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A LONGITUDINAL STUDY OF PRENATAL CARE AND PRENATAL OUTCOMES OF
WOMEN IN FOSTER CARE ACROSS MICHIGAN COUNTIES

by

Lauryn Jianrattanasawat

A thesis submitted to the Graduate College
in partial fulfillment of the requirements
for the degree of Master of Science
Geography
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Thesis Committee:

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A LONGITUDINAL STUDY OF PRENATAL CARE AND PRENATAL OUTCOMES OF WOMEN IN FOSTER CARE ACROSS MICHIGAN COUNTIES

Lauryn Jianrattanasawat, M.S.

Western Michigan University, 2017

According to the Michigan Department of Health and Human Services, at any given time, there are approximately 13,000 youth in foster care throughout Michigan. This study used secondary data of linked child welfare case records and State of Michigan Medicaid claims from January 1, 2009 to September 30, 2012 to research the effects of individual, foster care and spatial characteristics experienced by 307 women that became pregnant and delivered while still enrolled in foster care in Michigan on their prenatal care and prenatal outcomes. While, the majority of the analyses resulted in insignificant relationships, significant differences between foster care characteristics were identified regarding mental illness, and significant differences between races were identified regarding tobacco use. The spatial distribution of prenatal care and prenatal outcomes highlights that access to care leads to higher percentages of women being diagnosed with negative prenatal outcomes. One hundred percent of the women in Calhoun County received adequate prenatal care and it also ranked in the top 25 percent for seven out of the ten prenatal outcomes examined.

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Lauryn Jianrattanasawat

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CHAPTER I

INTRODUCTION

According to the Michigan Department of Health and Human Services (MDHHS), at any given time, there are approximately 13,000 youth enrolled in foster care throughout Michigan (2017). Foster children constitute a very vulnerable population. All foster youth have been inflicted with trauma. The act of taking a child out of their home and placing them in a strange place causes at least a portion of this trauma. The maltreatment that a child may have been exposed to before entering into foster care further adds to the emotional distress. This distress often leads to subsequent mental health issues that need to be addressed properly in order for a child to fulfill a successful life. One form of maltreatment that foster youth face before entering into foster care is neglect. Neglect can cause a child to have a number of health issues ranging from malnutrition to a variety of untreated illnesses. The goal of foster care is the reunification of child with birth parent. However, this often leads to more maltreatment of the child and subsequently additional removals from the home and placement back into foster care. This further adds to the suffering a child must endure. In addition to issues related to psychological distress and physical health issues, women in foster care also experience higher pregnancy rates in comparison to their peers (Boonstra, 2011). Teen pregnancy, in general, is strongly correlated to higher high school drop-out rates. These conditions represent more factors working against this vulnerable population. If a woman in foster care becomes pregnant, it is imperative that women that do become pregnant receive proper care for the full nine months of pregnancy, labor and delivery, and the neonatal period. Possible complications during pregnancy are hypertension,

gestational diabetes, anemia and obesity. If these conditions go untreated, they could lead to the death of the fetus, yet another trauma that a woman in foster care must endure. It is imperative that the struggles faced by women in foster care be minimized. This study investigates the extent of prenatal care and prenatal outcomes experienced by young women in foster care with the goal of assessing the effectiveness of prenatal healthcare services provided to women in foster care across Michigan from 1/1/2009-9/30/2012. Two primary objectives will need to be achieved to achieve this goal.

1. Identify factors that influence the likelihood of women that become pregnant and deliver while in foster care to receive adequate prenatal care or experience negative prenatal outcomes.

- Assess association between individual characteristics (age and race) and adequate prenatal care, maternal physical complications (hypertension, diabetes, anemia and obesity), maternal risk factors (mental illness and tobacco use), and fetal complications (excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement).

-Assess association between three foster care characteristics (number of living arrangements, living arrangement type and length in foster care before delivery) and adequate prenatal care, maternal physical complications (hypertension, diabetes, anemia and obesity), maternal risk factors (mental illness and tobacco use), and fetal complications (excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement).

-Assess association between spatial characteristics (urban and rural counties, Wayne County and the rest of Michigan, Michigan prosperity regions) and adequate

prenatal care, maternal physical complications (hypertension, diabetes, anemia and obesity), maternal risk factors (mental illness and tobacco use), and fetal complications (excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement).

2. Identify spatial anomalies of adequate prenatal care and negative prenatal outcomes.

- Use ArcGIS to visualize the distribution of adequate prenatal care, maternal physical complications (hypertension, diabetes, anemia and obesity), maternal risk factors (mental illness and tobacco use), and fetal complications (excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement) across Michigan counties.

CHAPTER II

BACKGROUND

The importance of quality prenatal care for pregnant women in foster care cannot be over-stated. This chapter summarizes the negative outcomes encountered by many foster youth including discrepancies among teen pregnancy rates in the United States. To help define quality prenatal care, this chapter will also explain the general guidelines for ideal prenatal care and the common complications that can occur during pregnancy.

Youth in Foster Care

There are approximately 400,000 youth in foster care in the United States (MDHHS, 2017). A youth in foster care has been taken from their home due to allegations of abuse or neglect against their parent or official guardian. All foster youth have experienced some form of trauma. A child in foster care has faced trauma due to the maltreatment experienced at home as well as the trauma experienced by being taken from their home and placed in a new residential situation. Often, a child in foster care is placed in a certified home of a non-related family or person. Sometimes the child can be placed with a relative. Other foster care living situations include incarceration or group homes.

Children incorporated in the foster care system are often left vulnerable and have little social support causing them to experience a variety of negative outcomes such as poverty, compromised health, unemployment, and incarceration. Courtney et al. (2011) conducted a study of 600 young adults (ages 23 to 24) who “aged out” of foster care in Iowa, Wisconsin and Illinois and found that 25 percent were homeless, 75 percent of the women had been pregnant since leaving foster care, 60 percent of the men had been convicted of a crime and only 6 percent

of all foster youth earned a two or four-year college degree.

In response to these negative outcomes, many supportive interventions have been implemented. One is the establishment of federal guidelines that require states to conduct a comprehensive health assessment within 30-60 days of placement in foster care. The health assessment includes physical, behavioral, and oral health screenings and follow-up assessments upon a child's entry into foster care (American Academy of Pediatrics, 2017). These requirements also encourage youth in foster care to gain better access to all healthcare programs, including prenatal programs.

Teen Pregnancy among Women in Foster Care

According to the Michigan Department of Health and Human Services (MDHHS), at any given time, there are approximately 13,000 youth in foster care throughout Michigan (2017). Young women in foster care are more than twice as likely to become pregnant by 19 years of age than their peers (Boonstra, 2011) and about 40 percent of these young women have their second child during their teen years (Monticue, 2013). In 2010, the teen birth rate in Michigan was 30.1 percent (The National Campaign to Prevent Teen and Unplanned Pregnancy, 2011).

There are many human consequences associated with teen pregnancy. There is a strong correlation between teen pregnancy and the likelihood a young woman completing her education. In 2010, only 40 percent of teen mothers finished high school, and only 2 percent finished college by age 30 (The National Campaign to Prevent Teen and Unplanned Pregnancy, 2010). Teen pregnancy also affects children born to teen parents. Children of teen mothers are 50 percent more likely to repeat a grade (The National Campaign to Prevent Teen and Unplanned Pregnancy, 2010). Maltreatment and teen pregnancy are intergenerational cycles. Individuals who were maltreated as children are more likely to abuse their children (Goleman, 1989).

Daughters of teen mothers were 66 percent more likely to become teen moms themselves (Meade, Kershaw, Ickovics, 2008). Children born to teen parents are more likely to enter the foster care system, which has a financial consequence of \$2.8 billion annually (Comlossy, 2013).

Teen childbearing has significant negative financial consequences. These consequences include increased costs in health care, foster care, incarceration and lost tax revenue. In 2010, taxpayers contributed approximately \$9.4 billion to source these financial consequences associated with teen pregnancy. Of the \$9.4 billion, \$2.1 billion fund public health care costs (The National Campaign to Prevent Teen and Unplanned Pregnancy, 2011).

Prenatal Guidelines

To ensure proper care during the nine months of pregnancy, there are general guidelines that practitioners, obstetricians and midwives follow regarding the administration of prenatal care for mothers that are experiencing a healthy/low-risk pregnancy (Table 1). At every appointment the mother's weight and blood pressure are measured, a urine sample is gathered (which tests for preeclampsia or a urinary track infection), and the baby's growth and heart rate are tracked. The following guidelines regarding the first prenatal visit, and visits during the first 28 weeks, 28 to 36 weeks and 36 weeks until birth are recommendations from the United States Department of Health and Human Services Office on Women's Health (Akkerman et al., 2012).

The first prenatal visit is usually delayed until the mother is at least 10 weeks to ensure the pregnancy is viable. During the first visit, the due date is calculated and a pregnancy test, pelvic exam and breast exam are administered. During the initial visit, the practitioner will also order blood work to identify mother's blood type and Rh factor, while checking for anemia, rubella immunity, hepatitis B, syphilis and HIV (Akkerman et al., 2012).

It is recommended that a mother have a prenatal check-up every four weeks until she is 28 weeks along. An ultrasound is usually conducted around 18 to 20 weeks to examine the baby's biophysical profile and determine the baby's gender. During this time, there are also optional tests that the mother may choose to have performed to determine if the baby has any chromosomal or genetic disorders. These tests include amniocentesis, chorionic villas, and maternal serum screen. Around 26 to 28 weeks the mother will undergo a glucose test to ensure that she is not experiencing gestational diabetes. When the mother is between 28 and 36 weeks along, it is recommended that she have a prenatal check-up every two weeks. Once the mother is 36 weeks, it is recommended that she have a prenatal check once a week until the baby arrives. A practitioner will also administer a Group B Streptococcus test at 36 weeks (Akkerman et al., 2012).

Table 1: Outline of General Parental Guidelines

Gestation	Frequency of Visits	Procedures Performed
10 weeks (First Visit)	4 weeks	<ul style="list-style-type: none"> • due date calculated • pregnancy test • pelvic exam • breast exam • blood work (mother's blood type and Rh factor, anemia, rubella immunity, hepatitis B syphilis and HIV)
18 - 20 Weeks		<ul style="list-style-type: none"> • Ultrasound (baby's biophysical profile and gender) • Optional tests (Amniocentesis, Chorionic Villas, and Maternal Serum Screen)
26 to 28 weeks		<ul style="list-style-type: none"> • Glucose Test
28 and 36 weeks	2 weeks	
36 weeks	1 week	<ul style="list-style-type: none"> • Group B Streptococcus test

* Every visit the mother's weight and blood pressure are measured, a urine sample is gathered and the baby's growth and heart rate are tracked.
(Akkerman et al., 2012)

Complications Experienced During Pregnancy

The general guidelines outlined above and followed by healthcare practitioners are to ensure healthy mothers and healthy babies. However, complications do arise in spite of the many precautions taken by practitioners. According to the Centers for Disease Control and Prevention (CDC, 2016b), some of the most common complications during pregnancy are hypertension, obesity and anemia.

Hypertension and Preeclampsia during Pregnancy

Hypertension, or high blood pressure, is consistently high pressure on the walls of the blood vessel when the heart contracts (American Heart Association, 2016). Preeclampsia is a severe blood pressure disorder with accompanying signs of other organ systems not functioning properly, and generally occurs after 32 weeks of pregnancy. All forms of hypertension during pregnancy can have serious implications for both mother and baby. Complications associated with hypertension during pregnancy are: restricted fetal growth, preterm delivery, placental abruption, cesarean delivery and preeclampsia. Hypertension restricts the flow of nutrients through the placenta to the baby, which may restrict the development of the fetus. Doctors may decide it is safest to deliver early if it is observed that the baby is not receiving adequate nutrients and oxygen due to the mother's high blood pressure. Hypertension in pregnancy can also cause the placenta to detach from the uterus prematurely, which is a medical emergency. These complications could ultimately result in a cesarean section (American Congress of Obstetrics and Gynecology, 2014). Complications that are unique to preeclampsia, such as liver failure, could also result in a cesarean delivery. The rate of caesarean section births in the United States was 32.0 percent in 2015, which is more than double what the World Health Organization recommends (Centers for Disease Control, 2017a).

Gestational Diabetes during Pregnancy

A woman is diagnosed with gestational diabetes when she experiences high blood glucose levels only during pregnancy. Gestational Diabetes affects mothers late in pregnancy. If gestational diabetes is not treated high blood sugar levels will transfer to the baby, which will cause the baby's pancreas to over produce insulin and the baby's body to store the extra sugars as fat. This excess fat stored while in utero will lead to macrosomia, a large baby, and can cause complications during delivery, including damage to the baby's shoulders. The baby's over productive pancreas will lead to low blood glucose levels at birth, increase the baby's risk of breathing troubles, and increase the risk of the baby developing Type 2 diabetes or becoming obese as an adult (America Diabetes Association, 2016).

Anemia during Pregnancy

Anemia occurs when a patient experiences low counts of healthy red blood cells, also known as hemoglobin. This is a common condition in pregnancy. It is estimated that 15 percent to 25 percent of mother's experience anemia during pregnancy. The mother's body produces more blood to support the growing fetus. However, this increase in plasma does not mean an increase in hemoglobin. The most common cause for a lack of increase in hemoglobin is from an iron deficiency. Red blood cells carry oxygen to tissues in the body. So, having an adequate amount of healthy red blood cells is imperative to the growth and development of a developing fetus (American Pregnancy Society, 2016).

Obesity during Pregnancy

Obesity is defined as having a Body Mass Index (BMI) of 30 or higher. The complications associated with obesity during pregnancy that can affect the mother are gestational

diabetes, preeclampsia and sleep apnea. Risks to the baby include birth defects, macrosomia, preterm birth, and stillbirth (The American Congress of Obstetricians and Gynecologists, 2016).

Mental Health and Pregnancy

The most common forms of mental health problems during pregnancy are depression and anxiety (Royal College of Psychiatry, 2012). Between 14 and 23 percent of mothers experience depression during pregnancy (The American Congress of Obstetricians and Gynecologists, 2017). Depression experienced during pregnancy is associated with low fetal birth weight and premature delivery (Gold & Marcus, 2008). Maternal suicide ranks higher in maternal mortality than hemorrhage and hypertensive disorders (Palladino, et al., 2011).

Tobacco Use and Alcohol Abuse during Pregnancy

Tobacco use and alcohol abuse during pregnancy have serious health implications. Women that smoke during pregnancy are more likely to have a miscarriage. Smoking during pregnancy also increases the risk of placental separation, preterm birth, Sudden Infant Death Syndrome (SIDS), and birth defects (Centers for Disease Control and Prevention, 2017b). Alcohol use during pregnancy can lead to miscarriage, stillbirth and fetal alcohol spectrum disorder. It is estimated that nearly 40,000 babies are born with fetal alcohol spectrum disorder in the United States per year (Centers for Disease Control and Prevention, 2016a).

Conclusion

Foster youth are a vulnerable population that is continually at a disadvantage in comparison to their peers. In addition to psychological and economical challenges, foster youth face more health issues in comparison to their peers and young women in foster care are twice as likely as their peers to become pregnant before turning 19 (Boonstra, 2011). With a combination

of poor health and high pregnancy rates, it is vital that young women in foster care receive proper prenatal care to encourage a healthy pregnancy and ultimately a healthy baby.

CHAPTER III

LITERATURE REVIEW

This literature review examines the methods used by, and findings of, previous studies regarding poor health outcome experienced by foster youth and how the type of placement, number of placements and age at placement can affect these outcomes. It also covers studies on the effects of foster care placement on birth rates and definitions of quality of prenatal care. Lastly, this literature review investigates the research methods of previous studies including those that use spatial analyses in research conducted on foster care and child health.

Foster Youth Experience Poor Health Outcomes

Previous studies have established that foster youth experience poor health outcomes (Ahrens, Garrison & Courtney, 2014, Hansens, et al., 2004). Data from the Midwest Evaluation of Adult Functioning of Former Foster Youth for Illinois, Iowa and Wisconsin program was used to evaluate cardiovascular risk factors and other chronic conditions among 596 former foster youth against an age-matched sample of adults from economically secure and economically insecure backgrounds. A multivariate regression model was used to evaluate health outcomes and care access, resulting in the foster care group reporting the highest odds of poor or fair general health (Ahrens, Garrison & Courtney, 2014).

A study comparing the overall health of children in foster care and Medicaid-eligible children living with their parents used medical charts from August 1998 to February 1999 of 226 foster children and 264 Medicaid-eligible children not in foster care from the UC Davis Medical Center in Sacramento County. A χ^2 analysis of the data revealed significantly more health and

developmental problems in children in foster care when compared to children living with their parents (Hansens, et al., 2004).

Health Outcomes affected by Placement Characteristics

Foster youth often have poor health. The type of placement, number of placements and age at placement were found to all correlate with poor health outcomes (Font, 2014, Dregan & Gulliford, 2012, Villegas & Pecora, 2012, Eggertsen, 2008, 2004, Rubin, et al., 2004). A study of 2,358 children in foster care from 1993-1996 combined Medicaid data with foster care administrative data collected from Department of Public Welfare. A comparison group was formed from Medicaid-eligible children not in foster care in 1995. Through the use of a negative binomial model, researchers found that visits to the Emergency Department and use of other ambulatory care positively correlate to the number of foster care placements (Rubin, et al., 2004). A British 1970 cohort of 10,895 foster youth was re-surveyed in 2000 to collect residential data (type of placement, length of placement, reason for admission and age at first placement) and adult outcomes (depression status, life dissatisfaction, self-efficacy, alcohol use, smoking habits, drug use and criminal offences). Logistic regression analyses, adjusting for confounding variables (neighborhood and family characteristics), indicated that type of residential care early in life was associated with criminal convictions and depression. The number of placements was associated with low-self worth. Age of placement was associated with criminal convictions and smoking (Dregan & Gulliford, 2012). A study of 1068 alum from the Casey National Alumni Study utilized logistic regression to analyze the association between mental health outcomes and the absolute age when a person entered child welfare program (5 or younger, 6 to 11, 12 or older), length of time in care (5.9 years or less, 6 to 9.9 years, 10 or more years) and number of

placements (4 or less, 5 to 8, 9 or more). The number of different placements was associated significantly with negative mental health outcomes (Villegas & Pecora, 2012).

Another study investigates how the number of homes a foster child has been placed in affects health outcomes for foster care youth. This study of 6,432 children placed in out-of-home care during 2000, 2001, and 2002 collected spatial data (ZIP codes) and administrative data from the Utah Division of Children and Family Services. After ZIP codes were geocoded into ArcMap, a multinomial logistic regression of the dependent variable (defined by whether a child experienced one, two or three or more placements, based on federal standards established by the U.S. Department of Health and Human Services) and the three independent variables (child characteristics, case-related characteristics and system characteristics) was calculated to conclude that minor health problems were the most significantly related to multiple placements (Eggertsen, 2008).

The type of living arrangement of foster youth can also contribute to poor health outcomes. Based on a national sample of 1,215 children, ages 6-17, from the National Survey of Child and Adolescent Well-being, Font (2014) found that kinship care correlates positively to academic achievements, behavior and health status in comparison to nonrelative foster care. An OLS regression analysis of these data showed several significant differences between the two groups.

Pregnancy Rates Affected by Foster Care Placement

Previous studies have investigated the affects of foster care and placement characteristics on pregnancy rates among foster youth in other states, that potentially could be used for a study of Michigan (King et al., 2014, Dworsky & Courtney, 2010, Carpenter et al., 2001). A study of 732 foster youth from Wisconsin, Minnesota and Iowa incorporated data from the Midwest

Evaluation of the Adults Functioning of Former Foster Youth and the National Longitudinal Study of Adolescent Health. Based on these data, a Cox proportional hazard model examined the relationship between care status and the risk of teenage pregnancy. Results showed that foster teens were more likely to experience pregnancy than their peers in the general population (Dworsky & Courtney, 2010). King et al. (2014) completed a California study of birth rate estimates for 15- to 17-year-old girls in foster care from 2006 to 2010 based on 2010 California Department of Social Services data regarding placement length (less than 12 months, 12-23 months, 24-59 months and 60 or more months), placement stability (1-2, 3-4, 5-8, 9 or more), and placement type (kin or relative home, nonrelative foster home, congregate care, guardian homes/other). After a cross-sectional examination, results showed that girls in foster care for less than 12 months, and girls who experienced 9 or more placements had higher birth rates.

The Carpenter et al. (2001) study incorporated data of 9620 women from a 1995 National Survey of Family Growth, ages 15 to 44 years, and utilizes bivariate and multi-linear regression to analyze the association of conception and sexual contact between foster care, kinship care and a control group. Foster care and kinship care are associated with younger age of first conception compared to that of the comparison group.

Operationalizing Definitions of Prenatal Care Quality

There is a noticeable lack of relevant literature related to the prenatal care received by women in foster care. However, much research has been conducted regarding prenatal care and how to define quality of care for the general population (Hansell, 1991; Reichman and Teitler 2005; Van Hoof, et al., 2000; Kaestner 1999). Hansell (1991) developed a complex sample of 9,941 live births and 6,386 fetal deaths in the United States in 1980 from the National Natality Survey and Fetal Mortality Survey. After defining prenatal care quality (percentages of prenatal

visits when blood pressure and urine are tested, hemoglobin or hematocrit are tested and the prevalence of advice regarding salt restriction and diuretic usage), a multilinear regression analysis resulted in a statistically significant relationship between sociodemographic factors and blood pressure monitoring. Logistic regression analysis also resulted in positive statistical associations among sociodemographic factors and the occurrence of urine testing, blood testing and advice. Using national prenatal care guidelines, a 1999 study of 275 Connecticut women, ages 21 years and younger, enrolled in any three Medicaid plans, evaluates the quality of prenatal care. χ^2 was used to compare plans and ANOVA is used for assessment of categorical variables to show that patients received most of the services of care that were recommended (Van Hoof, et al., 2000). For a similar purpose, Reichman and Teitler (2005) collected natal health data from the New Jersey State Department of Health and Human Services. Ordinary Least Squares and logistic regression analyses were conducted using a sample of 88,196 births in New Jersey between 1988 and 1996 to determine the effects of time the initiation of prenatal care on birth weight and gestational age outcomes among women patients enrolled in the Medicaid enhanced prenatal care program, HealthyStart. Results showed no statistical significance between time of initiating prenatal care and birth weight and gestational age outcomes. Using data from the 1988 National Maternal and Infant Health Survey incorporating 5,431 women with OLS regression. Kaestner (1999) explored the relationship between, infant health, and the quantity and quality of prenatal care. There was no statistically significant relationship between insurance status, birth weight, and quantity of prenatal care or quality of prenatal care in this study.

Spatial Analyses in Child Health Research

Spatial analyses are routinely employed in research on infant mortality, birth rates and birth weights (Krase, 2015; Maguire-Jack, et al., 2015; Yang, et al. 2013; Tian, et al., 2013; Freisthler, 2011; Fryer & Miyoshi, 1995). Global Poisson and geographically weighted Poisson regression models were used to assess a US sample of 3,071 births in 2003 that joined county-level data collected from the Bureau of Health Professions regarding birth outcomes to administrative data regarding marital status collected from the 2000 US Census. Marriage postponement was negatively related to both infant mortality, while cohabitation rates were positively related to infant mortality and divorce rates (Yang, Shoff & Matthews, 2013).

Hollar, Jr. (2015) conducted a study on infant mortality using data from the 2014 National County Health Rankings for 3,137 counties in the United States to calculate spatial regression models and Moran's I to investigate national patterns of infant mortality. The strongest predictors in infant mortality were obesity, smoking, teen births, housing problems, a lack of social support and urban residence. Results were then compared to administrative data, collected from U.S. Census, American Community Survey, CDC national Center for Health Statistics, National Center for Chronic Disease Prevention, National Center for HIV/AIDS, Centers for Medicaid Services, National Center for Education Statistics, and Dartmouth Atlas of Health Care.

In an investigation of spatial-temporal patterns of low birth weight prevalence in Georgia at the county level, low birth weight data were collected from Georgia Department of Public Health for the period from 1999-2009. The overall mean of regression trends for each county was calculated, so as to perform a one-way ANOVA contrast test, followed by a scan statistical model based on a Poisson probability model used to detect county clusters. Three counties and

two county clusters displayed significantly higher low birth weight rates for the period from 19999 to 2001. Urban counties had higher low birth rates than rural counties (Tian, et al., 2013).

GIS and the spatial statistic Moran's I are often used in conjunction to illustrate the relationship between ecological-level factors and variations in birth rates. Shoff (2009) completed a county-level analysis of the effects of the rurality of a county, the percentage of family planning clinics, and percentage of the county population in poverty had on the teenage (ages 15 to 17) birth rate in the United States in 2000. The geographically weighted regression-spatial lag model allowed for place-specific understanding of prenatal care utilization among US counties. A study of the continental US regarding prenatal care received by the female population, ages 15-44, in 2000 based on county-level data from the Office on Women's Health Quick Health Data Online and the US Census Bureau also employed a geographically weighted regression-spatial lag and an OLS-spatial lag (Shoff, Chen & Yang, 2014). A study of Los Angeles, California, examined how availability of social agencies within the city's 288 zip codes was related to foster care entry and child maltreatment investigations through the use of point process models and spatial regressions of data collected from the Directory of Social Service agencies and Center for Social Service Research at the University of California Berkley. Higher densities of child welfare services for referrals and lagged areas for referrals and foster care entries were related to lower rates of child maltreatment (Freisthler, 2011).

Spatial analyses have also been used in studying child maltreatment patterns. A study of 830 cases of confirmed child maltreatment (collected from the Colorado Department of Human Services) from 1986-1990 in 31 rural Colorado counties using Poisson distribution analyses of time-space clustering found apparent clustering over 3, 7, 14, 30 and 60 day intervals (Fryer & Miyoshi, 1995). Similar county-level disparity ratios tend to cluster together geographically. A

study based on an analysis of racial disparities in child maltreatment was conducted in the United States. County-level data regarding maltreatment reports to Child Protective Services was collected from the 2011 Neglect Data System, and combined with demographic data on race from the 2012 National Center for Health Statistics, and family poverty rates by race from the 2008–2012 US Census American Community Survey. After disparity ratios were calculated, the data were geocoded into ArcGIS, and Moran's I and Z-scores were computed resulting in a significant curvilinear relationship between race and population density. Higher rates of maltreatment disparities for black and Hispanic children were found in the most densely populated counties and most sparsely populated counties (Maguire-Jack, et al., 2015). A study of racial disparities in child maltreatment reporting among educational personnel in New York State used 35,195 reports of maltreatment collected from the National Child Abuse and Neglect Data System Child File from 2006 to calculate disparity ratios between White and African American maltreatment reports. These data were then geocoded into GIS software. While there were more maltreatment reports involving African American children, results of the χ^2 analysis indicated there were no significant differences in reporting for the 38 counties (Krase, 2015).

Spatial Analyses in Foster Care Research

Although not directly related to prenatal care, Mandell (2013) utilized Medicaid data of foster youth and GIS to identify disparities. A sample of 439,567 Wisconsin youth, birth to age 10, insured by Medicaid or in foster care between 2008 and 2011, identified disparities in the use of antipsychotic drugs at the county-level, using GIS mapping and multilevel modeling. Children in foster care were more likely to be medicated, and medicated for longer periods. Children in counties with higher median incomes were less likely to be medicated (Mandell, 2013).

Mandell's research offers valuable methodological options for the county proposed research.

Conclusion

Through the variety of articles researched, useful methods have been gathered which were utilized in the research of women in Michigan receiving prenatal care. Utilizing the type of methods employed by previous researchers, the following chapter outlines data and methods used for this study.

CHAPTER IV

DATA AND METHODS

This chapter details the data and methods used in this study. Sections include: data sources, population, definition of variables, and methods.

Data Source and Population

This study used secondary data of linked child welfare case records and State of Michigan Medicaid claims from January 1, 2009, to September 30, 2012. The merging of child welfare case records and State of Michigan Medicaid claims was external (Figure 1). Women included in the study were required to be 14 years old at some point in the study period. There were 4721 women in the original sample, of which, 1833 had at least one pregnancy-related charge while in foster care (Figure 1). This study only observed women that became pregnant and delivered while in foster care. Delivery was determined using the following Medicaid procedure codes and claims codes: 59409, 59612, 59400, 59410, 59614, 59515, 59610, 59622, 59618, 59510, 59514, 59620, 7359, 7309, 741, 7279, 7279, 7271, 736, 734, 731, 721, 650, 66950, 66951, 66960, 66961, 66970, 66971, 66980, 66981, 66982, 66983, 66984, 66990, 66991, 66992, 66993, 66994, as well as codes beginning with 640 and 6791. Start of pregnancy was determined by subtracting forty weeks from the date associated with a delivery code. There were 307 young women who became pregnant and delivered while in foster care (Figure 1). The N value for the majority of the analysis was 307. However, there were five women that have no associated living arrangement codes. So, for the analysis comparing living arrangement types and number of living arrangements, N= 302.

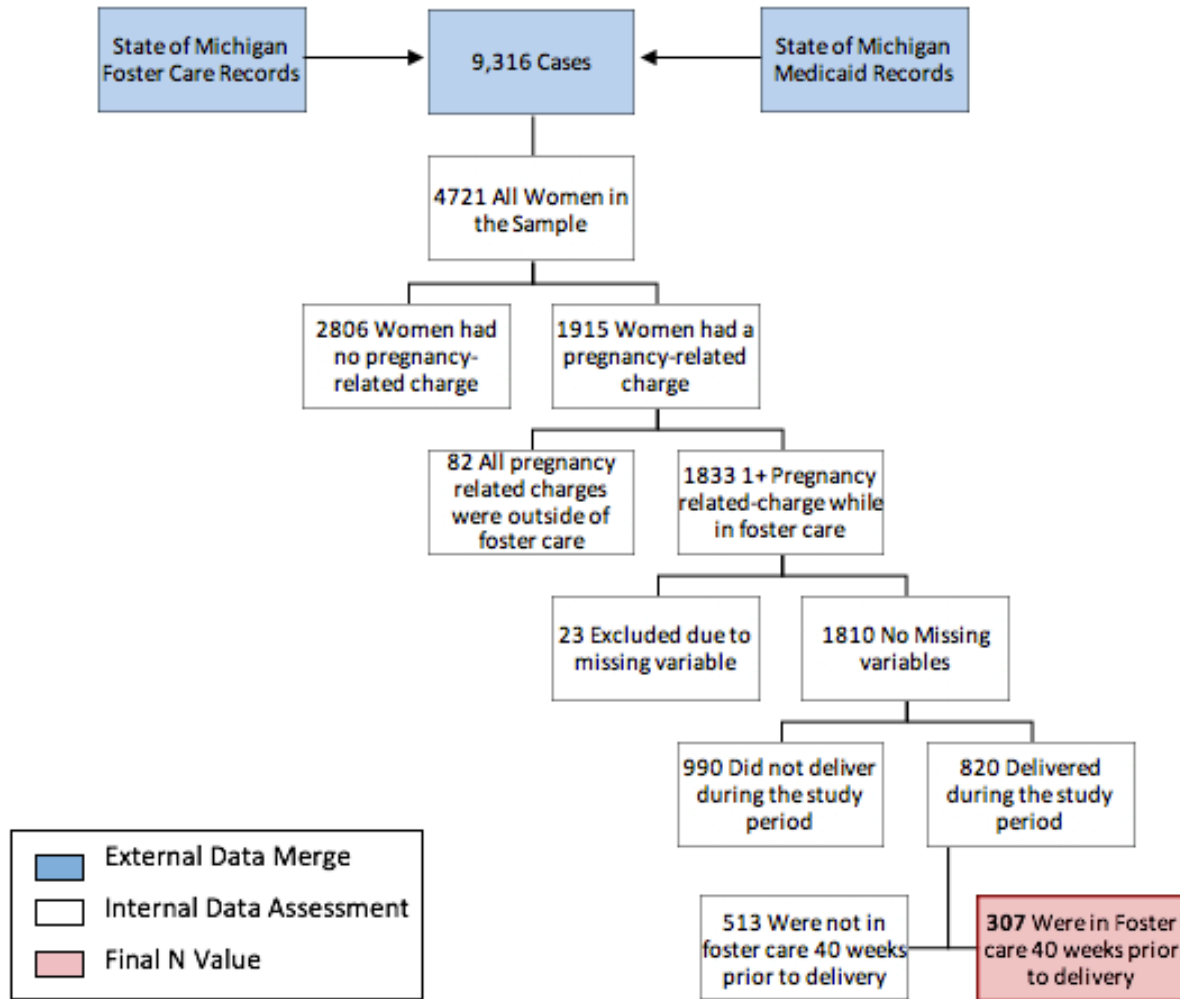


Figure 1: Defining Study Population of Women that Became Pregnant and Delivered while in Foster Care throughout Michigan from 1/1/2009-9/30/2012 using externally Merged Child Welfare Case Records and State of Michigan Medicaid Claims (Source: Author)

Defining Individual, Foster Care and Spatial Characteristics

This study defined who these women are, what their history with foster care is and where they are locational in order to further investigate how these factors affect prenatal care and prenatal outcomes. To clearly define these factors, this subsection has been divided into three parts: individual characteristics, foster care characteristics and spatial characteristics.

Individual characteristics include age and race. The average age at delivery was 17 years. This study compared women that were 13-17 years of age at delivery (N=186) and women that were 18 – 21 (N=121) (Table 2). Race was defined as non-Hispanic white, non-Hispanic black and other (Table 3). Of the 307 women, 30 percent were white, 66.4 percent were black, and 3.6 percent other (Table 2).

Table 2: Distribution of Individual Characteristics and Foster Care Characteristics of Women that Became Pregnant and Delivered while in Foster Care throughout Michigan from 1/1/2009 – 9/30/2012

Age	N	13 - 17	18 -21	
	307	186 (60.6%)	121 (39.4%)	
Race	N	White	Black	Other
	307	92 (30%)	204 (66.4%)	11 (3.6%)
Number of Living Arrangement	N	< 6	6 +	
	302	143 (47.4%)	159 (52.6%)	
Type of Living Arrangement	N	Family	Group	Other
	302	81 (26.8%)	51 (16.9%)	170 (56.3%)

(Source: Author)

Table 3: Re-Categorization of Race of Women that Became Pregnant and Delivered while in Foster Care throughout Michigan from 1/1/2009 – 9/30/2012

Original Race Categories	New Race Categories
Non-Migrant White, not of Hispanic Origin	White
Non-Migrant Black, not of Hispanic Origin	Black
Non-Migrant American Indian or Alaskan Native	Other
Non-migrant Asian	
Non-Migrant Unknown	
Non-Migrant Hispanic	
Not provided. Default value if race code is null.	
Non-migrant Native Hawaiian or Pacific Islander	

(Source: Author)

Foster care characteristics include number of living arrangements, living arrangement type, and length in foster care before pregnancy. The majority of the population experienced six different living arrangements (Figure 2). Of the women that became pregnant and delivered while in foster care 47.4 percent experienced less than six living arrangements, while 52.6 percent experienced six or more living arrangements. This study compared those that who experienced six living arrangements with the rest of the population. The original living arrangement codes were collapsed into three living arrangement types: family, group and other (Table 4). At delivery 26.8 percent of the women were in family, 16.9 percent of the women were in group and 56.3 percent of the women were in other (Table 2). Length in foster care was measured in years. The average length in foster care before becoming pregnant was 4.6 years (Figure 3).

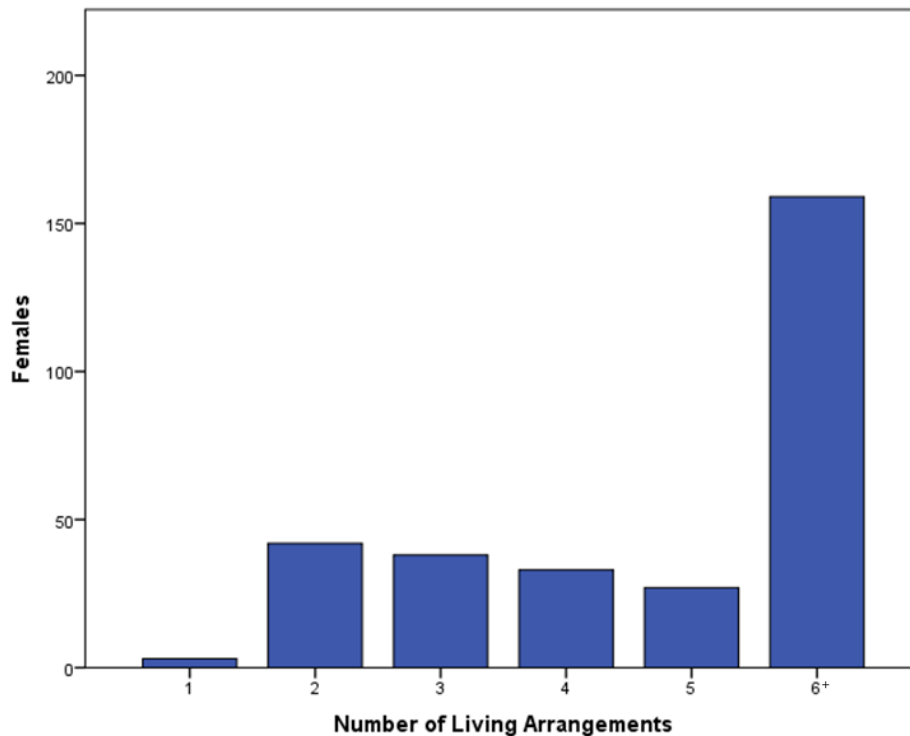


Figure 2: Number of Living Arrangements Experienced by Women that Became Pregnant and Delivered while in Foster Care throughout Michigan from 1/1/ 2009 – 9/30/2012 (Source: Author)

Table 4: Re-Categorization of Race of Women that Became Pregnant and Delivered while in Foster Care throughout Michigan from 1/1/2009 – 9/30/2012

Original Living Arrangement Description	New Living Arrangement Categories
Own home, parents	family
Relatives	
Legal Guardianship	
Adoptive Home	
Foster Home - FIA	
Out of state parent	
Out of state relative	
Out of state licensed foster home	
Out of state relatives licensed foster home	
Detention	
Jail	
Private child care institution	
FIA Training schools.	
Nokomis Challenge Program	
Mental Health Facility	
Court Treatment Facility	
Boarding School and Runaway Service Facility	
Arbor Heights	
Out of state child placing agency	
out of state child caring institution	other
AWOL escape	

(Source: Author)

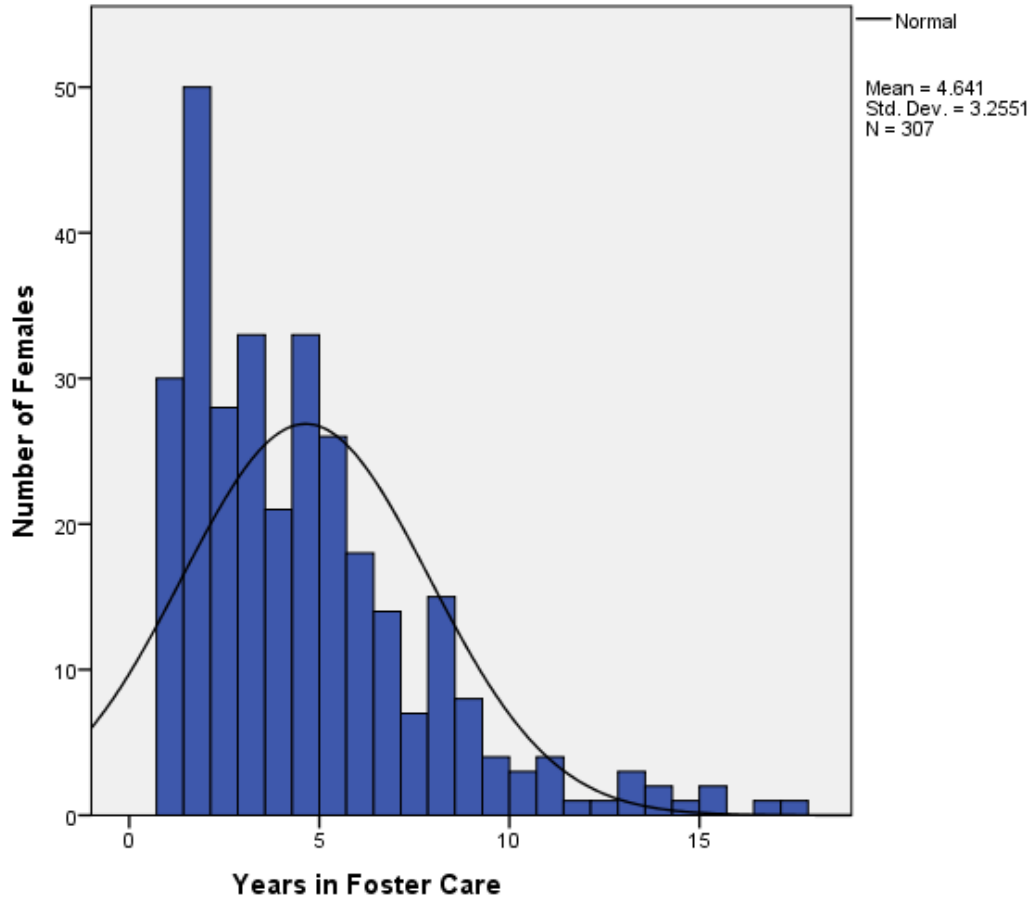
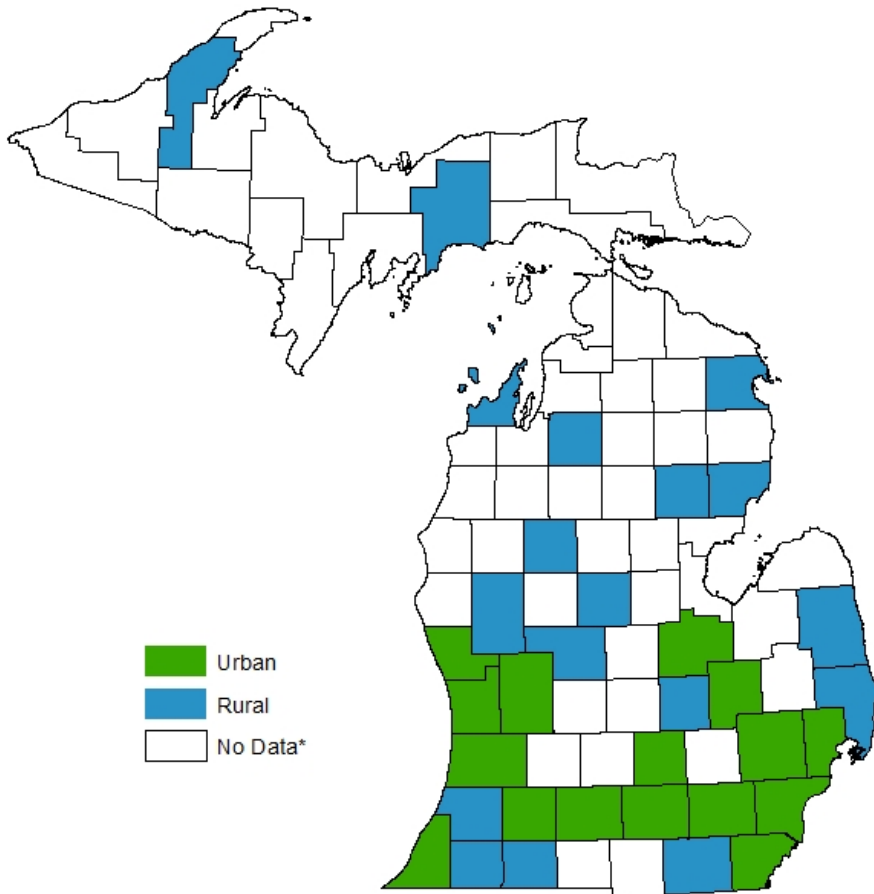


Figure 3: Years in Foster Care before becoming Pregnant for Women that Became Pregnant and Delivered while in Foster Care throughout Michigan from 1/1/ 2009 – 9/30/2012 (Source: Author)

Spatial characteristics included in this study were a dichotomous variable for urban and rural counties, another dichotomous variable separating Wayne County and the rest of Michigan, Michigan prosperity regions and Michigan counties. This study utilized Michigan Department of Community Health’s division of urban and rural counties (2006) (Figure 4). Along with performing an urban (N=282) and rural (N=25) comparison, this study also identified disparities between individuals in Wayne County (N=137) and individuals in the rest of Michigan (N=170). Michigan has ten prosperity regions. In compliance with Michigan’s Comprehensive Health Plan, all health insurance service areas are required to align with Michigan’s Prosperity Regions

(Michigan Department of Health and Human Services, 2015). Regions one, two and three had less than five women. So, these three regions were collapsed into one large region, creating eight regions (Figure 5). Over half the population resides in Region 10 (Table 5). Michigan has 83 counties (Appendix A, Table 1). However, only counties with a population of five or more women were considered for mapping (N=12).



*No women became pregnant or delivered while in foster care from 1/1/2009-9/30/2012

Figure 4: Urban and Rural Counties of Michigan used for Analysis of the Prenatal Care received by and prenatal outcomes of Women that Became Pregnant and Delivered in Foster Care from 1/1/2009-9/30/2012
(Michigan Department of Community Health, 2006)

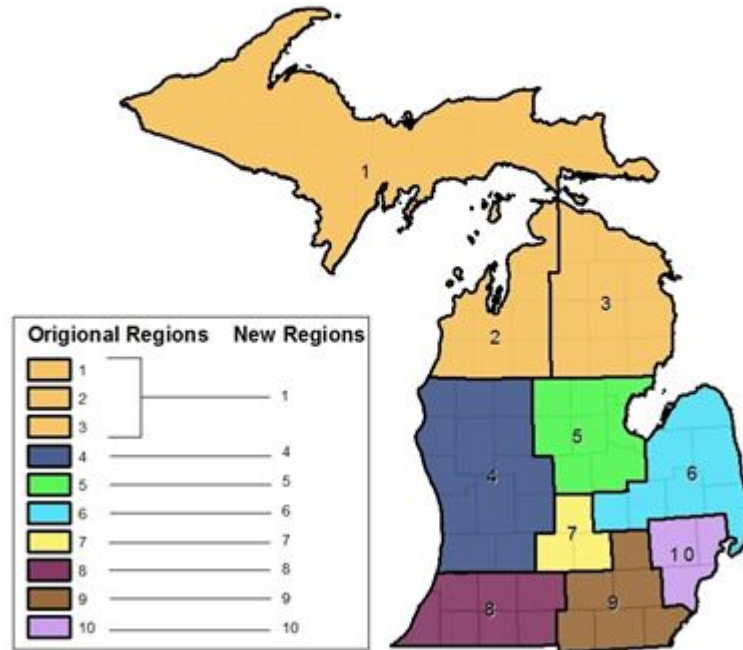


Figure 5: State of Michigan Prosperity Regions Redefined for Analysis of the Prenatal Care received by and prenatal outcomes of Women that Became Pregnant and Delivered in Foster Care from 1/1/2009-9/30/2012
(Source: Author)

Table 5: Distribution of Women that became Pregnant and Delivered while in Foster Care throughout Michigan's Prosperity Regions from 1/1/2009-9/30/2012

Region	Women became Pregnant and Delivered in FC n (%)
1,2,3	7 (2.3%)
4	32 (10.4%)
5	9 (2.9%)
6	27 (8.8%)
7	14 (4.6%)
8	32 (10.4%)
9	13 (4.2%)
10	173 (56.4%)

(Source: Author)

Defining Prenatal Care and Prenatal Outcomes

In this study prenatal care and prenatal outcomes have been divided into the following four categories: (1) adequate prenatal care, (2) physical maternal complications, (3) maternal risk factors, and (4) complications to the fetus. This subsection will define each category.

Adequate prenatal care was defined in this study by women that received a global maternity care code (Table 6). A global maternity care code is used if a woman has received seven or more prenatal visits with a single provider. This is the maximum number of visits that can be billed together.

Table 6: Medicaid Claims Codes used to identify Adequate Prenatal Care received by and Prenatal Outcomes of Women that Became Pregnant and Delivered while in Foster Care throughout Michigan from 1/1/2009 – 9/30/2012 with corresponding N Values and Percent

Categories	Variables	Claims Codes	N (%)
Adequate Care	7 + Visits	59400 59426 59510 59610 59618	196(63.8%)
Maternal Physical Complications	Hypertension	64200 64201 64202 64203 64204 64210 64211 64212 64213 64214 64220 64221 64222 64223 64224 64230 64231 64232 64233 64234 64240 64241 64242 64243 64244 64250 64251 64252 64253 64254 64260 64261 64262 64263 64264 64270 64271 64272 64273 64274	37 (12.1%)
	Diabetes	64880 64881 64882 64883 64884	20 (6.5%)
	Obesity	64910 64911 64912 64913 64914	32 (10.4%)
	Anemia	64820 64821 64822 64823 64824	62 (20.2%)
Maternal Risk Factors	Mental Illness	64840 64841 64842 64843 64844	59 (19.2%)
	Tobacco Use	64900 64901 64902 64903 64904	56 (18.2%)
Complications of the Fetus	Excessive Fetal Growth	65660 65661 65663	31 (10.1%)
	Poor Fetal Growth	65650 65651 65653	69 (22.5%)
	Abnormal Fetal Heart Rate	65970 65971 65973	56 (18.2%)
	Decreased Fetal Movement	65570 65571 65573	57 (18.6%)

(Source: Quest Diagnostics, 2015)

Maternal physical complications experienced during pregnancy observed for this study were hypertension, diabetes, anemia and obesity. The claims codes used to identify each complication are outlined in Table 6. According to the CDC, hypertension, diabetes, anemia and obesity are common health problems experienced during pregnancy, and if left unmanaged, can have severe to fatal consequences for both mother and child (2016b).

Maternal risk factors observed in this study were mental illness and tobacco use (Table 6). Substance abuse (drugs, alcohol and/or tobacco) during pregnancy, not only poses a severe risk for a developing fetus, it also has been found that adolescents who engage in these behaviors are more likely to experience an unexpected pregnancy (Berry, et al, 2000). Tobacco was the only substance used during pregnancy present in the data for this study.

Complications to the fetus observed in this study were excessive fetal growth, poor fetal growth, abnormal fetal heart rate and decreased fetal movement. Data for this study had limited information regarding the outcome of the baby. However, there were high frequencies of women that received at least one claims code associated with excessive fetal growth, poor fetal growth, abnormal fetal heart rate and decreased fetal movement (Table 6).

Methods

This section will outline the methods used in identifying differences in prenatal care and prenatal outcomes between individual characteristics, foster care characteristics and spatial characteristics.

Individual Characteristics

The individual characteristics incorporated in this research were age and race. Age analysis compared 13-17 year olds and 18-21 year olds with adequate prenatal care, maternal physical complications, maternal risk factors and complications of the fetus using χ^2 analyses.

Foster Care Characteristics

Foster care characteristics were number of living arrangements, living arrangement type and length in foster care before delivery. χ^2 analyses were used to compare number of living arrangements with inadequate prenatal care, maternal physical complications, maternal risk factors and complications to the fetus. Living arrangement types were compared regarding adequate prenatal care, maternal physical complications, maternal risk factors and complications to the fetus using χ^2 analyses. T-tests were used to compare years in foster care before becoming pregnant with maternal physical complications, maternal risk factors and complications to the fetus.

Spatial Characteristics

Spatial characteristics included in this study were a dichotomous variable for urban and rural counties, another dichotomous variable separating Wayne County and the rest of Michigan, Michigan prosperity regions and Michigan counties. χ^2 analyses were used to compare urban and rural counties regarding adequate prenatal care, maternal physical complications, maternal risk factors and complications to the fetus. The binary variable demarking Wayne County and the rest of Michigan were compared regarding adequate prenatal care, maternal physical complications, maternal risk factors and complications to the fetus using χ^2 analyses. χ^2 analyses were used to compare Michigan prosperity regions with adequate prenatal care, maternal physical complications, maternal risk factors and complications to the fetus. ArcGIS will be utilized to

identify anomalies in adequate prenatal care, maternal physical complications, maternal risk factors and complications to the fetus across the twelve Michigan counties used in this study.

Prenatal, Well Child and Dental Visits

This study also utilized well child visits and dental visits to understand the overall care of youth in foster care. Michigan requires children entering the foster care system to receive the first dental visits within 90 days and the first well-child visit within 30 days. Adequate dental care was defined as receiving a dental visit within 90 days and adequate well-child care was defined as receiving a well-child visit within 30 days. Adequate prenatal care remained as receiving 7 + visits. A hierarchal cluster analysis of adequate dental, well child and prenatal visits was used to identify which counties had similar success in achieving overall adequate care. Adequate dental and well-child were standardized using the total population of foster youth in each county while adequate prenatal care was standardized using the number of females that became pregnant and delivered in foster care in each county.

CHAPTER V

RESULTS

This chapter will detail the results generated from the analyses outlined in Chapter III. The three sections of this chapter are individual characteristics, foster care characteristics and spatial characteristics.

Individual Characteristics

Individual characteristics were age and race. Analyses were conducted to observe associations between individual characteristics and adequate prenatal, maternal physical complications, maternal risk factors and fetal complications.

Maternal Age

The age analysis compared 13-17 year olds and 18-21 year olds with adequate prenatal care, maternal complications, maternal risk factors and fetal complications. A χ^2 analysis was used to compare maternal age and adequate prenatal care. Adequate prenatal care was defined as experiencing seven or more prenatal visits. The χ^2 analysis identified no significant difference between maternal age and adequate prenatal care (Table 7).

Table 7: Association between Maternal Age and Adequate Prenatal Care Received by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Maternal Age at Delivery	7+ Prenatal Visits		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
13-17	71 (38.2%)	115 (61.8%)	0.831 (1)	0.362
18-21	40 (33.1%)	81 (66.9%)		

(Source: Author)

Chi-square analyses were used to compare maternal age with the four maternal physical complications. Maternal physical complications include hypertension, diabetes, anemia and obesity. With regard to maternal physical complications, the χ^2 analyses resulted in no significant differences between maternal age and hypertension, diabetes, anemia or obesity (Table 8).

Table 8: Association between Maternal Age with Maternal Physical Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Maternal Age at Delivery	Experienced Hypertension		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
13-17	167 (89.8%)	19 (10.2%)	1.503 (1)	0.220
18-21	103 (85.1%)	18 (14.9%)		
Experienced Diabetes				
13-17	173 (93.0%)	13 (7.0%)	1.084 (1)	0.298
18-21	116 (90.9%)	5 (9.1%)		
Experienced Anemia				
13-17	153 (82.3%)	33 (17.7%)	1.763 (1)	0.184
18-21	92 (76.0%)	29 (24.0%)		
Experienced Obesity				
13-17	168 (90.3%)	18 (10.2%)	0.281 (1)	0.596
18-21	107 (88.4%)	14 (11.6%)		

(Source: Author)

Chi-square analyses was also used to compare maternal age with maternal risk factors. Maternal risk factors include, mental illness and tobacco use. A χ^2 analysis identified no significant difference for mental illness (Table 9). A χ^2 analysis identified a significant difference between maternal age and tobacco use ($p=0.036$), with 24 percent of the 18-21 year olds experiencing tobacco use during pregnancy (Table 9).

Chi-square analyses were used to compare age groups with fetal complications. Fetal complications include excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement. With regard to fetal complications, the χ^2 analyses resulted in no

significant differences between age and excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement (Table 10).

Table 9: Association between Maternal Age and Maternal Risk Factors Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Maternal Age at Delivery	Experienced Mental Illness		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
13-18	151 (81.2%)	35 (18.8%)	0.049 (1)	0.825
18-21	97 (80.2%)	24 (19.8%)		
Tobacco Use				
13-18	159 (85.5%)	27 (14.5%)	4.390 (1)	0.036
18-21	92 (76.0%)	29 (24%)		

(Source: Author)

Chi-square analyses were used to compare age groups with fetal complications. Fetal complications include excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement. With regard to fetal complications, the χ^2 analysis resulted in no significant differences between age and excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement (Table 10).

Table 10: Association between Maternal Age and Fetal Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Maternal Age at Delivery	Experienced Excessive Fetal Growth		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
13-18	171 (92.0%)	15 (8.0%)	2.149 (1)	0.143
18-21	105 (86.8%)	16 (13.2%)		
Experienced Poor Fetal Growth				
13-18	149 (80.1%)	37 (19.9%)	1.807 (1)	0.179
18-21	89 (73.6%)	23 (26.4%)		
Experienced Abnormal Fetal Heart Rate				
13-18	138 (74.2%)	48 (25.8%)	0.001 (1)	0.971
18-21	90 (74.4%)	31 (25.6%)		
Experienced Decreased Fetal Movement				
13-18	155 (83.3%)	31 (16.7%)	1.127 (1)	0.288
18-21	95 (78.5%)	26 (21.5%)		

(Source: Author)

Maternal Race

Race was defined as white, black and other. Analyses compared maternal race with adequate prenatal care, maternal complications, maternal risk factors and fetal complications. The χ^2 analysis identified a significant difference between race and adequate prenatal care ($p=0.089$), with 70.7 percent of the white population, 59.8 percent of the black population, and 81.8 percent of the population defined as other received adequate prenatal care (Table 11).

Table 11: Association between Race and Adequate Prenatal Care Received by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Race	7+ Prenatal Visits		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
White	27 (29.3%)	65 (70.7%)	4.829 (2)	0.089
Black	82 (40.2%)	122 (59.8%)		
Other	2 (18.2%)	9 (81.8%)		

(Source: Author)

Chi-square analyses were used to compare race with reported cases of four maternal physical complications (hypertension, diabetes, anemia and obesity). The χ^2 analysis resulted in no significant differences between race and hypertension, diabetes, anemia or obesity (Table 12).

Table 12: Association between Race and Physical Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Race	Experienced Hypertension		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
White	84 (91.3%)	8 (8.7%)	1.608 (2)	0.448
Black	176 (86.3%)	28 (13.7%)		
Other	10 (91.0%)	1 (9.0%)		
Experienced Diabetes				
White	89 (96.7%)	3 (3.3%)	1.706 (2)	0.426
Black	190 (93.1%)	14 (6.9%)		
Other	10 (90.9%)	1 (9.1%)		
Experienced Anemia				
White	79 (85.9%)	13 (14.1%)	3.151 (2)	0.207
Black	157 (77.0%)	47 (23.0%)		
Other	9 (81.8%)	2 (18.2%)		
Experienced Obesity				
White	79 (85.9%)	13 (14.1%)	2.903 (2)	0.234
Black	185 (90.7%)	19 (9.3%)		
Other	11 (100.0%)	0 (0.0%)		

(Source: Author)

Chi-square analyses compared race with maternal risk factors (mental illness and tobacco use). With regard to mental illness, a χ^2 analysis identified no significant difference (Table 13). A χ^2 analysis identified a significant difference between maternal race and tobacco use ($p=0.0001$), with 32.6 percent of the white population reporting tobacco use, while only 11.6 percent of the black population and 18.2 percent of the population defined as other reported tobacco use during pregnancy (Table 13).

Table 13: Association between Risk Factors Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Maternal Race using χ^2 Analysis

Race	Experienced Mental Illness		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
White	76 (82.6%)	16 (17.4%)	0.677 (2)	0.713
Black	164 (80.4%)	40 (19.6%)		
Other	8 (72.7%)	3 (27.3%)		
Tobacco Use				
White	62 (67.4%)	30 (32.6%)	18.472 (2)	0.0001
Black	180 (88.2%)	24 (11.8%)		
Other	9 (81.8%)	2 (18.2%)		

(Source: Author)

Chi-square analyses were used to compare race with fetal complications (excessive fetal growth, poor fetal growth abnormal fetal heart rate and decreased fetal movement). A χ^2 analysis resulted in a significant difference between race and excessive fetal growth ($p=0.007$) (Table 14). Excessive fetal growth was experienced by 36.6 percent of the population defined as other, while only 12.0 percent of the white population and 7.8 percent of the black population experienced excessive fetal growth during pregnancy. With regard to poor fetal growth, abnormal fetal heart rate, and decreased fetal movement no significant differences were found (Table 14).

Table 14: Association between Race and Fetal Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Race	Experienced Excessive Fetal Growth		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
White	81 (88.0%)	11 (12.0%)	9.852 (2)	0.007
Black	188 (92.2%)	16 (7.8%)		
Other	7 (63.6%)	4 (36.4%)		
Experienced Poor Fetal Growth				
White	74 (80.4%)	18 (19.6%)	0.723 (2)	0.697
Black	156 (76.5%)	48 (38.5%)		
Other	8 (72.2%)	3 (27.3%)		
Experienced Abnormal Fetal Heart Rate				
White	70 (76.1%)	22 (23.9%)	0.649 (2)	0.723
Black	149 (73.0%)	55 (26.9%)		
Other	9 (81.8%)	2 (18.2%)		
Experienced Decreased Fetal Movement				
White	75 (81.5%)	17 (18.5%)	0.695 (2)	0.707
Black	165 (80.9%)	39 (19.1%)		
Other	10 (91.0%)	1 (18.2%)		

(Source: Author)

Foster Care Characteristics

Variables depicting foster care characteristics were (1) number of living arrangements, (2) type of living arrangement and (3) length in foster care. Analyses were conducted to observe associations between foster care characteristics and adequate prenatal, maternal physical complications, maternal risk factors and fetal complications.

Number of Living Arrangements

Chi-square analyses compared women that experienced less than six living arrangements and women that experienced six living arrangements with adequate prenatal, maternal physical complications, maternal risk factors and fetal complications. A χ^2 analysis identified no significant difference between number of living arrangements and adequate prenatal care (Table 15).

Table 15: Association between Number of Living Arrangements and Adequate Prenatal Care Received by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Number of Living Arrangements	7+ Prenatal Visits		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
< 6	53 (37.1%)	90 (62.9%)	0.048 (1)	0.827
6	57 (35.8%)	102 (64.2%)		

(Source: Author)

Chi-square analyses were used to compare the number of living arrangements (less than six living arrangements and six living arrangements) experienced by women in foster care with maternal physical complications (hypertension, diabetes, anemia and obesity). The χ^2 analysis resulted in no significant differences between the number of living arrangements and the four maternal complications (Table 16).

Table 16: Association between Number of Living Arrangements and Physical Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Number of Living Arrangements	Experienced Hypertension		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
< 6	126 (88.1%)	17 (11.9%)	0.024 (1)	0.878
6	141 (88.7%)	18 (11.3%)		
Experienced Diabetes				
< 6	136 (94.4%)	7 (5.6%)	0.230 (1)	0.632
6	153 (92.5%)	6 (7.5%)		
Experienced Anemia				
< 6	118 (82.5%)	25 (17.5%)	1.243 (1)	0.265
6	123 (77.4%)	36 (22.6%)		
Experienced Obesity				
< 6	134 (93.7%)	9 (6.3%)	0.226 (1)	0.635
6	151 (95.0%)	8 (5.0%)		

(Source: Author)

The number of different living arrangements and the two maternal risk factors (mental illness and tobacco use) were compared using χ^2 analyses. With regard to tobacco use, the χ^2 analysis identified no significant difference (Table 17). A χ^2 analysis identified a significant difference between number of living arrangements and mental illness ($p=.004$). Only 12.6 percent of women who faced less than six living arrangements experienced mental illness during pregnancy, while 25.7 percent of women who endured six living arrangements experienced mental illness during pregnancy (Table 17).

Table 17: Association between Number of Living Arrangements and Maternal Risk Factors Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Number of Living Arrangements	Experienced Mental Illness		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
< 6	125 (87.4%)	18 (12.6%)	8.343 (1)	0.004
6	118 (74.2%)	41 (25.7%)		
Tobacco Use				
< 6	119 (83.2%)	24 (16.8%)	0.557 (1)	0.456
6	127 (79.9%)	32 (20.1%)		

(Source: Author)

χ^2 analyses were used to compare number of living arrangements with fetal complications. With regards to excessive fetal growth, a χ^2 analysis resulted in a significant difference between the number of living arrangements above and below six and excessive fetal growth ($p=0.011$) (Table 18). Excessive fetal growth was experienced by 14.5 percent of women that faced six or more living arrangements. With regard to poor fetal growth, abnormal fetal heart rate, and decreased fetal movement, no significant differences were found (Table 18).

Table 18: Association between Number of Living Arrangements and Fetal Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Number of Living Arrangements	Experienced Excessive Fetal Growth		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
< 6	135 (94.4%)	8 (5.6%)	6.432 (1)	0.011
6	136 (85.5%)	23 (14.5%)		
Experienced Poor Fetal Growth				
< 6	112 (78.3%)	31 (21.7%)	0.109 (1)	0.741
6	122 (76.7%)	37 (23.3%)		
Experienced Abnormal Fetal Heart Rate				
< 6	109 (76.2%)	34 (23.8%)	0.597 (1)	0.440
6	115 (72.3%)	44 (27.7%)		
Experienced Decreased Fetal Movement				
< 6	117 (81.8%)	26 (18.2%)	0.085 (1)	0.771
6	128 (80.5%)	31 (19.5%)		

Source: Table Generated by Author

Types of Living Arrangements

Types of living arrangements experienced by women that became pregnant and delivered while in foster care were family-based living, group living and other. The category other included women that were considered AWOL. Analyses compared the types of living arrangements and adequate prenatal care, maternal complications, maternal risk factors and fetal complications. A χ^2 analysis identified no significant difference between the types of living arrangements and adequate prenatal care (Table 19).

Chi-square analyses were used to compare the types of living arrangements with the four defined maternal physical complications (hypertension, diabetes, anemia and obesity). The χ^2 analyses conducted resulted in no significant differences between the types of living arrangements experienced by women that became pregnant and delivered while in foster care and hypertension, diabetes, anemia or obesity (Table 20).

Table 19: Association between Type of Living Arrangements and Adequate Prenatal Care Received by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Type of Living Arrangement	7+ Prenatal Visits		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
Family	28 (34.6%)	53 (65.4%)	.258 (2)	0.879
Group	18 (35.3%)	33 (64.7%)		
Other	64 (37.6%)	106 (62.4%)		

(Source: Author)

Table 20: Association between Type of Living Arrangements and Physical Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Type of Living Arrangement	Experienced Hypertension		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
Family	70 (86.4%)	11 (13.6%)	1.017 (2)	0.601
Group	47 (92.2%)	4 (7.8%)		
Other	150 (88.2%)	20 (11.8%)		
Experienced Diabetes				
Family	80 (98.7%)	1 (1.2%)	3.470 (2)	0.176
Group	47 (92.2%)	4 (7.8%)		
Other	162 (95.3%)	8 (4.7%)		
Experienced Anemia				
Family	69 (85.2%)	12 (14.8%)	2.833 (2)	0.243
Group	42 (82.4%)	9 (17.6%)		
Other	130 (76.5%)	40 (23.5%)		
Experienced Obesity				
Family	77 (95.1%)	4 (4.9%)	2.019 (2)	0.364
Group	50 (98.0%)	1 (2.0%)		
Other	158 (93.0%)	12 (7.1%)		

(Source: Author)

The types of living arrangements were compared with maternal risk factors using χ^2 analyses. With regard to tobacco use, a χ^2 analysis identified no significant difference (Table 21). A χ^2 analysis identified a significant difference between the type of living arrangements and

mental illness ($p=0.008$), with 35.5 percent of the women that were in a group-based living arrangement experienced mental illness during pregnancy (Table 21).

Table 21: Association between Type of Living Arrangements and Maternal Risk Factors Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Type of Living Arrangement	Experienced Mental Illness		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
Family	67 (82.7%)	14 (17.2%)	9.761 (2)	0.008
Group	33 (64.7%)	18 (35.3%)		
Other	143 (84.1%)	27 (15.9%)		
Tobacco Use				
Family	70 (86.4%)	11 (13.6%)	2.764 (2)	0.251
Group	43 (84.3%)	8 (15.7%)		
Other	133 (78.2%)	37 (21.8%)		

(Source: Author)

Chi-square analyses were used to compare the types of living arrangements experienced by women that became pregnant and delivered while in foster care with the four defined fetal complications (excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement). The χ^2 analyses resulted in no significant differences between the type of living arrangement and excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement (Table 22).

Table 22: Association between Complications of Fetus Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Type of Living Arrangement using χ^2 Analysis

Types of Living Arrangement	Experienced Excessive Fetal Growth		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
Family	74 (91.4%)	7 (8.6%)	0.397 (2)	0.820
Group	46 (90.2%)	5 (9.8%)		
Other	151 (88.8%)	19 (11.2%)		
Experienced Poor Fetal Growth				
Family	66 (81.5%)	15 (18.5%)	0.723 (2)	0.697
Group	42 (82.4%)	9 (17.6%)		
Other	126 (74.1%)	44 (25.9%)		
Experienced Abnormal Fetal Heart Rate				
Family	62 (76.5%)	19 (23.5%)	1.849 (2)	0.397
Group	34 (66.7%)	17 (33.3%)		
Other	128 (75.3%)	42 (24.7%)		
Experienced Decreased Fetal Movement				
Family	72 (88.9%)	9 (11.1%)	4.375 (2)	0.113
Group	40 (78.4%)	11 (21.6%)		
Other	133 (78.2%)	37 (21.8%)		

(Source: Author)

Length in Foster Care

Analyses of length in foster care compared years spent in foster care prior to becoming pregnant and adequate prenatal, maternal physical complications, maternal risk factors and fetal complications. Through the use of an independent t-test no significant difference between years spent in foster care and (1) adequate and (2) inadequate prenatal care (Table 23 & 24).

Table 23: Group Statistics of Adequate Prenatal Care Received by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Length in Foster Care

Years in Foster care Prior to Pregnancy		N	Mean	Std. Deviation	Std. Error Mean
7+ Visits	No	111	4.801	3.5438	0.3364
	Yes	196	4.551	3.0854	0.2204

(Source: Author)

Table 24: Independent Sample Test of Adequate Prenatal Care Received by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Length in Foster Care

Years in Foster Care Prior to Pregnancy	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
7 + Visits	Assumed	3.074	0.644	305	0.520	0.2494	0.3870	Lower	1.0110
	Not Assumed		0.620	203.552	0.536	0.2494	0.4021	Upper	1.0423

(Source: Author)

Independent t-tests were also used to compare the number of years in foster care with maternal physical complications, as designated by the presence or absence of hypertension, anemia, diabetes and obesity. No significant differences between the number of years in foster care and hypertension, diabetes, anemia or obesity were found (Table 25 & 26).

Table 25: Group Statistics of Maternal Physical Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Length in Foster Care

Years in Foster care Prior to Pregnancy		N	Mean	Std. Deviation	Std. Error Mean
Hypertension	No	270	4.673	3.2690	0.1989
	Yes	37	4.414	3.1855	0.5237
Diabetes	No	289	5.732	3.3922	0.1995
	Yes	13	5.049	2.2756	0.6311
Anemia	No	245	4.526	3.2715	0.2090
	Yes	62	5.098	3.1740	0.4031
Obesity	No	285	5.644	3.2475	0.1924
	Yes	17	6.681	4.8065	1.1657

(Source: Author)

In similar fashion, independent t-tests were used to compare years in foster care with regards to the presence or absence of maternal risk factors (mental illness and tobacco use). No significant differences between years in foster care were identified (Table 27 & 28).

Table 26: Independent Sample Test of Maternal Physical Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Length in Foster Care

Years in Foster Care Prior to Pregnancy	Levene's Test for Equality of Variances		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
	F	Sig.						Lower	Upper	
Hypertension	Equal Variance Assumed	0.316	0.574	0.452	305	0.651	0.2585	0.5714	-0.8658	1.3828
	Not Assumed			0.461	47.010	0.647	0.2585	0.5602	-0.8685	1.3855
Diabetes	Assumed	0.981	0.323	0.718	300	0.473	0.6828	0.9511	-1.1889	2.5545
	Not Assumed			1.032	14.513	0.319	0.6828	0.6619	-0.7322	2.0978
Anemia	Assumed	0.031	0.860	-1.237	305	0.217	-0.5721	0.4624	-1.4819	0.3377
	Not Assumed			-1.260	96.465	0.211	-0.5721	0.4541	-1.4733	0.3292
Obesity	Assumed	7.617	0.006	-1.240	300	0.216	-1.0364	0.8361	-2.6818	0.6090
	Not Assumed			-0.877	16.883	0.393	-1.0364	1.1815	-3.5305	1.4577

(Source: Author)

Table 27: Group Statistics of Maternal Risk Factors Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Length in Foster Care

Years in Foster care Prior to Pregnancy		N	Mean	Std. Deviation	Std. Error Mean
Mental Illness	No	248	4.699	3.3433	0.2123
	Yes	59	4.400	2.8680	0.3734
Tobacco Use	No	251	4.764	3.3689	0.2126
	Yes	56	4.090	2.6422	0.3531

(Source: Author)

Students t-tests of independence were also used to compare years in foster care with the presence or absence of the four common fetal complications (excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement. The results of the analysis identified significant difference between years in foster care and poor fetal growth ($p=0.048$) (Table 30). The average length in foster care prior to becoming pregnant for women that experienced poor fetal growth was 5.5 years, while the average length in foster care prior to becoming pregnant for women that did not experience poor fetal growth was 4.4 years (Table 29). Additional tests for independence identified no significant difference between years in foster care and excessive fetal growth, abnormal fetal heart rate, and decreased fetal movement (Table 29 & 30).

Table 28: Independent Sample Test of Maternal Risk Factors Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Length in Foster Care

Years in Foster Care Prior to Pregnancy	Levene's Test for Equality of Variances		t-test for Equality of Means								
	Equal Variance Assumed	Not Assumed	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Mental Illness	Assumed	Not Assumed	0.867	0.353	0.634	305	0.527	0.2990	0.4720	Lower	Upper
Tobacco Use	Assumed	Not Assumed	2.865	0.092	1.404	305	0.161	0.6743	0.4803	-0.6297	1.2277
					1.636	99.262	0.105	0.6743	0.4122	-0.5532	1.1513
										-0.2708	1.6194
										-0.1435	1.4921

(Source: Author)

Table 29: Group Statistics of Complications of the Fetus Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Length in Foster Care

Years in Foster care Prior to Pregnancy		N	Mean	Std. Deviation	Std. Error Mean
Excessive Fetal Growth	No	276	4.611	3.2079	0.1931
	Yes	31	4.909	3.6959	0.6638
Poor Fetal Growth	No	238	4.407	2.9613	0.1920
	Yes	69	5.451	4.0319	0.4854
Abnormal Fetal Heart	No	251	4.764	3.3689	0.2126
	Yes	56	4.090	2.6422	0.3531
Decreased Fetal Movement	No	250	4.637	3.1282	0.1978
	Yes	57	4.663	3.7927	0.5024

(Source: Author)

Table 30: Independent Sample Test of Complications of the Fetus Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan and Length in Foster Care

Years in Foster Care Prior to Pregnancy	Levene's Test for Equality of Variances		t	df	Sig. (2-tailed)	t-test for Equality of Means			95% Confidence Interval of the Difference	
	F	Sig.				Mean Difference	Std. Error Difference	Lower	Upper	
Excessive Fetal Growth	0.055	0.815	-0.481 -0.430	305 35.264	0.631 0.670	-0.2971 -0.2971	0.6174 0.6913	-1.5119 -1.7002	0.9177 1.1060	
Poor Fetal Growth	12.271	0.001	-2.365 -2.001	305 90.300	0.019 0.048	-1.0447 -1.0447	0.4418 0.5220	-1.9139 -2.0816	-0.1754 -0.0077	
Abnormal Fetal Heart	2.865	0.092	1.404 1.636	305 99.262	0.161 0.105	0.6743 0.6743	0.4803 0.4122	-0.2708 -0.1435	1.6194 1.4921	
Decreased Fetal Movement	2.172	0.142	-0.055 -0.049	305 74.316	0.956 0.961	-0.0262 -0.0262	0.4786 0.5399	-0.9679 -1.1019	0.9155 1.0495	

(Source: Author)

Spatial Characteristics

It is important to investigate locational differences that might influence the likelihood of women that become pregnant and deliver while in foster care to receive adequate prenatal care or experience negative prenatal outcomes. Spatial characteristics are urban and rural counties, Wayne County and the rest of Michigan, and Michigan Prosperity Regions. Analyses compared spatial characteristics with adequate prenatal care, maternal complications, maternal risk factors and fetal complications.

Urban and Rural Counties

A χ^2 analysis was used to compare women that became pregnant and delivered while in foster care that resided in urban counties with women that became pregnant and delivered while in foster care that resided in rural counties to determine if they received adequate prenatal care. The χ^2 analysis identified no significant difference between women in urban and rural counties regarding adequate prenatal care (Table 31).

Table 31: Association between Urban and Rural Counties and Adequate Prenatal Care Received by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

	7+ Prenatal Visits		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
Rural	7 (28.0%)	18 (72.0%)	0.784 (1)	0.376
Urban	104 (36.9%)	178 (63.1%)		

(Source: Author)

Chi-square analyses were used to compare women that became pregnant and delivered while in foster care in urban and rural counties as measured by the presence or absence of the four maternal physical complications (hypertension, diabetes, anemia and obesity). The χ^2

analyses resulted in no significant differences between women in urban and rural counties and hypertension, diabetes, anemia or obesity (Table 32).

Table 32: Association between Urban and Rural Counties and Physical Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

	Experienced Hypertension		χ^2 Value (df)	<i>p</i> Value
	No n (%)	Yes n (%)		
Rural	24 (96.0%)	1 (4.0%)	1.665 (1)	0.197
Urban	246 (87.2%)	36 (12.8%)		
Experienced Diabetes				
Rural	23 (92.0%)	2 (8.0%)	0.225 (1)	0.635
Urban	266 (94.3%)	16 (5.7%)		
Experienced Anemia				
Rural	23 (92.0%)	2 (8.0%)	2.512 (1)	0.113
Urban	222 (78.7%)	60 (21.3%)		
Experienced Obesity				
Rural	24 (96.0%)	1 (4.0%)	1.203 (1)	0.273
Urban	251 (89.0%)	31 (11.0%)		

(Source: Author)

Chi-square analyses compared women that became pregnant and delivered while in foster care in either urban or rural counties and the presence of maternal risk factors (mental illness and tobacco use). With regard to mental illness, a χ^2 analysis identified no significant difference between women in urban and rural counties (Table 33). A χ^2 analysis identified a significant difference between women in urban and rural counties with regard to tobacco use ($p=.003$), with 40.0 percent of the urban population experiencing tobacco use during pregnancy (Table 33).

Table 33: Association between Urban and Rural Counties and Maternal Risk Factors Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

	Experienced Mental Illness		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
Rural	19 (76.0%)	6 (24.0%)	0.401 (1)	0.527
Urban	229 (81.2%)	53 (18.8%)		
Tobacco Use				
Rural	15 (60.0%)	10 (40.0%)	8.640 (1)	0.003
Urban	236 (83.7%)	46 (16.3%)		

(Source: Author)

Chi-square analyses were used to compare women that became pregnant and delivered while in foster care in urban counties and women that became pregnant and delivered while in foster care in rural counties with the presence or absence of the four fetal complications. With regards to excessive fetal growth, a χ^2 analysis resulted in a significant difference between women in urban and rural counties and excessive fetal growth ($p=0.0001$) (Table 34). Excessive fetal growth was experienced by 32 percent of the rural population. With regard to poor fetal growth, abnormal fetal heart rate, and decreased fetal movement no significant differences were found between women in urban and rural counties (Table 34).

Table 34: Association between Urban and Rural Counties and Complications of Fetus Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

	Experienced Excessive Fetal Growth		χ^2 Value (df)	<i>p</i> Value
	No n (%)	Yes n (%)		
Rural	17 (68.0%)	8 (32.0%)	14.382 (1)	0.0001
Urban	259 (91.8%)	23 (8.2%)		
Experienced Poor Fetal Growth				
Rural	20 (80.0%)	5 (20.0%)	0.096 (1)	0.757
Urban	218 (77.3%)	64 (22.7%)		
Experienced Abnormal Fetal Heart Rate				
Rural	22 (88.0%)	3 (12.0%)	2.686 (1)	0.101
Urban	206 (73.1%)	76 (26.9%)		
Experienced Decreased Fetal Movement				
Rural	20 (80.0%)	5 (20.0%)	0.037 (1)	0.848
Urban	230 (81.6%)	52 (18.4%)		

(Source: Author)

Wayne County and the Rest of Michigan

A χ^2 analysis was used to compare women that became pregnant and delivered while in foster care that resided in Wayne County with those that resided in the rest of Michigan to identify if they received adequate prenatal care. The χ^2 analysis identified a significant difference between women in Wayne County and women in the rest of Michigan ($p=0.006$). Of the women that became pregnant and delivered while in foster care that resided in the rest of Michigan, 70.6 percent received adequate prenatal care, while only 55.5 percent of the women that became pregnant and delivered in Wayne County received adequate prenatal care (Table 35).

Table 35: Association between Wayne County and the Rest of Michigan and Adequate Prenatal Care Received by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

	7+ Prenatal Visits		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
Rest of MI	50 (29.4%)	120 (70.6%)	7.507 (1)	0.006
Wayne County	61 (44.5%)	76 (55.5%)		

(Source: Author)

Chi-square analyses were used to compare women that became pregnant and delivered while in foster care from Wayne County and those from the rest of Michigan with regards to the four maternal physical complications (hypertension, diabetes, anemia and obesity). The χ^2 analysis resulted in a significant difference between Wayne County and the rest of Michigan and hypertension ($p=.053$), with 16.1 percent of the women in Wayne County experiencing hypertension during pregnancy (Table 36). With regard to diabetes, anemia and obesity, no significant differences were found (Table 36).

Table 36: Association between Wayne County and the Rest of Michigan Physical Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

	Experienced Hypertension		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
Rest of MI	155 (91.2%)	15 (8.8%)	3.746 (1)	0.053
Wayne County	115 (83.9%)	22 (16.1%)		
Experienced Diabetes				
Rest of MI	156 (91.8%)	14 (8.2%)	1.852 (1)	0.174
Wayne County	133 (97.1%)	4 (2.9%)		
Experienced Anemia				
Rest of MI	138 (81.2%)	32 (18.8%)	0.445 (1)	0.505
Wayne County	107 (78.1%)	30 (21.9%)		
Experienced Obesity				
Rest of MI	156 (91.8%)	14 (8.2%)	1.954 (1)	0.162
Wayne County	119 (86.9%)	18 (13.1%)		

(Source: Author)

Chi-square analyses compared women that became pregnant and delivered while in foster care that reside in Wayne County and those that reside in the rest of Michigan with regards to the two maternal risk factors (mental illness and tobacco use). With regard to mental illness, a χ^2 analysis identified no significant difference (Table 37). A χ^2 analysis identified a fairly significant difference between women in Wayne County and women in the rest of Michigan with regards to tobacco use ($p=.075$). Of the women in the rest of Michigan, 21.8 percent experienced tobacco use during pregnancy (Table 37).

Table 37: Association between Wayne County and the Rest of Michigan and Maternal Risk Factors Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

	Experienced Mental Illness		χ^2 Value (df)	p Value
	No n (%)	Yes n (%)		
Rest of MI	137 (80.6%)	33 (19.4%)	0.009 (1)	0.924
Wayne County	111 (81.0%)	26 (19.0%)		
Tobacco Use				
Rest of MI	133 (78.2%)	37 (21.8%)	3.172 (1)	0.075
Wayne County	118 (86.1%)	19 (13.9%)		

(Source: Author)

To identify the presence of the four fetal complications, χ^2 analyses were used to compare women that became pregnant and delivered while in foster care from Wayne County with those from the rest of Michigan. With regard to excessive fetal growth, poor fetal growth, abnormal fetal heart rate, and decreased fetal movement no significant differences were found between women in Wayne County and the Rest of Michigan (Table 38).

Table 38: Association between Wayne County and the Rest of Michigan and Complications of Fetus Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

	Experienced Excessive Fetal Growth		χ^2 Value (df)	<i>p</i> Value
	No n (%)	Yes n (%)		
Rest of MI	150 (88.2%)	20 (11.8%)	1.166 (1)	0.280
Wayne County	126 (92.0%)	11 (8.0%)		
Experienced Poor Fetal Growth				
Rest of MI	127 (74.7%)	43 (25.3%)	1.737 (1)	0.188
Wayne County	111 (%)	26 (19.0%)		
Experienced Abnormal Fetal Heart Rate				
Rest of MI	129 (75.9%)	41 (24.1%)	0.520 (1)	0.471
Wayne County	99 (72.3%)	38 (27.7%)		
Experienced Decreased Fetal Movement				
Rest of MI	143 (84.1%)	27 (15.9%)	1.816 (1)	0.178
Wayne County	107 (78.1%)	30 (21.9%)		

(Source: Author)

Michigan's Prosperity Regions

A χ^2 analysis was used to compare women that became pregnant and delivered while in foster care from the eight Prosperity Regions defined in this study to identify if adequate prenatal care was received. A χ^2 analysis identified a significant difference between the Prosperity Regions with regards to adequate prenatal care ($p=0.002$) (Table 39). One hundred percent of women in Region 1 received adequate prenatal care, while only 53.8 percent of women in Region 7 received adequate prenatal care (Table 39).

Table 39: Association between Michigan’s Prosperity Regions and Adequate Prenatal Care Received by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Region	7+ Visits	
	No (%)	Yes (%)
1	0 (0.0%)	7 (100.0%)
4	13 (40.6%)	19 (59.4%)
5	2 (22.2%)	7 (77.8%)
6	7 (25.9%)	20 (74.1%)
7	2 (14.3%)	12 (85.7%)
8	4 (12.5%)	28 (87.5%)
9	6 (46.2%)	7 (53.8%)
10	77 (44.5%)	96 (55.5%)
Total	111 (36.2%)	196 (63.8%)
	Value (df)	p Value
	22.672 (7)	0.002

(Source: Author)

Chi-square analyses were used to compare women that became pregnant and delivered while in foster care from Michigan’s Prosperity Regions with regards to the four defined maternal physical complications (hypertension, diabetes, anemia and obesity). The χ^2 analyses resulted in no significant difference between Michigan’s Prosperity Regions and hypertension, diabetes, anemia, and obesity (Table 40).

Table 40: Association between Michigan’s Prosperity Regions and Maternal Physical Complications Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Region	Hypertension		Diabetes		Anemia		Obesity	
	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)
1	7 (100.0%)	0 (0.0%)	6 (85.7%)	1 (14.3%)	7 (100.0%)	0 (0.0%)	7 (100.0%)	0 (0.0%)
4	29 (90.6%)	3 (9.4%)	31 (96.9%)	1 (3.1%)	21 (65.6%)	11 (34.4%)	31 (96.9%)	1 (3.1%)
5	8 (88.9%)	1 (11.1%)	8 (88.9%)	1 (11.1%)	6 (66.7%)	3 (33.3%)	8 (88.9%)	1 (11.1%)
6	25 (92.6%)	2 (7.4%)	23 (85.2%)	4 (14.8%)	21 (77.8%)	6 (22.2%)	27 (100.0%)	0 (0.0%)
7	14 (100.0%)	0 (0.0%)	14 (100.0%)	0 (0.0%)	13 (92.9%)	1 (7.1%)	13 (92.9%)	1 (7.1%)
8	28 (87.5%)	4 (12.5%)	29 (90.6%)	3 (9.4%)	28 (87.5%)	4 (12.5%)	26 (81.3%)	6 (18.8%)
9	13 (100.0%)	0 (0.0%)	13 (100.0%)	0 (0.0%)	10 (76.9%)	3 (23.1%)	11 (84.6%)	2 (15.4%)
10	146 (84.4%)	27 (15.6%)	165 (95.4%)	8 (4.6%)	139 (80.3%)	34 (19.7%)	152 (87.9%)	21 (12.1%)
Total	270 (87.9%)	37 (12.1%)	289 (94.1%)	18 (5.9%)	245 (79.8%)	62 (20.2%)	275 (89.6%)	32 (10.4%)
	Value (df)	p Value	Value (df)	p Value	Value (df)	p Value	Value (df)	p Value
	7.501 (7)	0.379	8.581 (7)	0.284	9.550 (7)	0.216	9.212 (7)	0.238

(Source: Author)

Chi-square analyses were used to compare women that became pregnant and delivered while in foster care in each of Michigan's Prosperity Regions to identify those that experienced maternal risk factors. The χ^2 analyses resulted in no significant difference between women in Michigan's Prosperity Regions and mental illness and tobacco use (Table 41).

Table 41: Association between Michigan's Prosperity Regions and Maternal Risk Factors Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Region	Mental Illness		Tobacco Use	
	No (%)	Yes (%)	No (%)	Yes (%)
1	5 (71.4%)	2 (28.6%)	4 (57.1%)	3 (42.9%)
4	27 (84.4%)	5 (15.6%)	26 (81.3%)	6 (18.8%)
5	6 (66.7%)	3 (33.3%)	7 (77.8%)	2 (22.2%)
6	22 (81.5%)	5 (18.5%)	22 (81.5%)	5 (18.5%)
7	10 (71.4%)	4 (28.6%)	11 (78.6%)	3 (21.4%)
8	28 (87.5%)	4 (12.5%)	25 (78.1%)	7 (21.9%)
9	11 (84.6%)	2 (15.4%)	10 (76.9%)	3 (23.1%)
10	139 (80.3%)	34 (19.7%)	146 (84.4%)	27 (15.6%)
Total	248 (80.8%)	59 (19.2%)	251 (81.8%)	56 (18.2%)
	Value (df)	p Value	Value (df)	p Value
	3.687 (7)	0.815	4.334 (7)	0.741

(Source: Author)

A χ^2 analysis was used to compare Michigan's Prosperity Regions with regards to complications of the fetus. A χ^2 analysis identified a significant difference between Michigan's Prosperity Regions and excessive fetal growth ($p=0.028$) (Table 33). None of the women in Region 4 experienced excessive fetal growth, while only 28.6 percent of women in Region 1 experienced excessive fetal growth (Table 42). A fairly significant difference between Michigan's Prosperity Regions and poor fetal growth was identified ($p=0.079$) (Table 42). Of the women in Region 10 only 17.9 percent experienced poor fetal growth, while 44.4 percent of women in Region 4 and 5 experienced poor fetal growth (Table 42).

Table 42: Association between Michigan's Prosperity Regions and Complications of the Fetus Experienced by Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009-9/30/2012 throughout Michigan using χ^2 Analysis

Region	Excessive Fetal Growth		Poor Fetal Growth		Abnormal Fetal Heart		Decreased Fetal Movement	
	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)
1	5 (71.4%)	2 (28.6%)	5 (71.4%)	2 (28.6%)	5 (71.4%)	2 (28.6%)	6 (85.7%)	1 (14.3%)
4	32 (100.0%)	0 (0.0%)	26 (81.3%)	6 (18.8%)	25 (78.1%)	7 (21.9%)	29 (90.6%)	3 (9.4%)
5	8 (88.9%)	1 (11.1%)	5 (55.6%)	4 (44.4%)	6 (66.7%)	3 (33.3%)	7 (77.8%)	2 (22.2%)
6	23 (85.2%)	4 (14.8%)	15 (55.6%)	12 (44.4%)	24 (88.9%)	3 (11.1%)	23 (85.2%)	4 (14.8%)
7	13 (92.9%)	1 (7.1%)	10 (71.4%)	4 (28.6%)	11 (78.6%)	3 (21.4%)	14 (100.0%)	0 (0.0%)
8	24 (75.0%)	8 (25.0%)	25 (78.1%)	7 (21.9%)	25 (78.1%)	7 (21.9%)	25 (78.1%)	7 (21.9%)
9	12 (92.3%)	1 (7.7%)	10 (76.9%)	3 (23.1%)	10 (76.9%)	3 (23.1%)	12 (92.3%)	1 (7.7%)
10	159 (91.9%)	14 (8.1%)	142 (82.1%)	31 (17.9%)	122 (70.5%)	51 (29.5%)	134 (77.5%)	39 (22.5%)
Total	276 (89.9%)	31 (10.1%)	238 (77.5%)	69 (22.5%)	228 (74.3%)	79 (25.7%)	250 (81.4%)	57 (18.6%)
	Value (df)	p Value	Value (df)	p Value	Value (df)	p Value	Value (df)	p Value
	15.71 (7)	0.028	12.745 (7)	0.079	5.275 (7)	0.626	8.454 (7)	0.294

(Source: Author)

Spatial Distribution

Geospatial software, ArcGIS was used to map the distribution of women that became pregnant and delivered while in foster care in terms of both adequate prenatal care and prenatal outcomes by county. The seven counties that experienced the highest percentages of women becoming pregnant and delivering while in foster care were Berrien (9.3%), Calhoun (10.4%), Houghton (14.3%), Monroe (9.4%), Ogemaw (10.0%), Washtenaw (8.3%) and Wayne Counties (8.3%) (Figure 6).

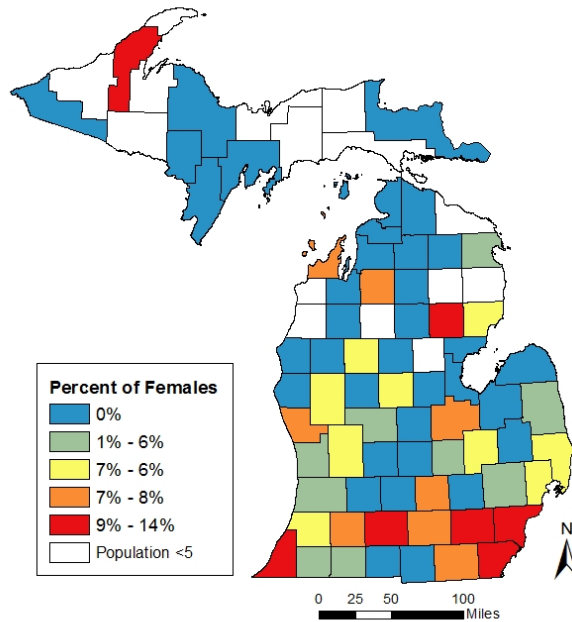


Figure 6: Spatial Distribution of Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009 -9/30/2012 across Michigan Counties (Source: Author)

The percent of women that became pregnant and delivered while in foster care who received adequate prenatal care was mapped to identify spatial anomalies. Berrien (90.9%), Calhoun (100.0%), Kalamazoo County (91.0%) had the highest percent of women that received adequate prenatal care, while Kent (53.3%), Macomb (50.0%) and Wayne County (55.5%) had the lowest percent of women receiving adequate prenatal care (Figure 7).

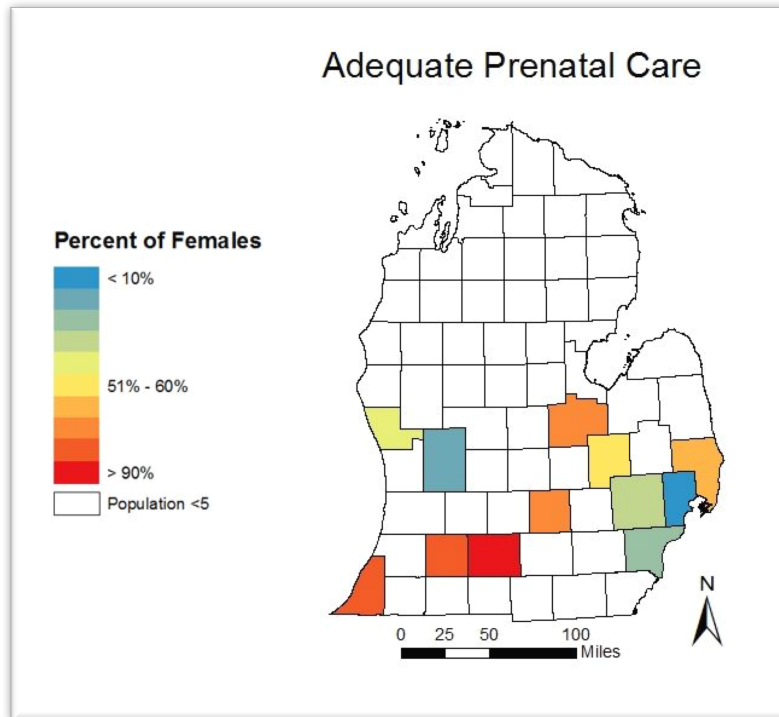


Figure 7: Spatial Distribution of Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009 -9/30/2012 across Michigan Counties and Received Adequate Prenatal Care
(Source: Author)

The percent of women that became pregnant and delivered while in foster care who experienced maternal physical complications was mapped to identify spatial patterns that could support regional differences. Berrien (90.9%), Calhoun (100.0%), and Oakland County (91.0%) had the highest percent of women that experienced hypertension, while no women in Ingham, Kalamazoo and St. Clare County experienced hypertension (Figure 8). The counties with the highest percent of women that experienced diabetes were Calhoun (20.0%), Oakland (22.2%), St. Clare County (20.0%). No women in Ingham, Macomb and Muskegon Counties experienced diabetes (Figure 8). Kent (40.0%), and Muskegon County (45.5%) had the highest percent of women that experienced anemia, while St. Clair County was the only county to have no women experience anemia (Figure 8). Berrien (27.3%), and Kalamazoo County (18.2%) had the highest

percent of women that experienced obesity. No women experienced obesity in Calhoun, Genesee, Muskegon or St. Clair Counties (Figure 8).

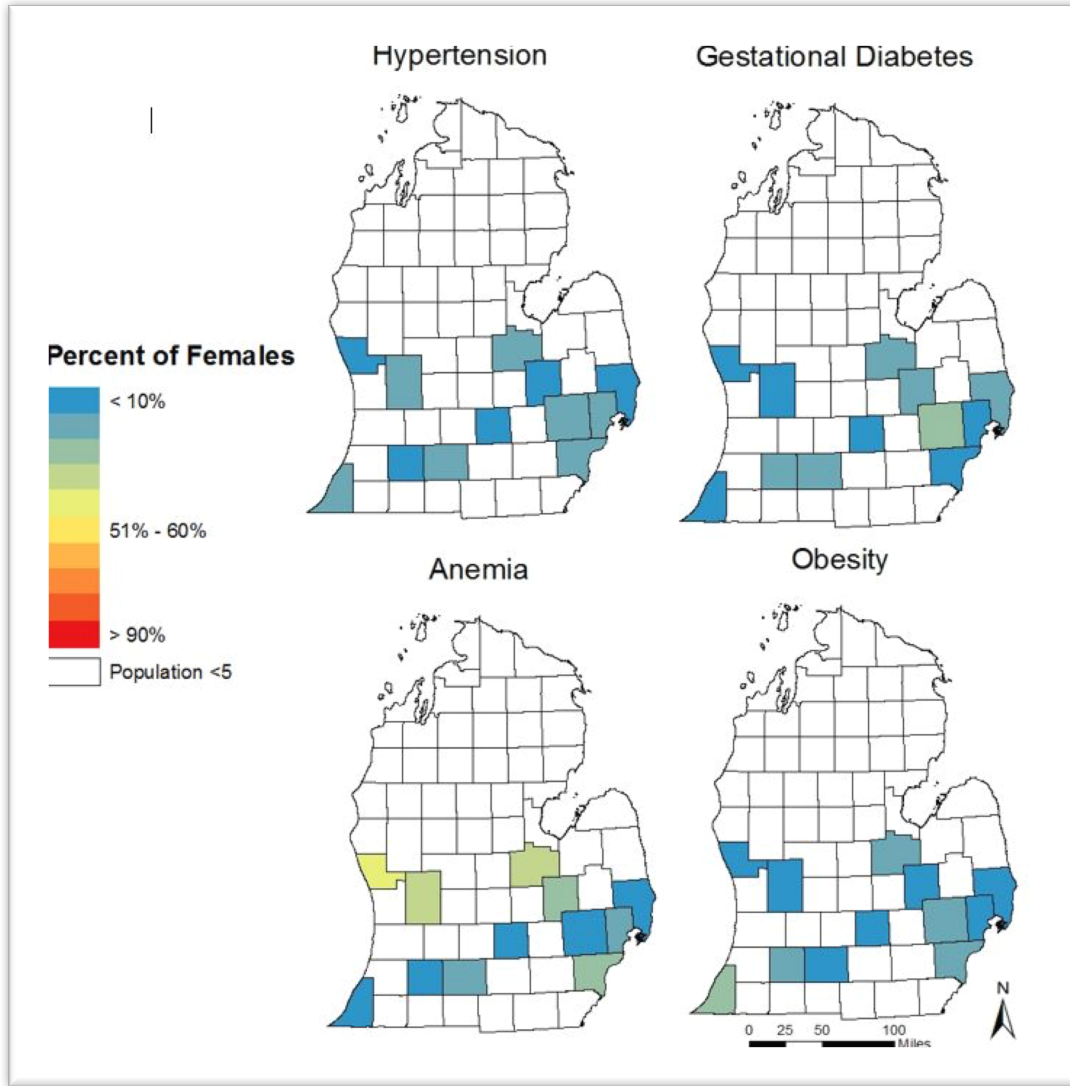


Figure 8: Spatial Distribution of Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009 -9/30/2012 across Michigan Counties and Experienced Physical Maternal Complications
(Source: Author)

The percent of women that became pregnant and delivered while in foster care that experienced any of the four maternal risk factors was mapped to identify spatial anomalies.

Calhoun County had the highest percent of women that experienced both maternal risk factors, mental illness (40.0%) and tobacco use (60.0%) (Figure 9). No women in Berrien, Kalamazoo and St. Clair County experienced mental illness (Figure 9). Genesee (10.0%), Kalamazoo (9.1%), and Kent County (13.3%) had the lowest percent of women to experience tobacco use (Figure 9).

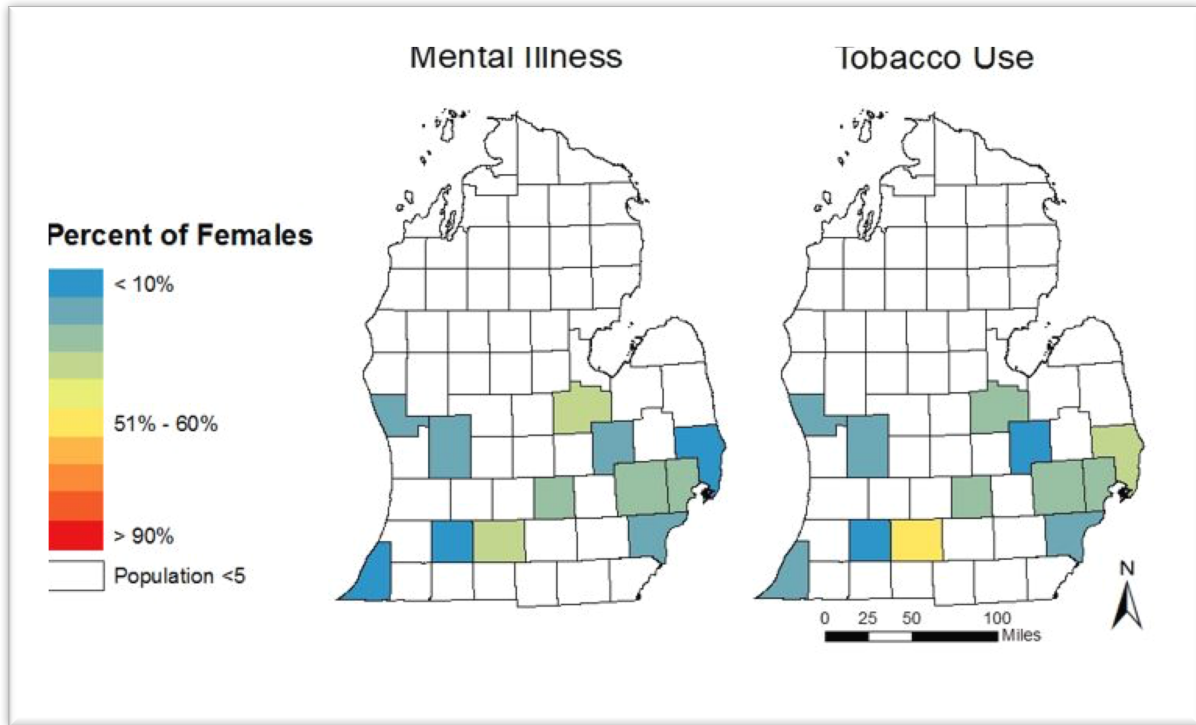


Figure 9: Spatial Distribution of Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009 -9/30/2012 across Michigan Counties and Experienced Maternal Risk Factors
(Source: Author)

The percent of women that became pregnant and delivered while in foster care that experienced complications to the fetus were mapped to identify spatial anomalies. Calhoun (40.0%) and St. Clair County (80%) had the highest percent of women that experienced excessive fetal growth, in contrast no women in Genesee, Muskegon or Kent Counties experienced excessive fetal growth (Figure 10). Genesee County (55.0%) had the highest percent of women that experienced poor fetal growth, while Kalamazoo (9.1%), Macomb (11.1%), and

Oakland County (16.7%) experienced poor fetal growth (Figure 10). Oakland (50.0%), and Saginaw County (37.5%) had the highest percent of women that experienced abnormal fetal heart rate, while Berrien (18.2%), Genesee (10.0%) and Muskegon County (18.2%) had the lowest percent of women that experienced abnormal fetal heart rate (Figure 10). Calhoun (20.0%), and Oakland County (22.2%) had the highest percent of women that experienced decreased fetal movement, while no women in Ingham, Muskegon and St. Clair experienced decreased fetal movement (Figure 10).

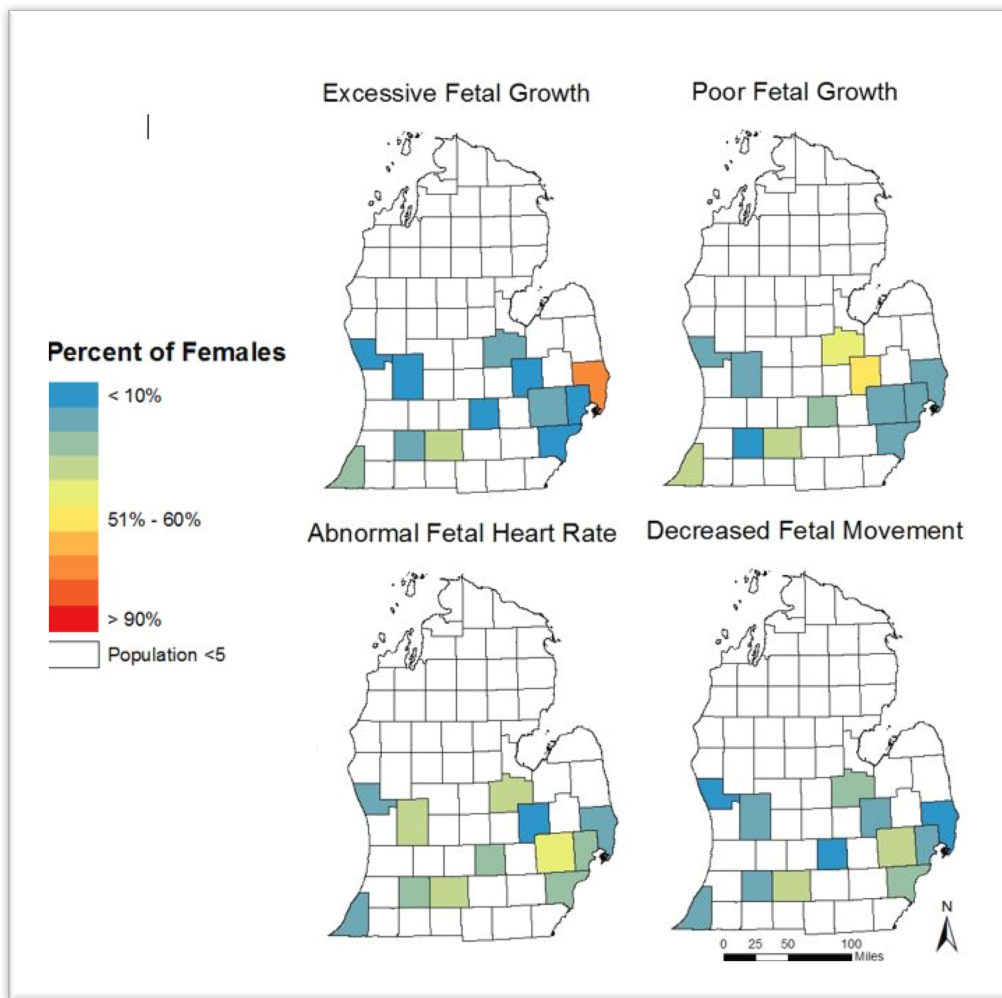


Figure 10: Spatial Distribution of Women that Became Pregnant and Delivered while in Foster Care from 1/1/2009 -9/30/2012 across Michigan Counties and Experienced Complications of the Fetus
(Source: Author)

Cluster Analysis of Prenatal, Well-Child and Dental Care

Hierarchical Cluster Analysis combining adequate dental care, well-child care and prenatal care was used to identify number of clusters which was further analyzed using K-Means Cluster Analysis. Hierarchical Cluster Analysis uses an algorithm that begins with each variable in a separate cluster and continues combine clusters in an attempt to identify homogeneous groups of variables based on selected characteristics (IBM Knowledge Center, 2013). A hierarchal cluster analysis of combining adequate dental care, well-child care and prenatal care was used to identify spatial patterns within Michigan counties with similar success in achieving overall adequate care. Three groups were defined using the hierarchal cluster analysis (Figure 11). K-Means Cluster Analysis identified that Cluster 1, Kalamazoo, Calhoun, Genesee, Berrien, Saginaw, St. Claire and Ingham Counties were similar with respectively high average percentage of women receiving adequate prenatal care, and youth receiving dental visits within 90 days of entering the foster care system, and performing average with regards to youth receiving well-child visits within 30 days of entering the foster care system (Table 43). With 87 percent of women receiving adequate prenatal care, Cluster 1 had the highest percent of women to receive prenatal care. However, only 24 percent of women in these counties received adequate well-child care (Table 43). Prenatal care provided the greatest separation between clusters ($F=28.848, p = 0.0001$) (Table 44).

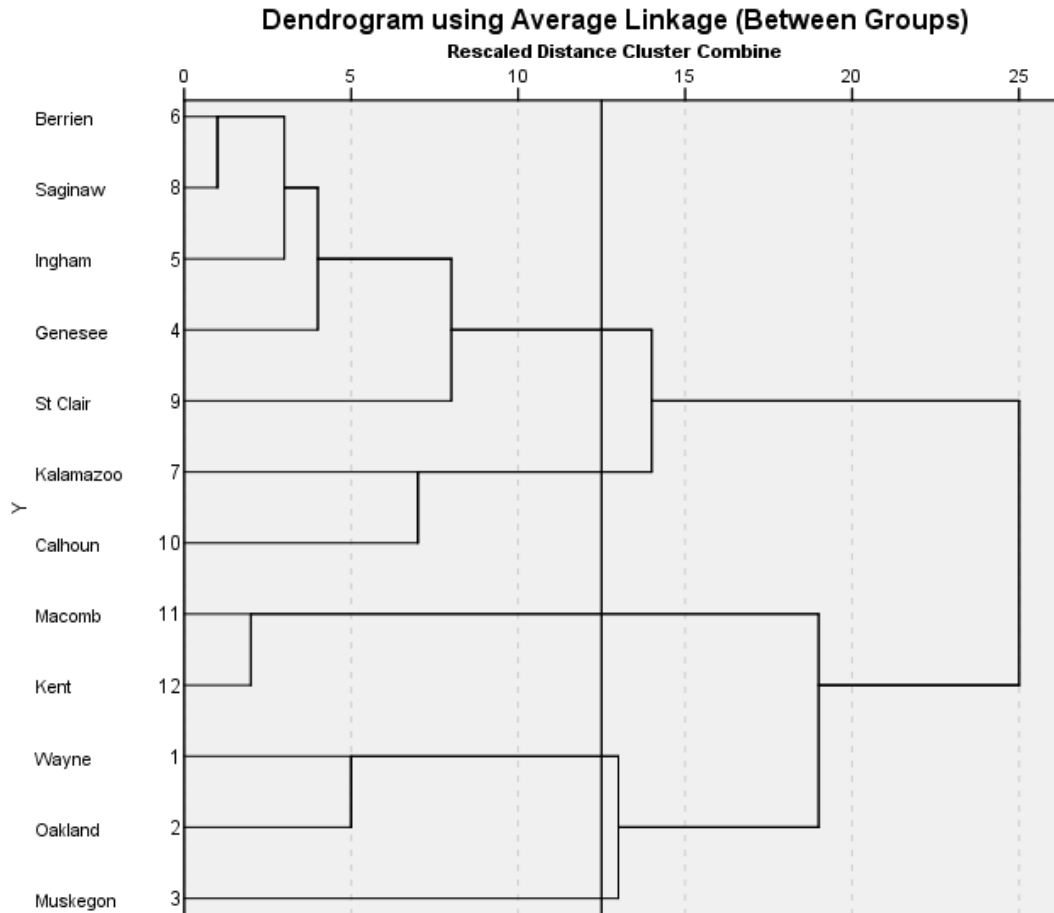


Figure 11: Dendrogram for Cluster Analysis of Adequate Prenatal, Dental and Well-Child Visits Experienced by Foster Youth throughout Michigan Counties from 1/1/2009-9/30/2012
(Source Author)

Table 43: Cluster Analysis of Adequate Prenatal, Dental and Well-Child Visits Experienced by Foster Youth throughout Michigan Counties from 1/1/2009-9/30/2012

Clusters	Average Percent within Clusters		
	Prenatal	Dental	Well Child
Kalamazoo, Calhoun Genesee, Berrien, Saginaw, St. Claire and Ingham	87 %	29 %	24 %
Kent and Macomb	52 %	24 %	30 %
Wayne, Oakland and Muskegon	60 %	20 %	13 %

(Source: Author)

Table 44: Analysis of Variance of Cluster Analysis of Adequate Prenatal, Dental and Well-Child Visits Experienced by Foster Youth throughout Michigan Counties from 1/1/2009-9/30/2012

ANOVA						
	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Prenatal	1416.536	2	49.103	9	28.848	0.000
Dental	89.932	2	27.536	9	3.266	0.086
Well	189.781	2	31.500	9	6.025	0.022
The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.						

(Source: Author)

CHAPTER VI

DISCUSSION

The goal of this study was to identify women that become pregnant and delivered while in foster care in the state of Michigan from 1/1/2009-9/30/2012 and whether or not they were receiving adequate prenatal care or experiencing negative prenatal outcomes, as well as identifying where these events occurred. This section will discuss the significant results of the study, the implications of the results and the limitations of the study.

Significant Results of the Study

Given that Wayne County has the largest number of women included in the study it, was hypothesized that this large group would determine the results for the urban rural classification analyses. However, results from many of the analyses showed there were not the similarities expected in the results. Wayne County had significantly higher percentage of women experience hypertension but it was not significant in terms of urban and rural residential status. In the analysis that compared Wayne County with the rest of Michigan with respect to receipt of adequate prenatal care, women living within the rest of Michigan had higher percentages of receiving adequate prenatal care. There was not a significant difference between women living in urban and rural counties. Women in rural counties were more likely to experience excessive fetal growth but this was not a significant relationship when comparing women in Wayne County and the rest of Michigan.

Analyses of tobacco use comparing age, race, urban rural and Wayne County and the rest of Michigan resulted in significant relationships. Women in rural counties were more likely to

experience tobacco use, as well as, women in the rest of Michigan. White women were more likely to experience tobacco use. Women ages 18-21 were more likely to experience tobacco use. It seems that race is a significant driver in the use of tobacco during pregnancy. The majority of the population in rural counties and the rest of Michigan were white. However, race did not seem to drive other results.

There was a significant difference in mental illness diagnosis during pregnancy between women that experienced less than six or six living arrangements, as well as, women that lived in, family-based living, group living or other living arrangements. Significantly more women were diagnosed with mental illness if they had experienced more than six living arrangements or lived in a group home. Further investigation is required to fully understand these results. It is unclear whether women experiencing these foster care situations are experiencing them because of mental illness, or if the mental illness is simply better identified when a woman has had these experiences.

It is apparent in the spatial distribution of adequate prenatal care, physical maternal complications, maternal risk factors and complications to the fetus that access to care results in higher percentages of women experiencing negative prenatal outcomes. One hundred percent of women that became pregnant and delivered while in foster care received adequate prenatal care in Calhoun County. Calhoun County also ranked in the top 25 percent for hypertension, gestational diabetes, mental illness, tobacco use, excessive fetal growth, abnormal fetal heart rate, and decreased fetal movement. This shows that access to prenatal care then leads to women being diagnosed with negative prenatal outcomes.

Based on the hierarchical cluster analysis conducted Kalamazoo, Calhoun, Genesee, St. Claire, Berrien, Saginaw, and Ingham Counties were the only spatial cluster to have relatively

high adequate care percentages regarding prenatal care and dental care. However, there were no clusters that performed above average in all three categories.

Implications of the Results

Maintaining the overall health of youth in Michigan's foster care is vitally important. Further investigation as to why youth in many locations are not receiving adequate dental and well-child visits is needed. Getting the proper prenatal care is imperative to treating or preventing potentially life threatening complications experienced. One hundred percent of women that became pregnant and delivered while in foster care in Calhoun County received proper prenatal care from 1/1/2009-9/30/2012. With this information, one can move forward to investigate the foster care prenatal programs of Calhoun County that ensure these women receive proper prenatal care while in the child welfare system. Kent, Macomb and Wayne Counties have a much lower percent of women receiving adequate prenatal care. Further investigation as to the cause for these low numbers is also important. Wayne County has the highest number of women in foster care during their pregnancy; this might be a cause for having low percent of women receiving adequate care.

This information is also imperative in developing targeted pregnancy prevention. Calhoun County, Monroe, Macomb, Houghton and Ogemaw have high percentage of women becoming pregnant and delivering while in foster care. Many of these counties have low number of females. So, the possibilities that these numbers are anomalies that happened to have occur during this study period. Further investigation would be needed to address this issue.

Limitations

Utilizing secondary data has inherent limitations. The data “pull” conducted by the State of Michigan and the data “merge” conducted by University of Michigan were out of the control of the author of this study. Human error is inherently present in the foster care records as well as the Medicaid claims data. Determining adequate prenatal care usually requires time to the first prenatal visit and fetal age; however, without access to birth records and global maternity care code being applied at the end of the pregnancy, we had to accept the global maternity care code as being adequate prenatal care. Another limitation faced by this study was low N values. For example, this study was unable to look at individual years because the N values become too low to perform any analysis. Spatial analyses were limited due to these low N values, as well as, the data only being available at the county level. Cluster analyses were unable to be performed because these limitations.

It is unfortunate that there were so many limitations to this study. This is an underserved population with very serious needs. The lack of accuracy and adequacy of data limits research, as well as, the implications of the research on potential legislation implementation and program development. These data are a tragedy to the initiative for evidence-based decisions in health care. For example, the CPT code for global maternity care only requires seven visits to a single physician and is usually billed at the end of the visit. Not only does this limit the information available for the analysis, like time to first visit, it limits a researcher’s ability to identify compounding factors. These women may be receiving more visits due to early discovery of complications. Therefore, more visits is not a positive indicator. To better this data for analytical purposes, providers may still use the global maternity care code; however, it is imperative that all procedures performed be required to be billed at the time of service and there must be

consistency between providers. Foster youth are a population that needs help and deserves help. For future studies, it is imperative that data become more accurate and complete. So, researchers, state workers and policy makers can properly provide young women in foster care with adequate prenatal care that has the potential to ensure the prevention, or treatment of negative prenatal outcomes.

WORK CITED

- Ahrens, K. R., Garrison, M. M., & Courtney, M. E. (2014). Health Outcomes in Young Adults from Foster Care and Economically Diverse Backgrounds. *Pediatrics*, 134(6), 1067–1074.
- Akkerman D, Cleland L, Croft G, Eskuchen K, Heim C, Levine A, Setterlund L, Stark C, Vickers J, Westby E. (2012). *Routine Prenatal Care*. Institute for Clinical Systems Improvement. Cambridge, MA.
- The American Congress of Obstetrics and Gynecology (2014). *Preeclampsia and Hypertension in Pregnancy: Resource Overview*. <https://www.acog.org/Womens-Health/Preeclampsia-and-Hypertension-in-Pregnancy> (Accessed November 1, 2017)
- The American Congress of Obstetrics and Gynecology (2016). *Obesity and Pregnancy*. <https://www.acog.org/Patients/FAQs/Obesity-and-Pregnancy> (Accessed November 1, 2017)
- The American Congress of Obstetrics and Gynecology (2017). *Depression and Postpartum Depression: Resource Overview*. <https://www.acog.org/Womens-Health/Depression-and-Postpartum-Depression#> (Accessed November 1, 2017)
- American Diabetes Association (2016). *What is Gestational Diabetes?* <http://www.diabetes.org/diabetes-basics/gestational/what-is-gestational-diabetes.html> (Accessed November 1, 2017)
- American Pregnancy Association (2016). *Anemia During Pregnancy: Causes, Symptoms & Treatment*. <http://americanpregnancy.org/pregnancy-concerns/anemia-during-pregnancy/> (Accessed November 1, 2017)
- Boonstra H.D. (2011) Teen Pregnancy Among Young Women In Foster Care: A Primer. *Guttmacher Policy Review*, 14(2), 8-19
- Carpenter, S. C., Clyman, R. B., Davidson, A. J., & Steiner, J. F. (2001, September). The Association of Foster Care or Kinship Care with Adolescent Sexual Behavior and First Pregnancy. *Pediatrics*, 108(3), 753-759.
- Centers for Disease Control and Prevention (2016a). *Alcohol Use in Pregnancy* <https://www.cdc.gov/ncbddd/fasd/alcohol-use.html> (Accessed November 1, 2017)
- Centers for Disease Control and Prevention (2016b) *Pregnancy Complications*. <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregcomplications.html> (Accessed November 1, 2017)

- Centers for Disease Control (2017a) *Cesarean Delivery Rate by State*.
https://www.cdc.gov/nchs/pressroom/sosmap/cesarean_births/cesareans.htm (Accessed November 1, 2017)
- Centers for Disease Control and Prevention (2017b). *Tobacco Use and Pregnancy*.
<https://www.cdc.gov/reproductivehealth/maternalinfanthealth/tobaccousepregnancy/index.htm> (Accessed November 1, 2017)
- Comlossly, M. (2013). Teen Pregnancy Among Youth in Foster Care. *Legisbriefs*, 21(42), n.p.
<http://ecom.ncsl.org/webimages/legisbriefs/November2013/2142.pdf> (Accessed November 1, 2017)
- Courtney, M., Dworsky, A., Brown, A., Cary, C., Love, K., & Vorhies, V. (2011). *Midwest evaluation of the adult functioning of former foster youth: Outcomes at age 26*. Chapin Hall at the University of Chicago, Chicago, IL.
- Dregan, A., & Gulliford, M. C. (2012). Foster care, residential care and public care placement patterns are associated with adult life trajectories: population-based cohort study. *Social Psychiatry and Psychiatric Epidemiology*, 47(9), 1517–1526.
- Dworsky, A., & Courtney, M. E. (2010). The risk of teenage pregnancy among transitioning foster youth: Implications for extending state care beyond age 18. *Children and Youth Services Review*, 32(10), 1351–1356.
- Eggertsen, L. (2008). Primary factors related to multiple placements for children in out-of-home care. *Child Welfare*, 87(6), 71–90.
- Font, S. A. (2014). Kinship and Nonrelative Foster Care: The Effect of Placement Type on Child Well-Being. *Child Development*, 85(5), 2074–2090.
- Freisthler, B. (2011). Need for and access to supportive services in the child welfare system. *GeoJournal*, 78(3), 429–441.
- Fryer Jr., G. E., & Miyoshi, T. J. (1995). A cluster analysis of detected and substantiated Child maltreatment incidents in rural Colorado. *Child Abuse & Neglect*, 19(3), 363–369.
- Gold, K. J., & Marcus, S. M. (2008). Effect of maternal mental illness on pregnancy outcomes. *Expert Review of Obstetrics and Gynecology*, 3(3), 391–401.
- Goleman D., (1989). Sad Legacy of Abuse: The Search for Remedies. *The New York Times*.
<http://www.nytimes.com/1989/01/24/science/sad-legacy-of-abuse-the-search-for-remedies.html?pagewanted=all> (Accessed November 1, 2017)
- Hansell, M. J. (1991). Sociodemographic factors and the quality of prenatal care. *American Journal of Public Health*, 81(8), 1023–1028.

- Hansen RL, Mawjee FL, Barton K, Metcalf MB, & Joye NR. (2004). Comparing the health status of low-income children in and out of foster care. *Child Welfare*, 83(4), 367–380.
- Hollar Jr, D. (2015). Evaluating the Interface of Health Data and Policy: Applications of Geospatial Analysis to County-Level National Data. *Children's Health Care* 45(3), 266–285.
- IBM Knowledge Center. (2013). Hierarchical Cluster Analysis. https://www.ibm.com/support/knowledgecenter/SSLVMB_22.0.0/com.ibm.spss.statistics.help/spss/base/idh_clus.htm?view=embed (Accessed November 1, 2017)
- Kaestner, R. (1999). Health insurance, the quantity and quality of prenatal care, and infant health. *Inquiry - Blue Cross and Blue Shield Association*, 36(2), 162–175.
- King, B., Putnam-Hornstein, E., Cederbaum, J. A., & Needell, B. (2014). A cross sectional examination of birth rates among adolescent girls in foster care. *Children and Youth Services Review*, 36, 179–186.
- Krase, K. S. (2015). Child Maltreatment Reporting by Educational Personnel: Implications for Racial Disproportionality in the Child Welfare System. *Children & Schools*, 37(2), 89–99.
- Maguire-Jack, K., Lanier, P., Johnson-Motoyama, M., Welch, H., & Dineen, M. (2015). Geographic variation in racial disparities in child maltreatment: The influence of county poverty and population density. *Child Abuse & Neglect*, 47, 1–13.
- Mandell, K. (2013). County level disparities in the prescription of antipsychotic drugs among children on Medicaid in Wisconsin. Presented at the 141st APHA Annual Meeting (November 2 - November 6, 2013), APHA.
- Meade, C. S., Kershaw, T. S., & Ickovics, J. R. (2008). The intergenerational cycle of teenage motherhood: An ecological approach. *Health Psychology*, 27(4), 419-429.
- Michigan Department of Community Health (2006). *Rural and Urban County Groupings*. https://www.michigan.gov/documents/mdch/6_Appendix_09.28.06_173954_7.pdf (Accessed November 1, 2017)
- Michigan Department of Health and Human Services (2015). *Michigan Announces Regional Managed Care Health Plans*. http://www.michigan.gov/mdhhs/0,5885,7-339-73970_71692-367160--,00.html (Accessed November 10, 2017)
- Michigan Department of Health and Human Services (2017). *Foster Care*. http://www.michigan.gov/mdhhs/0,5885,7-339-73971_7117---,00.html (Accessed November 1, 2017)

- Monticue C., (2013). USC study intersects teen births with foster care in LA County. *USCNews*. Retrieved from <http://news.usc.edu/57275/usc-study-intersects-teen-births-with-foster-care-in-la-county/> (Accessed November 1, 2017)
- The National Campaign to Prevent Teen and Unplanned Pregnancy (2010). *Policy Brief: Preventing Teen Pregnancy*. Washington, DC: The National Campaign to Prevent Teen and Unplanned Pregnancy. https://thenationalcampaign.org/sites/default/files/resource-primary-download/briefly_policybrief_school_completion.pdf (Accessed November 1, 2017)
- The National Campaign to Prevent Teen and Unplanned Pregnancy (2011). *Counting It Up: The Public Costs of Teen Childbearing: Key Data*. Washington, DC: The National Campaign to Prevent Teen and Unplanned Pregnancy. <http://www.thenationalcampaign.org/costs/pdf/counting-it-up/key-data.pdf>. (Accessed November 1, 2017)
- Palladino, C. L., Singh, V., Campbell, J., Flynn, H., & Gold, K. (2011). Homicide and Suicide During the Perinatal Period: Findings from the National Violent Death Reporting System. *Obstetrics and Gynecology*, 118(5), 1056–1063.
- Royal College of Psychiatricians (2012). *Mental Health in Pregnancy*. <http://www.rcpsych.ac.uk/expertadvice/problems/mentalhealthinpregnancy.aspx> (Accessed November 1, 2017)
- Rubin, D. M., Alessandrini, E. A., Feudtner, C., Localio, A. R., & Hadley, T. (2004). Placement Changes and Emergency Department Visits in the First Year of Foster Care. *Pediatrics*, 114(3), 354–360.
- Reichman, N. E., & Teitler, J. O. (2005). Timing of Enhanced Prenatal Care and Birth Outcomes in New Jersey's HealthStart Program. *Maternal and Child Health Journal*, 9(2), 151–158.
- Shoff, C. (2009). *Teenage Fertility: Does Place, Race or Poverty Matter* The Pennsylvania State University. College Station, Pa.
- Tian, J., Tu, W., Tedders, S., & Chen, D. (2013). A spatial–temporal analysis of low birth weight prevalence in Georgia, USA. *GeoJournal*, 78(5), 885–895.
- Villegas, S., & Pecora, P. J. (2012). Mental health outcomes for adults in family foster care as children: An analysis by ethnicity. *Children and Youth Services Review*, 34(8), 1448–1458.
- Van Hoof, T. J., Casey, B. A., Tate, J. P., Linnane, J. J., Petrillo, M. K., & Meehan, T. P. (2000). The Status of Prenatal Care among Medicaid Managed Care Patients in Connecticut. *Evaluation & the Health Professions*, 23(4), 409–421.

Yang, T.-C., Shoff, C., & Matthews, S. A. (2013). Examining the spatially non-stationary associations between the second demographic transition and infant mortality: A Poisson GWR approach. *Spatial Demography*, 1(1), 17–40.

Appendix A

HSIRB Approval Letters



Date: October 8, 2015

To: Amy Curtis, Principal Investigator
Lauryn Jianrattanasawat, Student Investigator for thesis
Kathleen Baker, Co-Principal Investigator
Rajib Paul, Co-Principal Investigator
Student Investigators: Prince Allotey, Vikrant Kumar, Elizabeth MacQuillan,
Chenyang Shi, Xiaojian Yang, Shaofeng Zhang

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 12-05-23

This letter will serve as confirmation that the change to your research project titled "Assessing the Physical Health and Well-Being of Older Foster Care Youth: A Review of the Automatic Medicaid Enrollment Initiative" requested in your memo received October 7, 2015 (to add student investigator, for thesis, Lauryn Jianrattanasawat) has been approved by the Human Subjects Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: May 29, 2016



Date: October 10, 2016

To: Amy Curtis, Principal Investigator
Kathleen Baker, Co-Principal Investigator
Rajib Paul, Co-Principal Investigator
Lauryn Jianrattanasawat, Student Investigator for thesis
Student Investigators: Prince Allotey, Vikrant Kumar, Elizabeth MacQuillan,
Chenyang Shi, Xiaojian Yang, Shaofeng Zhang, Virginia Dicken,
Kathryn Schurr

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 12-05-23

This letter will serve as confirmation that the change to your research project titled “Assessing the Physical Health and Well-Being of Older Foster Care Youth: A Review of the Automatic Medicaid Enrollment Initiative” requested in your memo received October 7, 2016 (to add student investigators Virginia Dicken and Kathryn Schurr) has been approved by the Human Subjects Institutional Review Board.

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The Board wishes you success in the pursuit of your research goals.

Approval Termination: May 29, 2017