2 hypertension is categorized as systolic pressure of at least 140 or diastolic pressure of at least 90 mmHG.¹⁵

¹⁴ High blood pressure and pregnancy: Know the facts. (2018, February 14). Retrieved December 3, 2018, from <https://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/pregnancy/art-20046098>

¹⁵ The American Association of Obstetricians and Gynecology. (May 2018) *Preeclampsia and High Blood Pressure During Pregnancy* [PDF file]. Retrieved from <https://www.acog.org/-/media/For-Patients/faq034.pdf>

The American Heart Association identifies two major risk factors for developing chronic hypertension: obesity and older age.¹⁶ Chronic hypertension is estimated to affect 22% of women of childbearing age and is present in approximately 3-5% of pregnancies. Other estimates say that 20-25% of women with chronic hypertension go on to develop preeclampsia.^{16,17}

Because hypertension may result in decreased blood flow to the placenta, the baby may not be receiving the necessary oxygen and nutrients, and early delivery may be necessary to prevent life-threatening complications.^{14,15} For women with chronic hypertension, the CDC recommends regular prenatal checkups starting early in the pregnancy.¹⁸ The best preventative measures, in addition to pre-conception checkups, are staying active, consuming a healthy diet, and avoiding drugs and alcohol.¹⁴ In order to manage chronic hypertension during pregnancy, women are encouraged to monitor their own blood pressure at home and track their weight.¹⁵ Some blood pressure medications are considered safe during pregnancy, but ACE inhibitors, angiotensin II receptor blockers, and renin inhibitors are generally avoided.¹⁴

In addition to premature labor and delivery, women with chronic hypertension have increased risk for placental abruption or impaired fetal growth.¹⁴ Hypertension also

¹⁶ Seely, E. W., & Ecker, J. (2014). Chronic Hypertension in Pregnancy. *Chronic Hypertension in Pregnancy*, 129(11). Retrieved December 3, 2018, from <https://www.ahajournals.org/doi/abs/10.1161/circulationaha.113.003904>

¹⁷ Carson, M. P., & Gibson, P. S. (2018, June 21). Hypertension and Pregnancy. Retrieved December 3, 2018, from <https://emedicine.medscape.com/article/261435-overview#a2>

¹⁸ High Blood Pressure During Pregnancy Fact Sheet. (n.d.). Retrieved April 22, 2019, from <https://www.cdc.gov/bloodpressure/pregnancy.htm>

puts extra stress on the maternal heart and kidneys, creates an increased risk of heart disease, kidney disease, and stroke, and is another risk factor for cesarean delivery.¹⁵

Preeclampsia

Preeclampsia is characterized by high blood pressure in pregnancy, and is usually accompanied by damage to the kidneys, liver, and other organ systems. Unlike chronic hypertension, the elevated blood pressure usually begins later in pregnancy (after about 20 weeks).¹⁹ There are several factors that can influence the development of preeclampsia, including the development of blood vessels that supply nutrients to the placenta. When these blood vessels develop or function abnormally, they can have different reactions to hormones that can alter the amount of blood flow to the placenta. Other risk factors for the development of preeclampsia include history of preeclampsia, chronic hypertension, first pregnancy, advanced maternal age, race, obesity, and multiple gestation.¹⁹ According to both the American Pregnancy Association and the Preeclampsia Foundation, preeclampsia is a condition that affects 5-8% of all pregnancies.^{20,21}

Preeclampsia has the potential for severe complications, including death. Because of this, the healthcare provider may determine that scheduled or induced preterm delivery is the safest option for both the mother and child.¹⁹ For preeclampsia to develop, blood pressure may increase suddenly or very slowly, and regular monitoring is important in order to catch these changes. Other symptoms include proteinuria (protein in the urine), severe headaches, vision changes, nausea, vomiting, shortness of breath, decreased urine

¹⁹ Preeclampsia. (2018, November 16). Retrieved December 3, 2018, from <https://www.mayoclinic.org/diseases-conditions/preeclampsia/symptoms-causes/syc-20355745>

²⁰ About Preeclampsia. (2010, July 05). Retrieved December 3, 2018, from <https://www.preeclampsia.org/health-information/about-preeclampsia>

output, and impaired liver function. Women at risk for preeclampsia may be prescribed daily low dose aspirin as a preventative measure.¹⁹ If not recognized and treated quickly, preeclampsia has the potential to develop into eclampsia, which may progress to seizures.²¹ Once preeclampsia develops, delivery is often the safest and most effective option.²⁰

Depression

Depression is defined by the American Psychiatric Association as “a common and serious medical illness that negatively affects how you feel, the way you think and how you act.”²² In addition to impacting behavior and mental well-being, depression also has the potential to affect physical health.

There is no singular known cause, but chemical imbalances in the brain could contribute to the development of depression, as could genetics, hormonal changes that take place during pregnancy, or stress.²³ Depression affects 6.7% of adults in any given year, and 16.6% will experience depression in their lifetime. Women are more likely than men to experience depression, and it is estimated that up to 1/3 of women will experience a major depressive disorder at some point in their lives.²² Observable symptoms include sad or depressed mood, unusual weight loss or gain, fatigue or loss of energy, loss of interest in activities, trouble thinking or concentrating, feelings of worthlessness or guilt, or thoughts of death or suicide.²³

²¹ Preeclampsia: Symptoms, Risks, Treatment and Prevention. (2017, April 04). Retrieved December 3, 2018, from <http://americanpregnancy.org/pregnancy-complications/preeclampsia/>

²² What Is Depression? (n.d.). Retrieved December 3, 2018, from <https://www.psychiatry.org/patients-families/depression/what-is-depression>

²³ Depression. (2012, June). Retrieved December 3, 2018, from <https://www.acog.org/Patients/FAQs/Depression?IsMobileSet=false>

Though no precise link is understood between depression and preterm birth, women with depression may have trouble taking care of themselves, eating healthfully, or getting enough rest.²² People with depression are also at a higher risk for substance abuse.²⁴ All of these factors may contribute to premature birth. The Journal of American Medical Association recommends universal screening for depression through pregnancy.²⁵ Medication in combination with psychotherapy is generally an effective treatment, but in extreme cases, hospitalization may be a necessary intervention.²⁶ Women who leave depression untreated throughout their pregnancy also have a greater chance of experiencing postpartum depression.²⁴

Anxiety

According to the Anxiety and Depression Association of America, anxiety is the most common mental illness in U.S., affecting 40 million adults (18.1% of the population) every year, and women are twice as likely as men to be affected.²⁷ Some studies estimate that 1 in 10 pregnant women experience anxiety during their pregnancy.²⁸

²⁴ Depression During Pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimes.org/complications/depression-during-pregnancy.aspx>

²⁵ Grote NK, Bridge JA, Gavin AR, Melville JL, Iyengar S, Katon WJ. A Meta-analysis of Depression During Pregnancy and the Risk of Preterm Birth, Low Birth Weight, and Intrauterine Growth Restriction. *Arch Gen Psychiatry*. 2010;67(10):1012–1024. doi:10.1001/archgenpsychiatry.2010.111

²⁶ Depression (major depressive disorder). (2018, February 03). Retrieved from <https://www.mayoclinic.org/diseases-conditions/depression/diagnosis-treatment/drc-20356013>

²⁷ Facts & Statistics. (n.d.). Retrieved from <https://adaa.org/about-adaa/press-room/facts-statistics>

²⁸ Anxiety and panic attacks in pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.tommys.org/pregnancy-information/im-pregnant/mental-wellbeing/specific-mental-health-conditions/anxiety-and-panic-attacks-pregnancy>

Like depression, anxiety can impact physical health as well as influence behavior and mental well-being. Preexisting symptoms of anxiety may worsen during pregnancy. These include constant worry or stress, recurring thoughts, panic attacks, tense muscles, and trouble sleeping.³¹ A systematic review and meta-analysis of prenatal maternal anxiety published in 2016 found that the strongest predictor of preterm birth was pregnancy-specific anxiety. The study suggests effective treatment could include programs with a specific aim to reduce maternal anxiety during pregnancy.²⁹ Constant stress created by anxiety can affect the immune system, lead to substance abuse, and disrupt hormone levels, all of which have the potential to increase the risk of preterm delivery.³⁰

Conversations with the healthcare provider are the best way for a diagnosis to be made. Effective treatment generally includes cognitive behavioral therapy, lifestyle changes, and sometimes medication. As long as the medication is determined to be safe, all of these may be utilized by pregnant women to reduce anxiety.³¹

Fetal Anomaly

Congenital fetal anomalies can be described as either structural or functional.³² Structural abnormalities affect the physical development of the fetus. Examples of

²⁹ Rose, M., Pana, G., & Premji, S. (2019, May 26). Prenatal Maternal Anxiety as a Risk Factor for Preterm Birth and the Effects of Heterogeneity on This Relationship: A Systematic Review and Meta-Analysis. Retrieved December 3, 2018, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4889802/>

³⁰ Stress and pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimes.org/pregnancy/stress-and-pregnancy.aspx>

³¹ Anxiety and pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.pregnancybirthbaby.org.au/anxiety-and-pregnancy>

³² Congenital anomalies. (2016, September 7). Retrieved December 3, 2018, from <http://www.who.int/news-room/fact-sheets/detail/congenital-anomalies>

structural abnormalities include cleft palate, heart defects, and missing or abnormal limbs. Functional abnormalities affect the functionality of body systems, including neurological, sensory, metabolic, degenerative, and immune disorders.³³ Like many of the other risk factors that have been discussed, there are several things that can influence the formation of a fetal anomaly, including genetics (inherited genetic mutations and chromosomal abnormalities), socioeconomic and demographic factors (low income and low access to resources and prenatal care), environmental factors (chemical exposure, substance abuse, radiation, etc.), infections (i.e. Zika or rubella), and maternal nutritional status.³²

Fetal anomalies affect an estimated 2-3% of pregnancies.³⁴ Of those, nearly 1/3 are delivered prematurely. It is worth noting that the rates of spontaneous preterm birth vary with each specific anomaly.³⁵ Induced preterm delivery may ensure birth in a controlled setting with access to medical care, lowering the risk of fetal death.³⁴ Congenital fetal anomalies are typically diagnosed by ultrasound screening, chorionic villus sampling, amniocentesis, and maternal serum biochemistry.³⁶

The ideal treatment consists of both removing preventable risk factors such as substance abuse and chemical or radiation exposure as well as providing appropriate

³³ Structural and Functional Birth Defects. (n.d.). Retrieved December 3, 2018, from <https://www.birthdefects.org/structural-and-functional-birth-defects/>

³⁴ Craigo, S. D. (2011, October). Indicated preterm birth for fetal anomalies. Retrieved December 3, 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/21962626>

³⁵ Berger, V., Moghadassi, M., Gosnell, K., Sparks, T., Velez, J. G., & Norton, M. (2017, May 9). The Risk of Preterm Birth in Pregnancies With Fetal... : Obstetrics & Gynecology. Retrieved December 3, 2018, from https://journals.lww.com/greenjournal/Abstract/2017/05001/The_Risk_of_Preterm_Birth_in_Pregnancies_With.633.aspx

³⁶ Todros, T., Capuzzo, E., & Gaglioti, P. (2001, April). Prenatal diagnosis of congenital anomalies. Retrieved December 3, 2018, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3232499/>

vaccinations to pregnant women. Other fetal anomalies that cannot be treated in utero may be treated soon after birth.³² Individualized management plans may be very helpful in providing the best possible care for infants born with congenital anomalies.³⁴

Uterine Anomaly

Congenital uterine anomalies are a product of the abnormal prenatal formation of Mullerian ducts.³⁷ The five primary types of uterine anomalies are bicornuate (indented external surface, two endometrial cavities), septate (normal surface, two endometrial cavities), arcuate (normal external surface, slight indentation into endometrial cavity, generally considered variation of normal uterine anatomy), unicornuate (only half of uterus has normally developed), and didelphys (the two halves of uterus remain separate).³⁸ Of these, the bicornuate and septate anomalies are the most common.³⁹ An estimated 5.5% of women have a congenital uterine anomaly.⁴⁰

The American Journal of Obstetrics and Gynecology reports that women with a uterine anomaly were 6 times as likely to deliver before 37 weeks.³⁹ Uterine anomalies have also been linked to preterm premature rupture of membranes, intrauterine growth restriction, placenta previa, placental abruption, and breech presentation. Some of these

³⁷ Chan, Y. Y., Jayaprakasan, K., Tan, A., Thornton, J. G., Coomarasamy, A., & Raine-Fenning, N. J. (2011, September 20). Reproductive outcomes in women with congenital uterine anomalies: A systematic review. Retrieved December 3, 2018, from <https://obgyn.onlinelibrary.wiley.com/doi/full/10.1002/uog.10056>

³⁸ Uterine Anomaly. (2018, September 13). Retrieved December 3, 2018, from <https://www.columbiadoctors.org/condition/uterine-anomaly>

³⁹ Hua, M., Odibo, A. O., Longman, R. E., Macones, G. A., Roehl, K. A., & Cahill, A. G. (2011, July 22). Congenital uterine anomalies and adverse pregnancy outcomes. Retrieved December 3, 2018, from <https://www.sciencedirect.com/science/article/pii/S0002937811009380>

⁴⁰ Chan, Jayaprakasan, Zamora, Thornton, & Coomarasamy. (2011, June 24). Prevalence of congenital uterine anomalies in unselected and high-risk populations: A systematic review. Retrieved December 3, 2018, from <https://academic.oup.com/humupd/article/17/6/761/873088>

may be due to diminished muscle mass or abnormal uterine bloodflow.³⁹ Transvaginal ultrasounds have proven to be an accurate way to assess likelihood of preterm birth in women with uterine anomalies, with short cervical length serving as the indicator.⁴¹ Magnetic resonance imaging (MRI) has also proven to be a trustworthy way to diagnose uterine anomalies.³⁹

In order to mitigate the impact of uterine anomaly on premature birth, pre-conception counseling is recommended. Surgical treatment may be possible for certain uterine anomalies before pregnancy.³⁸ An accurate diagnosis and antenatal monitoring can also help prevent spontaneous preterm labor.⁴²

Periodontal Disease

Periodontal disease is a chronic, inflammatory, bacteria-induced disease in the gums.⁴³ It is caused by gram-negative bacteria releasing endotoxins that cause loss of connective tissue attachment and supporting bone height.⁴⁴ Susceptibility to periodontal disease may be a result of changing hormone levels during pregnancy that promote an inflammatory response to the bacteria.⁴⁵ Approximately 40% of pregnant women have

⁴¹ Airoidi, J., Berghella, V., Sehdev, H., & Ludmir, J. (2005, September). Transvaginal Ultrasonography of the Cervix to Predict... : Obstetrics & Gynecology. Retrieved December 3, 2018, from https://journals.lww.com/greenjournal/Fulltext/2005/09000/Transvaginal_Ultrasonography_of_the_Cervix_to.17.aspx

⁴² Vaz, S. A., Dotters-Katz, S. K., & Kuller, J. A. (2017, March). Diagnosis and Management of Congenital Uterine Anomalies in Pregnancy. Retrieved December 3, 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/28304417>

⁴³ Expectant Mothers' Periodontal Health Vital To Health of Her Baby. (2013, August 28). Retrieved December 3, 2018, from https://www.perio.org/consumer/AAP_EFP_Pregnancy

⁴⁴ Michalowicz, B. S., Hodges, J. S., DiAngelis, A. J., Lupo, V. R., Novak, M. J., Ferguson, J. E., . . . Tschida, P. A. (2006, November 2). Treatment of Periodontal Disease and the Risk of Preterm Birth. Retrieved December 3, 2018, from <https://www.nejm.org/doi/full/10.1056/NEJMoa062249>

⁴⁵ Wilder, R. S. (Ed.). (2008). Periodontal Diseases and Adverse Pregnancy Outcomes: A Review of the Evidence and Implications for Clinical Practice. *Journal of Dental Hygiene*. Retrieved December 3, 2018,

some form of periodontal disease, but the rate is higher among racial and ethnic minorities as well as women in a lower socioeconomic demographic.⁴⁶ The American Dental Hygienists' Association estimates that 50-70% of women will develop gingivitis during their pregnancy.⁴⁵

Spontaneous preterm birth may be directly connected to periodontal disease through bacterial infection of the amnion or placenta, or indirectly connected through inflammatory responses.⁴⁷ However, there is evidence supported by recent research that periodontal disease may not actually impact the rates of premature birth as much as previously speculated, since incidence of periodontal disease is higher among populations already at-risk for premature birth.⁴⁶

Symptoms of periodontal disease include swollen gums, gums that bleed with brushing, bad breath, loose teeth, and gums that pull away from the teeth.⁴³ It can best be prevented by regular dental appointments as well as routine brushing and flossing. Periodontal disease can be treated by scaling and root planning, though these treatments do not significantly reduce the risk of preterm birth.⁴⁴

from https://www.adha.org/resources-docs/7838_Periodontal_Diseases_and_Adverse_Pregnancy_Outcomes.pdf

⁴⁶ Srinivas, S. K., & Parry, S. (2012, February). Periodontal Disease and Pregnancy Outcomes: Time to Move On? Retrieved December 3, 2018, from <http://www.liebertpub.com/doi/10.1089/jwh.2011.3023>

⁴⁷ Malinova, M. (2013, January 01). Periodontal disease and preterm birth. Retrieved December 3, 2018, from <https://europepmc.org/abstract/med/24294762>

Maternal Age >40 or <18

An increase in female enrollment and female presence in the workforce has been accompanied by women having children later in life than in previous generations.⁴⁸

According to the CDC, mean maternal age (age at which a woman has her first child) has increased from 24.9 to 26.3 from 2000 to 2014.⁴⁹ Approximately 3.1% of births were by mothers 40 and older in 2016.⁵⁰

It is not clear whether or not advanced maternal age alone is an independent risk factor for premature delivery. Rather, it may be associated with other, less-observable factors, such as social processes, that may impact the length of pregnancy.⁵¹ Certain conditions are linearly associated with increasing maternal age, including chronic hypertension, preexisting diabetes, and gestational diabetes, all of which can contribute to preterm delivery.⁵² Advanced maternal age is also more likely to result in chromosomal abnormalities, multiple gestation, and nonchromosomal birth defects.⁵³

⁴⁸ Bui, Q., & Miller, C. C. (2018, August 04). The Age That Women Have Babies: How a Gap Divides America. Retrieved December 3, 2018, from <https://www.nytimes.com/interactive/2018/08/04/upshot/up-birth-age-gap.html>

⁴⁹ Matthews, T., & Hamilton, B. E. (2016, January 14). Mean Age of Mothers is on the Rise: United States, 2000–2014. Retrieved December 3, 2018, from <https://www.cdc.gov/nchs/products/databriefs/db232.htm>

⁵⁰ Martin, J. A., Hamilton, B. E., Osterman, M. J., Driscoll, A. K., & Drake, P. (2018). *National Vital Statistics Report* (1st ed., Vol. 67, Births: Final Data for 2016). Retrieved December 3, 2018, from https://www.cdc.gov/nchs/data/nvsr/nvsr67/nvsr67_01.pdf

⁵¹ Alice Goisis, Hanna Remes, Kieron Barclay, Pekka Martikainen, Mikko Myrskylä; Advanced Maternal Age and the Risk of Low Birth Weight and Preterm Delivery: a Within-Family Analysis Using Finnish Population Registers, *American Journal of Epidemiology*, Volume 186, Issue 11, 1 December 2017, Pages 1219–1226, <https://doi.org/10.1093/aje/kwx177>

⁵² Fuchs, F., Monet, B., Ducruet, T., Chaillet, N., & Audibert, F. (2018, January 31). Effect of maternal age on the risk of preterm birth: A large cohort study. Retrieved December 3, 2018, from <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0191002>

⁵³ Gill, S. K., Broussard, C., Devine, O., Green, R. F., Rasmussen, S. A., & Reefhuis, J. (2015, August 11). Birth Defects Research Part A: Clinical and Molecular ... Retrieved December 3, 2018, from <http://onlinelibrary.wiley.com/doi/10.1002/bdra.23049/full>

Teenage pregnancy has been declining in the United States over the past three decades, partly due to the implementation of federal programs (like the Title X Family Planning Program), increased access to birth control, and lower rates of sexual activity among young women.⁵⁴ In 2016, the birth rate for women age 10-17 was 9 per 1,000 births. This is a 77% decrease from the rates in 1991. For the 2016 rates, most of those women (8.8/1,000) were age 15-17, while only 0.2/1,000 were age 10-14.⁵⁰

Even accounting for socioeconomic and other social demographic factors, young maternal age has been associated with adverse pregnancy outcomes, including premature birth and low birth weight. However, many young mothers have factors other than biological immaturity complicating their pregnancies, including decreased social support and low socioeconomic status.⁵⁵ Young maternal age is also associated with other adverse outcomes, including preeclampsia, postpartum hemorrhage, poor fetal growth, and fetal distress.⁵⁶

Bacteriuria

Bacteriuria is the presence of bacteria in the urine and is typically diagnosed after a urine culture is performed. Bacteriuria can be a sign of infection in the urinary tract, including the kidneys, ureters, bladder, or urethra.⁵⁷ Pregnant women often have an

⁵⁴ Decrease in teen pregnancy. (2018, March 02). Retrieved December 3, 2018, from <https://www.womenshealth.gov/30-achievements/09>

⁵⁵ Fraser, A. M., Brockert, J. E., & Ward, R. H. (1995, April 27). Association of Young Maternal Age with Adverse Reproductive Outcomes | NEJM. Retrieved December 3, 2018, from <https://www.nejm.org/doi/full/10.1056/NEJM199504273321701>

⁵⁶ Cavazos-Rehg, P.A., Krauss, M.J., Spitznagel, E.L. et al. Matern Child Health J (2015) 19: 1202. <https://doi.org/10.1007/s10995-014-1624-7>

⁵⁷ Asymptomatic Bacteriuria. (2019, January). Retrieved April 22, 2019, from https://www.health.harvard.edu/a_to_z/asymptomatic-bacteriuria-a-to-z

increased risk of developing urinary tract infections (UTIs), and they are typically tested throughout their pregnancy, beginning in the first trimester.⁵⁸ Symptoms of UTIs include pain or a burning sensation when urinating, frequent urination, blood in the urine, cloudy or foul-smelling urine, or a change in amount of urine, among other symptoms. If the infection reaches the kidneys, symptoms may include fever, back pain, nausea, and vomiting. A kidney infection could increase the risk for preterm birth.⁵⁹ UTIs are treated with antibiotics.⁶⁰ If the patient does not exhibit any symptoms of a UTI but still has bacteria in their urine sample, they may be diagnosed with asymptomatic bacteriuria. Asymptomatic bacteriuria is not always treated, but treatment with antibiotics is recommended for pregnant women, as asymptomatic bacteriuria has been associated with increased risk for preterm birth.⁵⁷

Smoking and Substance Abuse

Substance abuse during pregnancy includes the use of tobacco, alcohol, prescription or illicit drugs. These are especially harmful during pregnancy, as many substances pass easily through the placenta and can affect the fetus directly.⁶¹ Among pregnant women, the most common substances abused are tobacco followed by alcohol,

⁵⁸ Colgan, R., Nicolle, L. E., McGlone, A., & Hooton, T. M. (2006, September 15). Asymptomatic Bacteriuria in Adults. Retrieved April 22, 2019, from <https://www.aafp.org/afp/2006/0915/p985.html>

⁵⁹ Urinary Tract Infection During Pregnancy: Symptoms & Prevention. (2017, March 11). Retrieved April 22, 2019, from <https://americanpregnancy.org/pregnancy-complications/urinary-tract-infections-during-pregnancy/>

⁶⁰ Urinary Tract Infections | UTI | UTI Symptoms. (2019, April 08). Retrieved April 22, 2019, from <https://medlineplus.gov/urinarytractinfections.html>

⁶¹ Substance Use While Pregnant and Breastfeeding. (2018, July). Retrieved December 3, 2018, from <https://www.drugabuse.gov/publications/research-reports/substance-use-in-women/substance-use-while-pregnant-breastfeeding>

cannabis, and other illicit substances. According to a 2012 survey, 5.9% of women reported using illicit drugs, 8.5% drank alcohol, and 15.9% smoked cigarettes during their pregnancy.⁶²

The best way to prevent preterm delivery and other adverse pregnancy outcomes is to abstain from using the harmful substances. One study found that 96% of women who drank alcohol, 78% of women who reported using marijuana, 73% of women who used cocaine, and 32% of women who smoked cigarettes were able to abstain throughout their pregnancy.⁶²

The American College of Obstetricians and Gynecologists currently recommends screening in the form of questionnaires or conversations with patients, though not necessarily through laboratory testing.⁶³ In addition to preterm birth, there is an increased risk of stillbirth, infant mortality, low birth weight, birth defects, placental abruption, fetal alcohol syndrome, and withdrawal after birth associated with substance abuse during pregnancy.^{62,64}

Multiple Gestation

Multiple gestation can be caused either by multiple eggs being released at ovulation and each being fertilized by different sperm (resulting in fraternal multiples) or

⁶² Forray A. Substance use during pregnancy [version 1; referees: 2 approved]. *F1000Research* 2016, **5**(F1000 Faculty Rev):887 (<https://doi.org/10.12688/f1000research.7645.1>)

⁶³ *Alcohol Abuse and Other Substance Use Disorders: Ethical Issues in Obstetric and Gynecologic Practice*(633rd ed.). (2015). Retrieved December 3, 2018, from <https://www.acog.org/-/media/Committee-Opinions/Committee-on-Ethics/co633.pdf?dmc=1>

⁶⁴ Wilson, J, Thorp, Jr., J, *Glob. libr. women's med.*, (ISSN: 1756-2228) 2008; DOI 10.3843/GLOWM.10115

a single fertilized egg splitting (resulting in identical multiples).⁶⁵ Multiple gestation is often found at the first ultrasound.⁶⁶ The latest complete birth data reported by the CDC is from 2016. The incidence of twins is 33.4 per 10,000 births (0.334%), and the incidence of triplet and higher-order multiples is 101.4 per 100,000 (0.1014%). According to the same data, 59.91% of twins are born preterm. Triplets and higher-order multiples are almost always born preterm, with 98.08% of triplets, 96.77% of quadruplets, and 100% of quintuplets and higher being born before 37 weeks gestation.⁵⁰

The most common reason for premature delivery with multiple gestation is the higher incidence of preterm premature rupture of the membranes (PPROM), more commonly known as the water breaking.⁶⁷ PPRM accounts for 1/4 – 1/3 of all preterm deliveries and can be caused by natural weakening of the membranes or by infection.⁶⁸ When the water breaks prematurely, providers generally recommend delivery to avoid infection. However, if it is too early in the pregnancy (24-34 weeks), antibiotics may be given to avoid infection while allowing infant to develop more fully in utero. Steroids to advance lung development may also be administered to reduce the chances of respiratory distress at the time of delivery.⁶⁹ Multiple gestation is also often associated with increased risk of placental abruption, compression of umbilical cord, cesarean delivery,

⁶⁵ Multiple Pregnancy. (2018, July). Retrieved December 3, 2018, from <https://www.acog.org/Patients/FAQs/Multiple-Pregnancy?IsMobileSet=false>

⁶⁶ Multiple pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.chw.org/medical-care/fetal-concerns-center/conditions/pregnancy-complications/multiple-pregnancy>

⁶⁷ Complications in a Multiples Pregnancy. (2016, September 02). Retrieved December 3, 2018, from <http://americanpregnancy.org/multiples/complications/>

⁶⁸ Premature Rupture of Membranes (PROM)/Preterm Premature Rupture of Membranes (PPROM). (2014, August 24). Retrieved December 3, 2018, from <https://www.chop.edu/conditions-diseases/premature-rupture-membranes-prompreterm-premature-rupture-membranes-pprom>

⁶⁹ Water breaking: Understand this sign of labor. (2016, October 18). Retrieved December 3, 2018, from <https://www.mayoclinic.org/healthy-lifestyle/labor-and-delivery/in-depth/water-breaking/art-20044142>

and postpartum infection.⁶⁸ Women pregnant with twins or higher-order multiples may be encouraged to attend extra prenatal visits and receive ultrasounds more frequently in order to monitor any potential complications.⁷⁰

Sexually Transmitted Infections

Sexually transmitted infections (STIs) are those passed through intercourse (vaginal, anal, or oral) with an infected partner.⁷¹ In recent years, reported cases of STIs have reached record highs in the United States, with nearly 2.3 million cases reported in 2017.⁷² Many STIs are asymptomatic, especially in women.⁷³ When untreated, chlamydia and gonorrhea, two of the most common STIs in pregnancy, can develop into pelvic inflammatory disease.⁷² The CDC estimates that 15% of untreated chlamydia cases progress to PID.⁷⁴ Cervicitis in pregnant women can increase chances of preterm labor and delivery.

Standard prenatal care includes testing for chlamydia, gonorrhea, hepatitis B, human immunodeficiency virus (HIV), syphilis, genital herpes, genital warts, and trichomoniasis.⁷¹ This testing generally takes place at the first prenatal visit.⁷⁵ STIs such

⁷⁰ Being pregnant with twins, triplets and other multiples. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimes.org/complications/being-pregnant-with-twins-triplets-and-other-multiples.aspx>

⁷¹ Sexually transmitted diseases. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimes.org/pregnancy/sexually-transmitted-diseases.aspx>

⁷² United States Department of Health and Human Services Centers for Disease Control and Prevention. (2016, September). *Reported STDs in the United States, 2017* [PDF file]. Retrieved from <https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/std-trends-508.pdf>

⁷³ STDs during Pregnancy - CDC Fact Sheet. (2016, November 10). Retrieved December 3, 2018, from <https://www.cdc.gov/std/pregnancy/stdfact-pregnancy.htm>

⁷⁴ STDs in Women and Infants. (n.d.). Retrieved December 3, 2018, from <https://www.cdc.gov/std/stats16/womenandinf.htm>

⁷⁵ STDs and pregnancy: Get the facts. (2018, January 31). Retrieved December 3, 2018, from <https://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/stds-and-pregnancy/art-20115106>

as chlamydia, gonorrhea, syphilis, and trichomoniasis can be treated using antibiotics that are safe for pregnancy. Viral sexually transmitted diseases such as genital herpes, HIV, and hepatitis B cannot be cured, but may be treated with antiviral medications. The best ways to prevent STIs are to abstain from sex or have sex with a mutually monogamous partner who is known to be uninfected. Use of male condoms with all sexual activity can also reduce the risk of STI.

Many STIs can be passed to the baby if the baby is delivered vaginally through an infected birth canal.⁷¹ In order to reduce the risk of passing an infection to the infant, the physician may recommend delivery via cesarean section.⁷⁶ Maternal infection with chlamydia or gonorrhea can lead to conjunctivitis infections in newborns, and standard of care is for hospitals to give infants preventative eye medication at birth.⁷⁴

⁷⁶ How do sexually transmitted diseases and sexually transmitted infections (STDs/STIs) affect pregnancy? (n.d.). Retrieved December 3, 2018, from <https://www.nichd.nih.gov/health/topics/stds/conditioninfo/infant>

CHAPTER THREE

Centering Pregnancy

The Centering Healthcare model was introduced by Sharon Rising in the 1990s as a new, innovative model of prenatal care. Rising, a graduate of Yale Nursing School, realized that pregnant women could benefit from spending more time with their healthcare team during their pregnancy. The model she developed follows the traditional schedule of ten prenatal visits but allows the women to spend up to two hours per visit with their physician or nurse, rather than fifteen minutes. This time spent face to face with their healthcare providers facilitates a better relationship.

In addition to allowing women to have more time with their provider, Centering also makes it possible for women to connect with other expectant mothers. Each Centering cohort generally consists of 8 to 10 women who are all due in the same month. They are able to get to know each other, ask questions, and give each other advice in a comfortable setting. These groups are often incredibly diverse but are brought together through “the common experience of pregnancy.” Women who have had children before are able to give advice to first-time moms. They are able to share stories, connect, and support each other in ways that would be very difficult in traditional models of prenatal care. Centering Healthcare operates on the belief that a relaxed setting among peers allows women to be more receptive to the information presented in the discussions than they might be to traditional lectures from physicians.

Centering also functions to involve women in their own healthcare. Because they are more knowledgeable about pregnancy, “practices report fewer after-hours calls and

emergency visits.”⁷⁷ Today, Rising is the current President Emeritus of the Centering Healthcare Institute, and Centering Pregnancy is practiced in over 575 locations across the country. The Centering Healthcare Institute offers a Readiness Assessment on their website for clinics and practice sites that want to implement Centering methods. There are assessment tools available on their website, and they also offer applications for grants. All new Centering sites are expected to receive accreditation within two years of their founding. The Waco Family Health Center is one of twenty-four accredited practice sites in Texas.

My Experiences at the Waco Family Health Center

I was able to attend monthly Centering sessions with two groups during the summer of 2018. This was done so that I could experience and familiarize myself with the program. The two groups I followed were not a part of the research. As the women arrive, they begin to measure their own blood pressure and weight, with the assistance of one of the nurses. One by one, they are called back behind the divider for their physical exam with two of the physicians. While this is happening, healthy snacks are provided, and the rest of the women sit in the circle of chairs, chatting with one another. As the weeks go on, it is incredible to see how close the women become. As they become more comfortable with the others, women often open up and speak up during group discussions.

The healthcare team that leads the Centering sessions finds a great balance between facilitating and teaching. While they provide accurate and useful information,

⁷⁷ Centering Pregnancy. (n.d.). Retrieved April 23, 2019, from <https://www.centeringhealthcare.org/what-we-do/centering-pregnancy>

they also allow the women to speak up with their own ideas and input. For example, during the lesson on pain management during labor, women often have questions about epidurals. The physicians will often let the group answer, and women who have given birth before have the opportunity to share about their experiences with or without an epidural. This insight often proves beneficial to first-time mothers. In the event that someone shares something that is not quite true (or may not hold true for everyone), the physicians will gently present facts and information to correct the misunderstanding. The residents and attending physicians also follow up with the women about concerns that were discussed in the last session. There is also typically an activity integrated into the lesson, and everyone in the room (physicians, partners, shadowing students) are involved in the activities. Interactive games are often used to make the activities more engaging and fun. Family members or partners are often welcome to attend the session with the expectant mothers – they have questions that the residents and physicians are able to answer and are able to participate and contribute to the session. Over several months, healthcare providers from other departments or specialties have the opportunity to share their insights with the women as well. Dentists, lactation consultants, and nutritionists are able to encourage good oral hygiene, breastfeeding, and healthy eating. The Centering Pregnancy curriculum incorporates educational threads throughout the length of the program to encourage healthy choices during pregnancy. The curriculum also works to establish a foundation for continued healthy behaviors after completion of the program.

Literature Review

Numerous studies have shown that Centering Pregnancy (CP) is not only a viable option for women, it may be better than traditional care for certain results. The literature

review for this project focused on studies done within the last ten years that look at CP's impact on expectant mothers and the healthcare facilities that implement this program. One study focused on how an urban community clinic Calgary, Alberta, Canada handled the implementation of CP. The clinic found that, while there were some adjustments that needed to be made, it was relatively easy to integrate into the practice. If communication is fostered, it was not an insurmountable task. The study noted that the designation of a CP program coordinator was "critical" to the implementation of the program. This coordinator streamlined communication, oversaw administrative details, and managed tensions that arose. The study also found that CP created an opportunity for increased social support during pregnancy.⁷⁸

Another study focused on Hispanic patients with gestational diabetes mellitus (GDM). While the investigators did not find a significant difference in rates of preterm birth, they did find that participants in the Centering Pregnancy program had a lower rate of requiring drug therapy for their GDM compared with patients who received traditional care. The study ultimately concluded that participation in a Centering Pregnancy program did not adversely affect the birth outcomes of its participants and is a viable option for Hispanic women with GDM. The study also found other benefits of the program, including an increased participation in postpartum glucose screening, contraceptive use, and breastfeeding.⁷⁹

⁷⁸ Kania-Richmond, A., Hetherington, E., McNeil, D., Bayrampour, H., Tough, S., & Metcalfe, A. (2017). The Impact of Introducing Centering Pregnancy in a Community Health Setting: A Qualitative Study of Experiences and Perspectives of Health Center Clinical and Support Staff. *Maternal & Child Health Journal*, 21(6), 1327–1335. <https://doi-org.ezproxy.baylor.edu/10.1007/s10995-016-2236-1>

⁷⁹ Schellinger, M., Abernathy, M., May, C., Foxlow, L., Barbour, K., Luebbehusen, E., ... Rose, R. (2017). Improved Outcomes for Hispanic Women with Gestational Diabetes Using the Centering Pregnancy Group Prenatal Care Model. *Maternal & Child Health Journal*, 21(2), 297–305. <https://doi-org.ezproxy.baylor.edu/10.1007/s10995-016-2114-x>

A 2009 study focused on Centering Pregnancy's ability to encourage healthy behaviors in its participants. The women included in the study were at least 28 weeks pregnant. The research found that the women in traditional prenatal care actually adopted more healthy behaviors than the women participating in Centering Pregnancy. The study concluded that Centering could do more to encourage healthy decision-making in pregnancy, and it suggested increasing the amount of time devoted to education early on in the pregnancy in order to avoid unevenly distributing (or "backloading") education towards the end prenatal care. Other suggestions included allotting more time for questions and group discussions where women could report concerns and discuss medication, as well as increased emphasis on weight gain and smoking cessation.⁸⁰ The study acknowledges the positive outcomes of women who participate in Centering Pregnancy and suggests that, with these suggested improvements, Centering Pregnancy could encourage long-term healthy behaviors among patients.

Another study focused on Centering Pregnancy's viability as an option for Hispanic women. The study followed 49 women who were allowed to choose between traditional care and Centering Pregnancy. Though the results did not show any significant difference in birth outcomes, patients who participated in Centering Pregnancy reported high satisfaction, and some of them even remained in contact with others from their cohort. Ultimately, the study found that Centering Pregnancy is a viable and satisfactory prenatal care model for Hispanic women.⁸¹

⁸⁰ Shakespear, K., Waite, P. J., & Gast, J. (2010). A Comparison of Health Behaviors of Women in Centering Pregnancy and Traditional Prenatal Care. *Maternal & Child Health Journal*, 14(2), 202–208. <https://doi-org.ezproxy.baylor.edu/10.1007/s10995-009-0448-3>

⁸¹ Robertson, B., Aycock, D. M., & Darnell, L. A. (2009). Comparison of Centering Pregnancy to Traditional Care in Hispanic Mothers. *Maternal & Child Health Journal*, 13(3), 407–414. <https://doi-org.ezproxy.baylor.edu/10.1007/s10995-008-0353-1>

A study done on the impact of the Centering Pregnancy model of prenatal care on adolescent mothers found that it increased compliance in prenatal care along with many other benefits. Women who attending the Centering sessions were more likely to gain an appropriate amount of weight, use effective contraception, and breastfeed after giving birth. Women were also less likely to experience postpartum depression. Overall, maternal health behaviors of these adolescent mothers improved through the Centering Pregnancy model of prenatal care, compared to traditional methods.⁸²

A paper written for the *Archives of Gynecology & Obstetrics* outlined practical tips for practices and clinics looking to implement Centering Pregnancy. The researchers found that a major benefit of the Centering model was increased satisfaction among healthcare providers, primarily through an increased efficiency in time management. This model also helped free up clinic space for other patients and providers by conducting Centering sessions in a separate room or part of the building. The researchers recognized that clinics may find it difficult to find a space in which to conduct these meetings, but improved patient flow in the clinic is a major incentive to create such a space. The article even suggests using an empty waiting room if the sessions are occurring after hours. Funding can also present a challenge, as the implementation cost is approximately \$20,000. Training for staff members can increase that cost, and additional materials may need to be purchased in order to designate a particular area for Centering classes. If this cost is too much for a clinic, grant applications can be found on the Centering website. Overall, this study reported benefits to providers and patients, and the researchers

⁸² Trotman, G., Chhatre, G., Darolia, R., Tefera, E., Damle, L., & Gomez-Lobo, V. (2015). The Effect of Centering Pregnancy versus Traditional Prenatal Care Models on Improved Adolescent Health Behaviors in the Perinatal Period. *Journal of Pediatric & Adolescent Gynecology*, 28(5), 395–401. <https://doi-org.ezproxy.baylor.edu/10.1016/j.jpag.2014.12.003>

encourage clinics to overcome space and financial challenges in order to implement Centering Pregnancy.⁸³

⁸³ DeCesare, J., & Jackson, J. (2015). Centering Pregnancy: practical tips for your practice. *Archives of Gynecology & Obstetrics*, 291(3), 499–507. <https://doi-org.ezproxy.baylor.edu/10.1007/s00404-014-3467-2>

CHAPTER FOUR

Results

A total of 435 patients that received prenatal care through the Centering Pregnancy program at the Family Health Center met the criteria to be considered eligible for this study. These patients attended at least two Centering classes, their pregnancies ended in live births, and they were expected to deliver between March 2014 and December 2017. Over 44% (193/435) of these patients had a high-risk diagnosis. Of the 435 FHC Centering patients, 46 delivered prematurely (10.575%). Of 193 patients classified as “high-risk,” 34 delivered prematurely (17.617%). Of the 242 non-high-risk patients, 12 delivered prematurely (4.959%). These results are outlined in Table 3.

Table 4. Preterm Births among FHC Centering Patients, 2014-2017

	Number of Patients	Number of Premature Births	Percentage
Centering Patients	435	46	10.575%
high-risk	193	34	17.617%
non high-risk	242	12	4.959%

The Centering groups at the FHC were separated into English and Spanish speaking groups. A total of 233 patients in this study attended the English groups, and 31 delivered prematurely (13.305%). For the Spanish groups, 166 patients attended and 14 delivered prematurely (8.434%). Another group of patients attended English groups at the

Women's Health Center (a clinic associated with the FHC). At the WHC, 35 patients received their care through Centering and only one delivered prematurely (2.857%).

These results are outlined in Table 4.

Table 5. Preterm Births among FHC Centering Patients by Group, 2014-2017

Group	Number of Patients	Number of Premature Births	Percentage
English groups	233	31	13.305%
high-risk	110	23	20.909%
non high-risk	123	8	6.504%
Spanish groups	166	14	8.434%
high-risk	78	10	12.821%
non high-risk	88	4	4.545%
WHC groups	35	1	2.857%
high-risk	5	1	20.000%
non high-risk	30	0	0.000%

Table 5 displays the percentage of preterm births according to the age of the mother. The majority of patients fell in the 20-29 age range. Of these 246 patients, 31 delivered prematurely (12.602%). The next most common age range, 30-39, had 105 patients, 10 of which delivered prematurely (9.524%). None of the patients age 15 or below (only one) or age 40 or higher (4) delivered prematurely. There were 32 teenage

patients (age 15-17), and 3 delivered prematurely (9.375%). Of the 46 patients in the 18-19 age range, 2 delivered prematurely (4.348%).

Table 6. Preterm Births among FHC Centering Patients by Age, 2014-2017

Age	Number of Patients	Number of Premature Births	Percentage
<15	1	0	0.000%
15-17	32	3	9.375%
18-19	46	2	4.348%
20-29	246	31	12.602%
30-39	105	10	9.524%
40+	4	0	0.000%

Of the patients in this study that participated in Centering Pregnancy at the Waco Family Health Center, 47 were white. Eight of these patients delivered prematurely (17.021%). A total of 102 FHC Centering patients were Black, and 14 of these patients delivered prematurely (13.725%). A majority of the patients identified as Hispanic. Of these 272 patients, only 24 delivered prematurely (8.824%), the lowest rate of all racial/ethnic groups.

Table 7. Preterm Births among FHC Centering Patients by Race/Ethnicity, 2014-2017

Race/Ethnicity	Number of Patients	Number of Premature Births	Percentage
White	47	8	17.021%
Black	102	14	13.725%
Hispanic	272	24	8.824%
Other	14	0	0.000%

The number of concurrent risk factors per individual patient ranged from 0 – 7. Most patients had 0 – 2 risk factors. Of the 89 patients who did not have any identifiable risk factors, 4 delivered prematurely (4.494%). There were 151 patients who only had one risk factor, and 11 of them delivered prematurely (7.285%). Of the 115 patients who had two risk factors, 15 delivered prematurely (13.043%). A total of 51 patients had three identifiable risk factors, and 8 of them delivered prematurely (15.686%). A total of 17 patients had four concurrent risk factors, and 3 of them delivered prematurely (17.647%). Only 9 patients had five risk factors, and 4 of them delivered prematurely (44.444%). Only 2 patients had 6 risk factors, and only one patient had 7 risk factors. None of these patients delivered prematurely. See Table 7 for these results.

Table 8. Preterm Births among FHC Centering Patients by Number of Risk Factors, 2014-2017

Number of Risk Factors	Number of Patients	Number of Premature Births	Percentage
0	89	4	4.494%
1	151	11	7.285%
2	115	15	13.043%
3	51	8	15.686%
4	17	3	17.647%
5	9	4	44.444%
6	2	0	0.000%
7	1	0	0.000%

Table 8 outlines the incidence of individual risk factors as well as their correlation with preterm birth. The most common risk factor among the patients in this study was bacteriuria. This was documented in the charts of 180 patients. The second most common risk factor was African American race (102 patients), followed by sexually transmitted infections (76 patients). The least common risk factor was periodontal disease, as no patients had this risk factor documented in their charts.

Table 9. Preterm Births among FHC Centering Patients by Individual Risk Factor, 2014-2017

Risk Factor	Incidence	Number of Premature Births	Percentage
African American Race	102	14	13.725%
Anxiety	26	2	7.692%
Depression	57	11	19.298%
Multiple Gestation	4	4	100.000%
Uterine Anomaly	3	0	0.000%
STI	76	7	9.211%
Bacteriuria	180	15	8.333%
Periodontal Disease	0	0	0.000%
Previous Preterm Delivery	40	15	37.500%
Substance Abuse	12	4	33.333%
Smoking	30	7	23.333%
Maternal Age <18 or >40	40	3	7.500%
Inadequate Prenatal Care	21	0	0.000%
Fetal Anomaly	7	2	28.571%
Chronic/Gestational Hypertension	22	9	40.909%
Preexisting Diabetes	8	1	12.500%
Gestational Diabetes	32	4	12.500%
Preeclampsia	6	3	50.000%

Discussion

Compared to national, state, and county data, the preterm delivery rate among patients who utilized the Centering Pregnancy model of prenatal care at the Family Health Center is encouraging. While the total rate (10.575%) was slightly higher than the 2016 national average (9.93%), it was slightly lower than both Texas and McLennan County rates in 2015 (11.747%, 11.480%).

Table 10. Comparison of Preterm Birth Rates

	National, 2017 (CDC)	Texas, 2015 (TCHS)	McLennan County, 2015 (TCHS)	FHC Centering, 2014-2017
Percent Born Preterm	9.93%	11.747%	11.480%	10.575%

Slightly larger differences are seen when comparing preterm birth rates by race/ethnicity. The preterm birth statistics among white patients showed a higher rate for FHC Centering patients (17.021%) than for Texas (10.544%) or McLennan County (9.883%). This difference may be due to the small sample size of white FHC Centering patients. However, the rate of preterm birth among African American FHC Centering patients (13.725%) was lower compared to the state of Texas (15.271%) and McLennan County (19.141%). Hispanic FHC Centering patients also showed a lower preterm birth rate (8.824%) than Texas (15.086%) and McLennan County (10.345%).

Table 11. Comparison of Preterm Birth Rates by Race/Ethnicity

Race/Ethnicity	Percent Born Preterm		
	Texas, 2015 (TCHS)	McLennan County, 2015 (TCHS)	FHC Centering, 2014-2017
White	10.544%	9.883%	17.021%
Black	15.271%	19.141%	13.725%
Hispanic	15.086%	10.212%	8.824%
Other	10.280%	10.345%	0.000%

Another comparison shows that FHC Centering patients have lower preterm birth rates in almost every age group. Among 15-17 age group, FHC Center Patients had a noticeably lower rate (9.375%) than Texas (13.835%) and McLennan County (13.000%). Among 18-19 age group, the FHC Centering rate (4.348%) was drastically lower than Texas (12.144%) and McLennan County (11.017%) rates. However, in the 20-29-year-old age group, the FHC Centering preterm birth rate (12.602%) was actually higher than Texas (10.996%) and McLennan County rates (11.887%). In the 30-39 age group, the preterm birth rate for FHC Centering patients (9.524%) was once again lower than Texas (12.160%) and McLennan County (10.458%).

Table 12. Comparison of Preterm Birth Rates by Age

Age	Percent Born Preterm		
	Texas, 2015 (TCHS)	McLennan County, 2015 (TCHS)	FHC Centering, 2014-2017
<15	17.982%	0.000%	0.000%
15-17	13.835%	13.000%	9.375%
18-19	12.144%	11.017%	4.348%
20-29	10.996%	11.887%	12.602%
30-39	12.160%	10.458%	9.524%
40+	18.099%	0.000%	0.000%

Though the large difference in sample sizes limits the generalizability of these results to the general population, these results are useful to the Family Health Center as they provide an overview of the population that participates in Centering Pregnancy. As mentioned earlier, nearly 45% of all FHC Centering Patients included in the study had a high-risk diagnosis. There is no universally agreed-upon definition of what constitutes a “high-risk” pregnancy, so it is difficult to get a sense of how much of the general population can actually be classified this way. The University of California San Francisco Medical Center estimates that 6% to 8% of all pregnancies in the United States are high-risk.⁸⁴ Even if this approximation is on the low end, the risk level of the patients at the

⁸⁴ High-Risk Pregnancy. (n.d.). Retrieved April 22, 2019, from https://www.ucsfhealth.org/conditions/high-risk_pregnancy/

FHC seems abnormally high. The scope of this study does not explore why this population is so vulnerable, but socioeconomic status (SES) may have something to do with it. According to the U.S. Census Bureau, 26.8% of the Waco population lives in poverty. For context, the U.S. Census Bureau estimates that the poverty rate is 14.7% for the state of Texas and 12.3% nationally.

Through discussions with staff at the FHC, I was able to identify possible limitations to participation and engagement with Centering Pregnancy. One of these obstacles was transportation. While reading through the charts, I noticed that many of the patients cited transportation issues as the reason they missed appointments. The public transportation system in Waco is difficult to navigate. Easier and more reliable transportation could possibly increase patient attendance at Centering classes. The other obstacle was a lack of childcare. Several mothers who had other children were not able to find reliable childcare. These women were faced with the choice of bringing their children to the Centering classes or not attending them. I noticed that women who brought their children were often distracted from the lessons.

One limitation of this study is that many of the results from this study are specific enough to the Waco Family Health Center that they cannot be compared to any national or state statistics. The state and county statistics that are available (preterm birth rates by age and race/ethnicity) are only available up until 2015. In order to assess the most accurate comparison, it would be ideal to have birth data from the same time period that was studied at the Family Health Center (March 2014-December 2017). The results of this study could be reexamined when more recent birth data becomes available. Another limitation to this study was its inability to establish causation for the rates of premature

birth because only the data of patients who attended Centering classes was studied. This study establishes a baseline that could potentially be compared against the birth data of women who attended traditional prenatal care at the FHC during the same time period. It then may be possible to determine whether or not the Centering Pregnancy model is responsible.

Conclusion

While sample size limited generalizability, these results still have the potential to benefit the Waco Family Health Center. The fact that the preterm birth rates among FHC Centering patients were typically lower than statewide and county rates, especially when viewed in context of an extremely high-risk population, is very encouraging. This research has shown that Centering Pregnancy is a viable model of prenatal care for patients at the Waco Family Health Center, and the results will hopefully aid the Family Health Center in assessing the efficacy of the Centering Pregnancy model of prenatal care as well as provide a foundation for future studies.

APPENDICES

APPENDIX A

National Preterm Birth Statistics by Race, 2017

Table A1. Preterm Births in U.S. by Race, 2017

Race	Number of Patients	Number of Premature Births	Percentage
White	1,992,461	180,332	9.051%
Black	560,715	78,024	13.915%
Hispanic	898,764	86,393	9.612%
Total	3,855,500	382,726	9.927%

Data was taken from the National Vital Statistics Report, Births: Final Data for 2017.

APPENDIX B

Texas Preterm Birth Statistics by Race and Age, 2005-2015

Table B1. Preterm Births in Texas by Race, 2015

Race	Number of Patients	Number of Premature Births	Percentage
White	136,663	14,410	10.544%
Black	47,515	7,256	15.271%
Hispanic	191,080	28,827	15.086%
Other	28,181	2,897	10.280%
Total	403,439	47,390	11.747%

Table B2. Preterm Births in Texas by Race, 2005-2014

Race	Number of Patients	Number of Premature Births	Percentage
White	1,356,781	156,565	11.539%
Black	446,570	75,705	16.953%
Hispanic	1,926,930	250,348	12.992%
Other	200,909	22,443	11.171%
Total	3,931,190	505,061	12.848%

Table B3. Preterm Births in Texas by Age, 2015

Age	Number of Patients	Number of Preterm Births	Percentage
<15	456	82	17.982%
15-17	9,700	1,342	13.835%
18-19	22,983	2,791	12.144%
20-29	213,242	23,449	10.996%
30-39	146,427	17,806	12.160%
40+	10,586	1,916	18.099%

Table B4. Preterm Births in Texas by Age, 2005-2014

Age	Number of Patients	Number of Preterm Births	Percentage
<15	7,197	1,427	19.828%
15-17	157,806	24,056	15.244%
18-19	310,931	41,669	13.401%
20-29	2,126,886	257,848	12.123%
30-39	1,240,580	164,045	13.223%
40+	87,696	15,998	18.243%

The data in these tables was taken from the Texas Department of State Health Services Center for Health Statistics.

APPENDIX C

McLennan County Preterm Birth Rates by Race and Age, 2005-2015

Table C1. Preterm Births in McLennan County by Race, 2015

Race	Number of Patients	Number of Premature Births	Percentage
White	1,629	161	9.883%
Black	559	107	19.141%
Hispanic	1,224	125	10.212%
Other	116	12	10.345%
Total	3,528	405	11.480%

Table C2. Preterm Births in McLennan County by Race, 2005-2014

Race	Number of Patients	Number of Premature Births	Percentage
White	16,685	1,789	10.722%
Black	5,394	917	17.000%
Hispanic	11,929	1,411	11.828%
Other	716	80	11.173%
Total	34,724	4,197	12.087%

Table C3. Preterm Births in McLennan County by Age, 2015

Age	Number of Patients	Number of Preterm Births	Percentage
<15	0	0	0.000%
15-17	100	13	13.000%
18-19	236	26	11.017%
20-29	2,061	245	11.887%
30-39	1,071	112	10.458%
40+	53	0	0.000%

Table C4. Preterm Births in McLennan County by Age, 2005-2014

Age	Number of Patients	Number of Preterm Births	Percentage
<15	68	15	22.059%
15-17	1,564	263	16.816%
18-19	3,348	440	13.142%
20-29	20,687	2,365	11.432%
30-39	8,557	1,023	11.955%
40+	500	91	18.200%

The data in these tables was taken from the Texas Department of State Health Services Center for Health Statistics.

BIBLIOGRAPHY

- About Preeclampsia. (2010, July 05). Retrieved December 3, 2018, from <https://www.preeclampsia.org/health-information/about-preeclampsia>
- Airoidi, J., Berghella, V., Sehdev, H., & Ludmir, J. (2005, September). Transvaginal Ultrasonography of the Cervix to Predict... : Obstetrics & Gynecology. Retrieved December 3, 2018, from https://journals.lww.com/greenjournal/Fulltext/2005/09000/Transvaginal_Ultrasonography_of_the_Cervix_to.17.aspx
- Alcohol Abuse and Other Substance Use Disorders: Ethical Issues in Obstetric and Gynecologic Practice*(633rd ed.). (2015). Retrieved December 3, 2018, from <https://www.acog.org/-/media/Committee-Opinions/Committee-on-Ethics/co633.pdf?dmc=1>
- Alice Goisis, Hanna Remes, Kieron Barclay, Pekka Martikainen, Mikko Myrskylä; Advanced Maternal Age and the Risk of Low Birth Weight and Preterm Delivery: a Within-Family Analysis Using Finnish Population Registers, *American Journal of Epidemiology*, Volume 186, Issue 11, 1 December 2017, Pages 1219–1226, <https://doi.org/10.1093/aje/kwx177>
- Anxiety and panic attacks in pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.tommys.org/pregnancy-information/im-pregnant/mental-wellbeing/specific-mental-health-conditions/anxiety-and-panic-attacks-pregnancy>
- Anxiety and pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.pregnancybirthbaby.org.au/anxiety-and-pregnancy>
- Asymptomatic Bacteriuria. (2019, January). Retrieved April 22, 2019, from https://www.health.harvard.edu/a_to_z/asymptomatic-bacteriuria-a-to-z
- Being pregnant with twins, triplets and other multiples. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimes.org/complications/being-pregnant-with-twins-triplets-and-other-multiples.aspx>
- Berger, V., Moghadassi, M., Gosnell, K., Sparks, T., Velez, J. G., & Norton, M. (2017, May 9). The Risk of Preterm Birth in Pregnancies With... : Obstetrics & Gynecology. Retrieved December 3, 2018, from https://journals.lww.com/greenjournal/Abstract/2017/05001/The_Risk_of_Preterm_Birth_in_Pregnancies_With.633.aspx

- Bui, Q., & Miller, C. C. (2018, August 04). The Age That Women Have Babies: How a Gap Divides America. Retrieved December 3, 2018, from <https://www.nytimes.com/interactive/2018/08/04/upshot/up-birth-age-gap.html>
- Carson, M. P., & Gibson, P. S. (2018, June 21). Hypertension and Pregnancy. Retrieved December 3, 2018, from <https://emedicine.medscape.com/article/261435-overview#a2>
- Cavazos-Rehg, P.A., Krauss, M.J., Spitznagel, E.L. et al. Matern Child Health J (2015) 19: 1202. <https://doi.org/10.1007/s10995-014-1624-7>
- Chan, Jayaprakasan, Zamora, Thornton, & Coomarasamy. (2011, June 24). Prevalence of congenital uterine anomalies in unselected and high-risk populations: A systematic review. Retrieved December 3, 2018, from <https://academic.oup.com/humupd/article/17/6/761/873088>
- Chan, Y. Y., Jayaprakasan, K., Tan, A., Thornton, J. G., Coomarasamy, A., & Raine-Fenning, N. J. (2011, September 20). Reproductive outcomes in women with congenital uterine anomalies: A systematic review. Retrieved December 3, 2018, from <https://obgyn.onlinelibrary.wiley.com/doi/full/10.1002/uog.10056>
- Colgan, R., Nicolle, L. E., McGlone, A., & Hooton, T. M. (2006, September 15). Asymptomatic Bacteriuria in Adults. Retrieved April 22, 2019, from <https://www.aafp.org/afp/2006/0915/p985.html>
- Complications in a Multiples Pregnancy. (2016, September 02). Retrieved December 3, 2018, from <http://americanpregnancy.org/multiples/complications/>
- Congenital anomalies. (2016, September 7). Retrieved December 3, 2018, from <http://www.who.int/news-room/fact-sheets/detail/congenital-anomalies>
- Craig, S. D. (2011, October). Indicated preterm birth for fetal anomalies. Retrieved December 3, 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/21962626>
- DeCesare, J., & Jackson, J. (2015). Centering Pregnancy: practical tips for your practice. *Archives of Gynecology & Obstetrics*, 291(3), 499–507. <https://doi.org.ezproxy.baylor.edu/10.1007/s00404-014-3467-2>
- Decrease in teen pregnancy. (2018, March 02). Retrieved December 3, 2018, from <https://www.womenshealth.gov/30-achievements/09>
- Depression (major depressive disorder). (2018, February 03). Retrieved from <https://www.mayoclinic.org/diseases-conditions/depression/diagnosis-treatment/drc-20356013>
- Depression During Pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimes.org/complications/depression-during-pregnancy.aspx>

- Depression. (2012, June). Retrieved December 3, 2018, from <https://www.acog.org/Patients/FAQs/Depression?IsMobileSet=false>
- DeSisto, C. L., Kim, S. Y., & Sharma, A. J. (2014, June 19). Preventing Chronic Disease | Prevalence Estimates of Gestational Diabetes Mellitus in the United States, Pregnancy Risk Assessment Monitoring System (PRAMS), 2007–2010 - CDC. Retrieved December 3, 2018, from https://www.cdc.gov/pcd/issues/2014/13_0415.htm
- Expectant Mothers' Periodontal Health Vital To Health of Her Baby. (2013, August 28). Retrieved December 3, 2018, from https://www.perio.org/consumer/AAP_EFP_Pregnancy
- Facts & Statistics. (n.d.). Retrieved from <https://adaa.org/about-adaa/press-room/facts-statistics>
- Forray A. Substance use during pregnancy [version 1; referees: 2 approved]. *F1000Research* 2016, 5(F1000 Faculty Rev):887 (<https://doi.org/10.12688/f1000research.7645.1>)
- Fraser, A. M., Brockert, J. E., & Ward, R. H. (1995, April 27). Association of Young Maternal Age with Adverse Reproductive Outcomes | NEJM. Retrieved December 3, 2018, from <https://www.nejm.org/doi/full/10.1056/NEJM199504273321701>
- Fuchs, F., Monet, B., Ducruet, T., Chaillet, N., & Audibert, F. (2018, January 31). Effect of maternal age on the risk of preterm birth: A large cohort study. Retrieved December 3, 2018, from <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0191002>
- Gestational Diabetes: Testing and Treatment. (2018, November 24). Retrieved December 3, 2018, from <http://americanpregnancy.org/pregnancy-complications/gestational-diabetes/>
- Gestational Diabetes. (2017, April 28). Retrieved from <https://www.mayoclinic.org/diseases-conditions/gestational-diabetes/diagnosis-treatment/drc-20355345>
- Gill, S. K., Broussard, C., Devine, O., Green, R. F., Rasmussen, S. A., & Reefhuis, J. (2015, August 11). Birth Defects Research Part A: Clinical and Molecular ... Retrieved December 3, 2018, from <http://onlinelibrary.wiley.com/doi/10.1002/bdra.23049/full>
- Grote NK, Bridge JA, Gavin AR, Melville JL, Iyengar S, Katon WJ. A Meta-analysis of Depression During Pregnancy and the Risk of Preterm Birth, Low Birth Weight, and Intrauterine Growth Restriction. *Arch Gen Psychiatry*. 2010;67(10):1012–1024. doi:10.1001/archgenpsychiatry.2010.111

- High blood pressure and pregnancy: Know the facts. (2018, February 14). Retrieved December 3, 2018, from <https://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/pregnancy/art-20046098>
- High Blood Pressure During Pregnancy Fact Sheet. (n.d.). Retrieved April 22, 2019, from <https://www.cdc.gov/bloodpressure/pregnancy.htm>
- High-Risk Pregnancy. (n.d.). Retrieved April 22, 2019, from https://www.ucsfhealth.org/conditions/high-risk_pregnancy/
- How do sexually transmitted diseases and sexually transmitted infections (STDs/STIs) affect pregnancy? (n.d.). Retrieved December 3, 2018, from <https://www.nichd.nih.gov/health/topics/stds/conditioninfo/infant>
- How to Treat Gestational Diabetes. (n.d.). Retrieved December 3, 2018, from <http://www.diabetes.org/diabetes-basics/gestational/how-to-treat-gestational.html>
- Hua, M., Odibo, A. O., Longman, R. E., Macones, G. A., Roehl, K. A., & Cahill, A. G. (2011, July 22). Congenital uterine anomalies and adverse pregnancy outcomes. Retrieved December 3, 2018, from <https://www.sciencedirect.com/science/article/pii/S0002937811009380>
- Improving health by transforming care through Centering groups. (n.d.). Retrieved February 21, 2019, from <https://www.centeringhealthcare.org/>
- Kania-Richmond, A., Hetherington, E., McNeil, D., Bayrampour, H., Tough, S., & Metcalfe, A. (2017). The Impact of Introducing Centering Pregnancy in a Community Health Setting: A Qualitative Study of Experiences and Perspectives of Health Center Clinical and Support Staff. *Maternal & Child Health Journal*, 21(6), 1327–1335. <https://doi-org.ezproxy.baylor.edu/10.1007/s10995-016-2236-1>
- Kitzmilller, J. L., Block, J. M., Brown, F. M., Catalano, P. M., Conway, D. L., Coustan, D. R., . . . Kirkman, M. S. (2008, May 01). Managing Preexisting Diabetes for Pregnancy. Retrieved December 3, 2018, from <http://care.diabetesjournals.org/content/31/5/1060>
- Malinova, M. (2013, January 01). Periodontal disease and preterm birth. Retrieved December 3, 2018, from <https://europepmc.org/abstract/med/24294762>
- Martin, J. A., Hamilton, B. E., Osterman, M. J., Driscoll, A. K., & Drake, P. (2018). *National Vital Statistics Report*(1st ed., Vol. 67, Births: Final Data for 2016). Retrieved December 3, 2018, from https://www.cdc.gov/nchs/data/nvsr/nvsr67/nvsr67_01.pdf
- Matthews, T., & Hamilton, B. E. (2016, January 14). Mean Age of Mothers is on the Rise: United States, 2000–2014. Retrieved December 3, 2018, from <https://www.cdc.gov/nchs/products/databriefs/db232.htm>

- Michalowicz, B. S., Hodges, J. S., DiAngelis, A. J., Lupo, V. R., Novak, M. J., Ferguson, J. E., . . . Tschida, P. A. (2006, November 2). Treatment of Periodontal Disease and the Risk of Preterm Birth. Retrieved December 3, 2018, from <https://www.nejm.org/doi/full/10.1056/NEJMoa062249>
- Multiple Pregnancy. (2018, July). Retrieved December 3, 2018, from <https://www.acog.org/Patients/FAQs/Multiple-Pregnancy?IsMobileSet=false>
- Multiple pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.chw.org/medical-care/fetal-concerns-center/conditions/pregnancy-complications/multiple-pregnancy>
- Preeclampsia: Symptoms, Risks, Treatment and Prevention. (2017, April 04). Retrieved December 3, 2018, from <http://americanpregnancy.org/pregnancy-complications/preeclampsia/>
- Preeclampsia. (2018, November 16). Retrieved December 3, 2018, from <https://www.mayoclinic.org/diseases-conditions/preeclampsia/symptoms-causes/syc-20355745>
- ¹Preexisting Diabetes. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimes.org/complications/preexisting-diabetes.aspx>
- Pregnancy and Pre-existing Diabetes. (2010, July 20). Retrieved December 3, 2018, from <http://www.diabetes.org/newsroom/press-releases/2010/pregnancy-and-pre-existing-diabetes.html>
- Premature Birth. (2018, November 05). Retrieved February 21, 2019, from <https://www.cdc.gov/features/prematurebirth/index.html>
- Premature Rupture of Membranes (PROM)/Preterm Premature Rupture of Membranes (PPROM). (2014, August 24). Retrieved December 3, 2018, from <https://www.chop.edu/conditions-diseases/premature-rupture-membranes-prompreterm-premature-rupture-membranes-pprom>
- Robertson, B., Aycock, D. M., & Darnell, L. A. (2009). Comparison of Centering Pregnancy to Traditional Care in Hispanic Mothers. *Maternal & Child Health Journal*, 13(3), 407–414. <https://doi-org.ezproxy.baylor.edu/10.1007/s10995-008-0353-1>
- Rose, M., Pana, G., & Premji, S. (2019, May 26). Prenatal Maternal Anxiety as a Risk Factor for Preterm Birth and the Effects of Heterogeneity on This Relationship: A Systematic Review and Meta-Analysis. Retrieved December 3, 2018, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4889802/>

- Schellinger, M., Abernathy, M., May, C., Foxlow, L., Barbour, K., Luebbehusen, E., ... Rose, R. (2017). Improved Outcomes for Hispanic Women with Gestational Diabetes Using the Centering Pregnancy Group Prenatal Care Model. *Maternal & Child Health Journal*, 21(2), 297–305. <https://doi-org.ezproxy.baylor.edu/10.1007/s10995-016-2114-x>
- Schenkenberger, S. S. (2017, November 15). Gestational diabetes increases risk of preterm labor. Retrieved December 3, 2018, from <https://inside.akronchildrens.org/2017/11/14/gestational-diabetes-increases-risk-of-preterm-labor/>
- Seely, E. W., & Ecker, J. (2014). Chronic Hypertension in Pregnancy. *Chronic Hypertension in Pregnancy*, 129(11). Retrieved December 3, 2018, from <https://www.ahajournals.org/doi/abs/10.1161/circulationaha.113.003904>
- Sexually transmitted diseases. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimes.org/pregnancy/sexually-transmitted-diseases.aspx>
- Shakespear, K., Waite, P. J., & Gast, J. (2010). A Comparison of Health Behaviors of Women in Centering Pregnancy and Traditional Prenatal Care. *Maternal & Child Health Journal*, 14(2), 202–208. <https://doi-org.ezproxy.baylor.edu/10.1007/s10995-009-0448-3>
- Srinivas, S. K., & Parry, S. (2012, February). Periodontal Disease and Pregnancy Outcomes: Time to Move On? Retrieved December 3, 2018, from <http://www.liebertpub.com/doi/10.1089/jwh.2011.3023>
- STDs and pregnancy: Get the facts. (2018, January 31). Retrieved December 3, 2018, from <https://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/stds-and-pregnancy/art-20115106>
- STDs during Pregnancy - CDC Fact Sheet. (2016, November 10). Retrieved December 3, 2018, from <https://www.cdc.gov/std/pregnancy/stdfact-pregnancy.htm>
- STDs in Women and Infants. (n.d.). Retrieved December 3, 2018, from <https://www.cdc.gov/std/stats16/womenandinf.htm>
- Stress and pregnancy. (n.d.). Retrieved December 3, 2018, from <https://www.marchofdimes.org/pregnancy/stress-and-pregnancy.aspx>
- Structural and Functional Birth Defects. (n.d.). Retrieved December 3, 2018, from <https://www.birthdefects.org/structural-and-functional-birth-defects/>
- Substance Use While Pregnant and Breastfeeding. (2018, July). Retrieved December 3, 2018, from <https://www.drugabuse.gov/publications/research-reports/substance-use-in-women/substance-use-while-pregnant-breastfeeding>

- The American Association of Obstetricians and Gynecology. (May 2018) *Preeclampsia and High Blood Pressure During Pregnancy* [PDF file]. Retrieved from <https://www.acog.org/-/media/For-Patients/faq034.pdf>
- Todros, T., Capuzzo, E., & Gaglioti, P. (2001, April). Prenatal diagnosis of congenital anomalies. Retrieved December 3, 2018, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3232499/>
- Trotman, G., Chhatre, G., Darolia, R., Tefera, E., Damle, L., & Gomez-Lobo, V. (2015). The Effect of Centering Pregnancy versus Traditional Prenatal Care Models on Improved Adolescent Health Behaviors in the Perinatal Period. *Journal of Pediatric & Adolescent Gynecology*, 28(5), 395–401. <https://doi-org.ezproxy.baylor.edu/10.1016/j.jpag.2014.12.003>
- United States Department of Health and Human Services Centers for Disease Control and Prevention. (n.d.). *Pre-Existing Diabetes and Pregnancy* [PDF file]. Retrieved from https://www.cdc.gov/pregnancy/documents/DiabetesDefects_Cleared.pdf
- United States Department of Health and Human Services Centers for Disease Control and Prevention. (2016, September). *Reported STDs in the United States, 2017* [PDF file]. Retrieved from <https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/std-trends-508.pdf>
- Urinary Tract Infection During Pregnancy: Symptoms & Prevention. (2017, March 11). Retrieved April 22, 2019, from <https://americanpregnancy.org/pregnancy-complications/urinary-tract-infections-during-pregnancy/>
- Urinary Tract Infections | UTI | UTI Symptoms. (2019, April 08). Retrieved April 22, 2019, from <https://medlineplus.gov/urinarytractinfections.html>
- Uterine Anomaly. (2018, September 13). Retrieved December 3, 2018, from <https://www.columbiadoctors.org/condition/uterine-anomaly>
- Vaz, S. A., Dotters-Katz, S. K., & Kuller, J. A. (2017, March). Diagnosis and Management of Congenital Uterine Anomalies in Pregnancy. Retrieved December 3, 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/28304417>
- Water breaking: Understand this sign of labor. (2016, October 18). Retrieved December 3, 2018, from <https://www.mayoclinic.org/healthy-lifestyle/labor-and-delivery/in-depth/water-breaking/art-20044142>
- What Is Depression? (n.d.). Retrieved December 3, 2018, from <https://www.psychiatry.org/patients-families/depression/what-is-depression>
- Wilder, R. S. (Ed.). (2008). Periodontal Diseases and Adverse Pregnancy Outcomes: A Review of the Evidence and Implications for Clinical Practice. *Journal of Dental Hygiene*. Retrieved December 3, 2018, from https://www.adha.org/resources-docs/7838_Periodontal_Diseases_and_Adverse_Pregnancy_Outcomes.pdf

Wilson, J, Thorp, Jr., J, *Glob. libr. women's med.*, (ISSN: 1756-2228) 2008; DOI
10.3843/GLOWM.10115