Infant Health in Greater St. Louis

(2010 to 2014)

Submitted August 2016, Released February 2018

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The Situation

The survival of babies is considered one of the strongest indicators of the health of any community, but data shows that there is a marked difference in infant mortality outcomes across racial lines in the St. Louis region.

The Perspective

In contrast to the rest of the industrialized world, there are neighborhoods in St. Louis City and County with an infant mortality rate that is worse than some developing countries, like Uzbekistan and Vietnam.

National trends show slight improvements in infant mortality rates across the United States.[1] The country is still experiencing high mortality rates in comparison to other developed countries, and in St. Louis the problem is even more pronounced, particularly for Black[2], non-Hispanic mothers.

- The national infant mortality rate in the U.S. for 2013 was 5.96 deaths per 1,000 live births[3]
- In Missouri, the rate was reported at 6.6 in 2010, down from 7.5 in 2005
- In St. Louis, the rate was 6.1 in 2014
- Black women in the U.S. experience 13.31 infant deaths per 1,000 live births[4] in 2014
- In St. Louis, the rate among Black women was 11.2 in 2014[5]

Clinical care plays a role in the health of mothers and babies. The leading factors contributing to infant mortality rates are congenital malformations, disorders related to short gestation and low birth weight, and sudden infant death syndrome (SIDS).[6] While most physical defects cannot be prevented, many of the issues that contribute to premature births, small babies and risk of SIDS can be improved if they are addressed.

Today, we know that the conditions in which babies thrive and survive are predicated by many factors beyond maternal behaviors, like diet and exercise. We now know that environmental and economic factors impact the stress on the mother and the potential health of the baby before it is born, or even conceived. These factors include the availability and affordability of healthy foods, reliable transportation, and quality housing. Improvement in these areas could lead to better outcomes for children, families, neighborhoods and communities at-large.

1 NVSR, 2013
2 Subsequent references for "Black, non-Hispanic" will be written as "Black."
3 Centers for Disease Control and Prevention, 2013
4 MacDorman and Mathews, 2011
5 Kids Count Data Center, 2014
6 SID, CDC, 2013

About This Study

Our analysis evaluated birth certificate data from 2010 through 2014 for St. Louis City and County in a variety of ways, including:

- Perinatal[7] periods of risk (PPOR) analysis
- General Infant Health analysis (with PPOR restricted sample and without PPOR restricted sample)
- The geographic distribution of risk factors and birth outcomes

KEY THEMES

Five major themes have emerged from the data that require further attention to improve the life of moms, babies and families in the St. Louis region. Within each of these categories there is a call to action for interventions related to policy implications.

1. Maternal Health Matters
2. Infant Health Matters
3. Equity Matters
4. Place Matters
5. Access to and Quality of Data Matters

Theme 1: Maternal Health Matters

Babies in the U.S. with the healthiest outcomes are those born to White, non-Hispanic[8] moms with a high school diploma and are over age 20. Babies of all races in the St. Louis region die at higher rates than this group. If they are born in St. Louis City and/or if they are Black, the outcomes are even worse. While infant mortality rates in the region have declined slightly in recent years, Black babies are three times more likely to die than White babies. The infant mortality rate for Black women in St. Louis City is 9.3 versus 3.3 for White women.[9] In the County, the rate goes down slightly to 7.0 for Black women, in comparison with 2.5 for White women, although disparities persist.

The majority of baby deaths occur in the neonatal[10] period, relating to newborn babies, and are largely caused by perinatal conditions[11] that mothers may have been at risk for even before pregnancy. Part of the infant mortality problem can be attributed to a baby's size when it is born, but many babies are also being born early. Preterm[12] birth rates are highest among Black women in the City (18.9%), and second highest for Black women in the County (16.8%). For White women, the rate is approximately 10% whether they live in the City or County.

7 Relating to the weeks immediately before and after birth
8 Subsequent references for "White, non-Hispanic" will be written as "White."
9 Based on the 'restricted PPOR' sample, excluding those babies who were born under 500 grams
10 Relating to newborn children
11 Related to conditions that affect the baby in the womb, like diabetes, hypertension, etc.
12 Babies born with less than 37 weeks of completed gestation

Full-term, average-sized babies tend to thrive, where low birth weight and preterm babies struggle to stay alive during the first few critical days, weeks and months of their lives. This is also when they are most vulnerable to infection, disease and other health and developmental issues. In addition, many of the small or premature babies who live beyond their first birthday face continued health issues throughout childhood and even into adulthood.

We examined birth outcomes across a wide array of factors to identify themes that might indicate when, how and why these deaths are occurring, so that we can better understand and address the causes. The most consistent theme we identified is that healthier moms tend to have healthier babies. And to be a healthier mom, a woman needs to have the opportunity to be a healthier person, before pregnancy. Data shows that health opportunities are linked to equitable access to economic and environmental stability. Policies that could impact these outcomes include increasing access to health care for women before they conceive and increasing coverage for health care appointments for the mother for up to a year after a baby's birth.

What We Found

Infant Mortality by Size, Race and Location

The story of infant mortality in the St. Louis region is the story of Black women losing their babies and/or caring for children with health and developmental issues.

TABLE 1: Differences in Birth Outcomes by Race

Referent Group	STL City Black	STL City White	STL County Black	STL County White
Infant Mortality Rate Overall	9.3	3.3	7.0	2.5
Preterm	18.9	10.6	16.8	10.0
VLBW[13]	2.9	0.9	2.5	0.8
LBW[14]	15.6	7.4	13.3	6.3

13 Very Low Birth Weight
14 Low Birth Weight

Infant Mortality by Risk Factors and Behaviors

Many influences affect the risk of infant death, low birth weight or preterm birth. To determine which risk factors were most important, we looked at the variables most linked to neonatal mortality. Four factors remained significant predictors of neonatal mortality:

- Paternity acknowledgment (Naming the father on the birth certificate)
- Male gender
- Gestational age
- Small for gestational age

After adjusting for all other variables under study, not having the father acknowledged on the birth certificate increased the odds for neonatal death by 41% (aOR[15] 1.41, 1.01-1.97). Acknowledgment of father on the birth certificate may be a proxy for social support and stability, which, when lacking, may make infant survival more difficult/less likely.

The leading causes of infant deaths included congenital malformations, disorders related to short gestation, low birth weight, and SIDS.[16]

Low Birth Weight Takeaways

Up to 15.6% of the babies born to Black women in the City were low birth weight (less than 2,500 grams or approximately 5.5 pounds) in comparison with only 6.3% of babies born to White women in the County. A baby weighing 5.5 pounds is considered moderately low birth weight (LBW). A very low birth weight (VLBW), with lower chance of survival, is less than 1,500 grams or 3.3 pounds.

The disparity ratio is approximately 2:1 regarding moderately low birth weight and goes up to 3:1 regarding very low birth weight.

Very Low Birth Weight Takeaways

We found a survival advantage for Black VLBW babies compared to White VLBW babies, but an overall population advantage for larger, White babies. That means, although there are too many Black VLBW babies being born, our health care system has become good at taking care of them.

The risk factors, causes and interventions for mortality attributed to birth weight distribution relate to behavioral, social, health, and economic disparities experienced by mothers, which may ultimately result in the delivery of a VLBW infant.

Those elements associated with birth weight-specific mortality relate to perinatal or medical care provided to mother and infant before, during and after delivery, resulting in decreased infant survival.

15 Adjusted Odds Ratio
16 CDC, 2013

VLBW babies are surviving at rates better for Black women and women in St Louis City, than the referent population (13% and 19% better than the referent group, respectively). For example, among VLBW births, there was 62.5% mortality for babies with Black moms and 53.7% mortality for babies of all women in St. Louis City that can be attributed to birth weight distribution.

Results for St. Louis City and Black race are similar, indicating that there are a large number of VLBW babies being born. Further analysis focused on evaluating risk factors for VLBW is needed.

Age: The chance of having a baby at a VLBW was 135% higher if the mom was of Black; 44% higher if the mom smoked during pregnancy; and 22% higher if the mom was under the age of 20.

Hypertension: Having a VLBW baby was 148-237% greater if the mom had pre-pregnancy hypertension, gestational hypertension, or hypertension eclampsia.

Marital Status or Parental Acknowledgment: Being married reduced the population-level risk for VLBW by 15%, suggesting that social support may be playing an important role in the health of women before and during pregnancy.

What Can Be Done?

To address issues around women's health before pregnancy, there are specific strategies that are recommended to improve the health of all women throughout St. Louis City and County.

This needs to happen before and in between pregnancies to prevent bad outcomes for babies.

1. Expand Medicaid to low-income, Medicaid eligible women in Missouri to:
    - Promote comprehensive, whole person care across the reproductive lifespan.
    - Enable all women in our state to access the same routine preventive screening services for Preconception Care and comprehensive medical follow-up as women who are insured through their employers or through the Health Exchanges.
    - Allow women to receive care for diagnosed medical conditions, such as pre-pregnancy hypertension.
    - Abolish the need for the Uninsured Women's Health Services that the state is proposing to fund through General Revenue after it dissolves the 1115 waiver with the Centers for Medicare and Medicaid Services.
    - Create a long-term sustainable solution for a persistent barrier to care that numerous programmatic, grant-funded initiatives have been unable to ameliorate.
2. Support existing community-based organizations that work to address social and physical determinants of health, including those that work to:
    - Eliminate and reduce smoking and tobacco use, especially programs targeting low-income women of color.
3. Support and Expand Case Management Models that address the social as well as physical determinants of health as these have been shown to be successful in improving birth outcomes.
    - Many successful case management models exist in our own community however the scope is small which limits the reach of the programs and the funding is inadequate for long-term sustainability and expansion.

About This Research

Perinatal Periods of Risk (PPOR) Instances of Excess

Where We Focused:

We compared the fetal and infant mortality rates (FIMR) in the population under study against a national referent population of White, non-Hispanic women greater than 20 years of age with at least a high school diploma.

What We Looked For:
If the FIMR in our community is higher than the referent community, we have excess mortality because we know that lower rates are possible as just seen in the referent group.

What We Found:
FIMR dropped from 10.8 deaths per 1,000 fetal deaths and live births in 2000-2004 to 7.5 in 2010-2014.

In our updated PPOR analysis, we found that excess FIMR due to maternal health issues is improving, but is still higher than the referent group. The greatest excess was in the maternal health category.

It is the health of the mother before pregnancy and the capacity and resources in her environment to enable healthy behaviors that may be putting babies at excess risk in our community.

- 33.9% of risk is attributed to being Black, and while the color of skin is not amenable to change, social conditions in which being Black can cause stress and ill-health are amenable to change
- 4.7% of risk is attributed to smoking while pregnant, which is 100% preventable.
- 8.4% of risk is attributed to having hypertension, which is preventable.

Sub-Categories of Note:
We break the FIMR into categories based upon birth weight and gestational age to further compare our excess infant mortality to each of the risk categories. This pinpoints how a community might more tightly focus community interventions to combat infant death.

- Maternal Health: all VLBW births, less than 1,500 grams
- Maternal Care: all fetal deaths, and at least 1,500 grams
- Newborn Care: all neonatal deaths at least 1,500 grams
- Infant Health: all post-neonatal deaths and at least 1,500 grams

PPOR Distribution by Weight

Where We Focused:
We explored distribution of birth weight and birth weight-specific mortality, often referred to as the Kitagawa method.[17] This method looks at the proportion of VLBW births (500 to 1,499 grams) and not VLBW births (1,500 to 2,500+ grams) in increments of 250 grams.

What We Looked For:
We compared our population against a national reference population,[18] to help understand whether one population has a birth weight advantage and/or a survival advantage.

17 Kitagawa analyses examine whether excess mortality is due to increasing numbers of infants born at very low birth weight (birth weight distribution), or to increased mortality among very low birth weight infants (birth weight-specific mortality)

18 U.S. non-Hispanic White mothers aged 20 years and older with 13 years or more of education

Theme 2: Infant Health Matters

While there has been an overall improvement from earlier analyses, the excess of infant death[19] suggests that focus areas of intervention in baby health are related to:

- Sleep position
- Smoking
- Injury prevention

Top Categories of Infant Death:

- Sudden and Unexplained Infant Death (SUID)[20]
- Injury[21]
- Perinatal conditions
- Congenital anomalies
- Infections
- Ill-defined

The greatest excess[22] in cause of death in the post-neonatal period is within SUID, accounting for 50% of the excess risk for babies of Black women and 48% of babies in St. Louis City. The SUID category identifies deaths due to sleep-related suffocation and SIDS, which can point to possible community-level interventions to address this excess death.

The second-highest category for risk is infant injury, which includes causes of death, such as drowning or motor vehicle accidents.

What We Found

To determine which risk factors were most important in predicting infant death in the post-neonatal period, we used a logistic regression model for risk of post-neonatal mortality (the time frame during which a baby is least likely to die). After adjusting for all potential confounders, we found that babies born to Black mothers were 137% more likely to die in the post-neonatal period than babies born to White mothers. This suggests that the social and economic deprivations historically associated with being Black may need to be addressed to decrease this disparity. Tobacco use during pregnancy also increased one's risk for their baby to die in the post-neonatal period by 154%.

What Can Be Done?

1. **Develop targeted interventions to reduce risk in families and communities most at risk for unsafe sleep practices. Organizations and groups to involve include:**
   - Local Infant Loss Resources
   - Researchers
   - Home visitation programs

19 Among babies who were larger than 1,499 grams and who died after their 28 days of life (the "Infant Health" period of risk)
20 Deaths due to sleep-related suffocation and SIDS
21 Includes causes of death, such as drowning or motor vehicle accidents
22 Using an internal referent population (a national referent group is not available)

- Medical care providers
- Child Fatality Review Panels and FIMR
- Fetal and Infant Mortality Review programs

2. Support other community-based organizations that work to:

- Eliminate and reduce smoking and tobacco use, especially programs targeting low-income women of color
- Promote breast feeding
- Reduce sleep-related infant deaths
- Reduce smoking in pregnant women and cigarette smoke exposure in infants after birth
- Expand efforts preventing SIDS and accidental suffocation and strangulation in bed

Theme 3: Equity Matters

In the grand scheme of things, racial equity poses a significant threat for infant mortality to mothers in St. Louis. Many demographic and socio-economic determinants play a large factor in the overall health of mothers and babies. Mothers and newborns are critically impacted by things like housing conditions, smoking habits, sleeping arrangements, low education levels, marital status, social support, and prenatal care coverage. Such factors can prompt VLBW, pre-pregnancy hypertension, gestational hypertension, hypertension eclampsia, and a variety of other chronic health conditions that can stimulate infancy deaths.

On a broader spectrum, specific segments of the population, including gender, race or ethnicity, education, income, disability, or living in various geographic localities, are key elements that influence health outcomes. Unequal distribution of these social determinants is often triggered by racial inequity, along with other unjust social economic policies, resulting in regional disparity throughout St. Louis. This racial disparity is an indication that Black women pose a greater likelihood of being exposed to infant mortality within the region.

What We Found

Statistics reveal that mothers of Black babies are more likely to endure an unhealthy pregnancy, which often causes an infancy death. This contributes to the alarming infant mortality rate for Black women in St. Louis.

The rate for infant mortality currently stands at 9.3 per 1,000 live births for Black women in St. Louis City, and at 7.0 for Black women in the County, while the rate for White women sits at only 3.0 and 2.5 per 1,000 live births in the city and county, respectively.

Though rates for both races have improved over time, disparity continues to be a severe issue. Interventions are being provided to help reduce these rates, but we have failed to find interventions, policies and strategies that are able to improve disparity overall.

Disproportionate exposure to toxic stress created by inequity is suggested to be one of the reasons that babies born to Black women are three times as likely to die as babies born to White women in our community.

What Can Be Done?

1. **Invest in community-driven broad based, long term, capacity building initiatives that can address an array of complex and comorbid health and social problems concurrently.**

2. **Build the capacity of communities to heal themselves through engagement and empowerment.**

   "Racism is a system of structuring opportunity and assigning value based on the social interpretation of how one looks (which is what we call "race"), that unfairly disadvantages some individuals and communities, unfairly advantages other individuals and communities, and saps the strength of the whole society through the waste of human resources."

   – Camara Jones, MD, Ph.D., MPH; Past President, American Public Health Association

Our health can be impacted by several forces, such as housing, education and employment status, some of which we can impact as individuals. However, when opportunity is based on the color on one's skin, it becomes a determinant of health and results in advantage to some that is denied to others.

What can we do to address race as it impacts health? The American Public Health Association[23] suggests the following:

- Put racism on the agenda. Name racism as a force determining the social determinants of health.
- Ask, "How is racism operating here?" Identify how racism drives past and current policies, practices, norms, and values that create the inequitable conditions in which we are born, grow, live, learn and age.
- Organize and strategize to act. Promote and facilitating conversation, research and intervention to address racism and its negative impact on the health of our nation.

The Ferguson Commission report, Forward through Ferguson[24], called the St. Louis Region to intentional action and to apply a racial equity framework to policies, initiatives, programs and projects to address racial disparities in health and other issues. It suggested we begin by asking the following during our analysis:

- Whom does this benefit?
- Does this differentially impact racial and ethnic groups?
- What is missing that will decrease or eliminate racial disparities?

Service interventions alone are insufficient to confront the complex root causes of health

23 https://www.apha.org/topics-and-issues/health-equity/racism-and-health
24 https://forwardthroughferguson.org/report/signature-priorities/racial-equity/

inequity and health disparities. A paradigm shift is needed to create transformative health improvements, produce population-based change, or revamp the social climate and generate the momentum needed to address the scope of problems that perpetuate environments where health disparities have continued to thrive.

SERVICE INTERVENTIONS ALONE ARE INSUFFICIENT TO CONFRONT THE COMPLEX ROOT CAUSES OF HEALTH INEQUITY AND HEALTH DISPARITIES.

Theme 4: Place Matters

The fetal and infant mortality rate in St. Louis County (6.5) was lower than in St. Louis City (10.0). When looking at excesses by place, however, both St. Louis City and County show the maternal health category had the greatest excess at 39% of the excess in the County and 33% of the excess in the City.

The distribution of demographic and social characteristics of mothers varied by place as well. For example, in comparison with women living in St. Louis County, there were significantly more mothers in St. Louis City who were:

- Unmarried (80% versus 39%)
- Participating in a government program (69% versus 44%)
- Recipients of inadequate prenatal care (18% versus 10%)
- Smoking during pregnancy (15% versus 9%)
- Without a high school diploma (10.8% versus 9.0%)
- Under 20 years of age (10.5% versus 6.2%)
- Diagnosed with a chronic health condition – gestational hypertension (9% versus 5%) and hypertension eclampsia (1% versus 0.7%).

This shows a greater burden of poor social determinants of health in the City than in the County, which are important to consider as upstream factors associated with health.

What We Found

When reviewing maps showing the distribution of births sorted by demographic characteristics[25], socio-economic characteristics[26], and selected birth outcomes[27], we identified patterns of poor birth outcomes/risk factors with neighborhood characteristics of poverty and environmental distress.[28]

- Risk for having a VLBW birth were similar between St. Louis City (38%) and St. Louis County (32%) of the risk due to being Black.
- Smoking during pregnancy accounted for 4% of the risk in the County and 7% of the risk in the City.
- Gestational hypertension accounted for 7% of the risk for VLBW in the County and 12% of the risk in the City.

25 Black, non-Hispanic births, teen births
26 Medicaid births, WIC births
27 Infant mortality, neonatal mortality, post-neonatal mortality, preterm births, very preterm births, and low birth weight
28 Female-headed households, high school graduation rates, percent of households in poverty, median income, unemployment, and vacant housing

It is likely that unmeasured confounders, such as the physical and socio-economic conditions in which one lives, in addition to the life style and health care conditions, play an important role in this relationship between place and Infant Health.

Infant mortality is slightly higher in St. Louis City than St. Louis County, for both Black and White women. As we conducted a detailed geographic analysis of risks in the City, we found that infant mortality was highest in the St. Louis City zip codes of 63107 (Fairground Neighborhood), 63120 (Walnut Park East), 63113 (Lewis Place), 63115 (Penrose), and 63118 (Benton Park). In the County, the areas with the highest risk for infant mortality were the zip codes of 63133 (Pagedale / Wellston), 63044 (Bridgeton), 63136 (Jennings), 63138 (North County), and 63135 (Ferguson). More effort in these specific locations is needed to address the higher rates of infant mortality.

What Can Be Done?

The disparity rate of infant mortality between Black women and White women in St. Louis City and County is threefold. Rates for both races have improved, but the disparity remains constant over time indicating that we are providing interventions that reduce the rates, but we have failed to find interventions, policies and strategies that are able to improve the disparity and reduce the gap.

It is very clear that the highest rates of risk factors for poor birth outcomes are in locations with higher psycho-social and economic burdens. Where there are higher rates of Medicaid births, WIC births, infant mortality, preterm birth, and low birth weight, we also see higher rates of households missing a paternal figure, lower high school graduation rates, and neighborhoods with more households in poverty. These communities in distress may need to develop the infrastructure for community support and develop and leverage assets as place-based investment strategies to address the significant stress in these communities.

Communities will not be structurally changed into more vibrant places by traditional incremental strategies, such as reorganizing decision-making groups, revamping programs, improving service locations, or improving evaluation methods and technology. The structural change needed to transform communities must involve non-traditional ways of thinking that create changes in interpersonal and inter-organizational relationships. Community members must be engaged in the public process. The changes and the process must inspire innovation, establish and nurture peer support, ease the daily stress burden of parents, and promote change in all the systems that serve them, so that communities can protect and nurture themselves and the next generation.

Theme 5: Access to and Quality of Data Matters

While public health data is generally rich, it is often not available in a timely fashion and we had challenges accessing accurate data. Communities need access to timely, accurate and complete data in order to track their progress toward effectiveness, accessibility and quality of population-based health services. Optimally, this includes access to timely, non-fragmented, reliable data.

What We Found

The data needed to conduct this analysis is not readily accessible to communities and must be specifically requested from the state in order to conduct the analysis and create maps. Data requests can be delayed by processes, such as the Institutional Review Board, which can take months. Data is not available in real time and the most current data is several years old. Furthermore, understaffing and frequent turnover at the state department of health reduces the training and efficiency of the public health work force, making it difficult to address the need for accurate and timely data. This lack of availability of real-time data means that communities must make decisions about future actions based on retrospective data.

What Can Be Done?

1. Improve access to and use of non-fragmented real-time data

    - Surveillance: The capturing of data
    - Infrastructure: The accessibility of data

Conclusion

Equity and place are affected by the distribution of social determinants of health. Social determinants of health are inter-related to social and economic factors that influence health. They are conditions in the environments in which we are born, live, learn, work, play, worship, and age that influence a wide range of health, functioning, and quality-of-life outcomes and risks. Unequal distribution of the social determinants of health can cause poor health outcomes when one experiences things like persistent poverty, unstable housing, and limited educational and employment opportunity. The St. Louis region has a persistently high disparity in infant mortality between Black women and White women irrespective of place.

Infant mortality for Black women is three-fold that of White women irrespective of place. In fact, the infant mortality rate increases even more dramatically when you include the smallest babies:[29]

- From 9.3 to 14 per 1,000 live births for Black women in St. Louis City and from 7.0 to 11.8 for Black women in the County. In contrast, the rates only increase by 1 per 1,000 for White women in either the City or County.

29 Moving from the PPOR-restricted to the unrestricted sample

While White women in our sample had 52 fewer deaths than the referent group, Black women had 195 more deaths.

The distribution of demographic and social characteristics of moms varied by race. There were significantly more Black women in St. Louis City (54.2%) than White women (35.6%) in our sample. In comparison, there were significantly more Black new moms who were:

- Participating in a government program (87.9% versus 24.1%)
- Unmarried (80% versus 21.8%)
- Recipients of inadequate prenatal care (21.3% versus 4.9%)
- Without a high school degree (20.1% versus 78.2%)
- Under 20 years old (14.4% versus 2.8%)
- Smoking during pregnancy (13.3% versus 10.0%)
- Diagnosed with a chronic health condition – insulin-dependent diabetes (1.1% versus 0.5%), other diabetes (5.5% versus 4.2%), pre-pregnancy hypertension (2.9% versus 1.0%), gestational hypertension (9.5% versus 4.3%), and hypertension eclampsia (1.2% versus 0.5%).

Data supports the idea that larger social determinants of health, such as education and social support, may be on the causal pathway between pregnancy and healthy birth outcomes.

What We Found

Data suggests a clear disparity in the amount of Black very small babies[34] who die in utero or after birth but before their first birthday. PPOR FIMR rates:

- White women: 4.5
- Black women: 12.0

Among White women, being married was associated with a 25% reduced risk for VLBW in reference with unmarried women.

Pre-pregnancy hypertension, gestational hypertension and hypertension eclampsia were also significant predictors of VLBW births, increasing their risk by 197%, 124% and 379% respectively.

In comparison, for Black women, being under the age of 20 increased the risk for VLBW by 30%, while graduation from high school and being married reduced the risk around 20% each. Smoking during pregnancy increased the odds of VLBW by 56%, accounting for almost 7% of the population attributable risk for VLBW. Pre-pregnancy hypertension (aOR 2.28), gestational hypertension (aOR 2.45), and hypertension eclampsia (aOR 3.15) were significant predictors of VLBW for Black women.

What Can Be Done?

Communities in distress will not be structurally changed into more vibrant places by traditional incremental strategies, such as reorganizing decision-making groups, revamping programs, improving service locations or improving evaluation methods and technology. The structural and systemic change needed to transform communities must involve non-traditional ways of thinking that create changes in interpersonal and inter-organizational relationships.

Community members must be engaged in the public process. The changes and the process must inspire innovation, establish and nurture peer support, ease the daily stress burden of parents, and promote change in all the systems that serve them, so that communities can protect and nurture themselves and the next generation.

Those community members of all races, statuses and roles who are committed to addressing the disparities in racial equity will need to consider the following:

1. Infant mortality is one of the key indicators of community health in any area.

- The St. Louis region has a higher infant mortality rate that is comparable to some developing countries.
- The loss of a baby affects the mother, her family, and her community.

2. Healthier women have healthier pregnancies and healthier babies.

- The conditions in which babies thrive and survive are predicted by many factors beyond maternal behaviors, like diet and exercise.
- Environmental and economic factors, like the availability and affordability of health foods, reliable transportation, and stress on the mother before she gets pregnant, are important factors.

3. Healthier babies have a greater chance to become healthier adults, and in turn, have healthier babies.

- Smaller babies have a harder time surviving and thriving.
- Babies who survive serious health issues after birth have a greater chance to grow into adults who have chronic health issues.

4. To solve the problem of infant mortality, we must address inequity, which is complex and not a simple thing to fix.

- Race is not a proxy for poverty: being poor increases the likelihood of negative outcomes, but being Black increases the likelihood of negative outcomes, no matter your income or location in St. Louis.

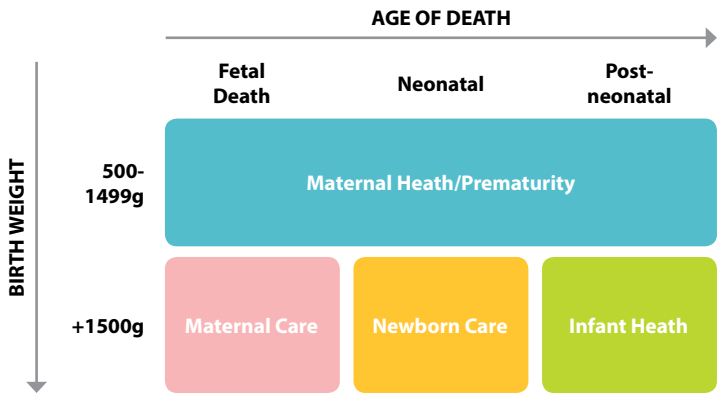
2 | Perinatal Periods of Risk (PPOR) Analysis

Phase 1

Perinatal Periods of Risk (PPOR) is a way to measure equity in birth outcomes.[31] It is a method of analysis that evaluates fetal and infant deaths by comparing women with the social privileges (older than 19, greater than high school diploma, and White) to the population in our community. If certain groups (person, place and time) have higher rates of fetal and infant deaths, it reflects areas where we know we need to do better from a social justice perspective. The PPOR analysis was conducted with St. Louis City and County data from 2010-2014, updated from an earlier PPOR analysis of data from 2000-2009. Methodologically, it is important to note that the earlier analysis was a death cohort analysis (all live births and fetal and infant deaths in the same year) while the updated PPOR analysis was a birth cohort analysis, meaning that the live births were linked to infant death. Between 2010-2014 there were 81,733 live births and fetal deaths, after the restrictions that are required by PPOR methodology. These restrictions exclude live births weighing less than 500 grams; and fetal deaths with a birth weight less than 500 grams and gestational age at least 24 weeks.

Overall, there were 81,733 live births (98.4% of those births at 1,500 grams or more). Over the time span, the number of fetal deaths and live births was consistent from year to year.

FIGURE 1: PPOR Categories



31 Why our infant death rates may not match other published rates for the same years: These data are based on a birth cohort (all babies born in a year and then matched case-by-case with death certificates for any babies who died within a year of birth). In addition, PPOR methodology excludes all birth weights under 500 grams and includes fetal deaths at or above 500 grams and at least 24 weeks gestation. Infant mortality statistics released each spring from official sources are often calculated from the number of infant deaths that year occurring before the first birthday, divided by the total number of live births that year. So, babies in the numerator (deaths that year) are not necessarily the same individuals included in the denominator (babies born that year) since some of the babies who died may have been born the previous year and some of the babies born may not have passed through the entire year of risk. Birth cohort mortality statistics, such as reported here, are the most accurate, but take a year longer to produce.

Table 2 provides an overview of live births, fetal and infant deaths, sorted by birth weight, overall, by year, by location (St. Louis City and St. Louis County) and race/ethnicity. In St. Louis County, there were 57,926 births and in St. Louis City there were 23,807 births. White moms accounted for 42,113 births, Black moms accounted for 31,065 of the births, Hispanic accounted for 3,267 of the births, and the remaining 5,288 births were other or unknown race-ethnicity. The distribution of births by residence and race are provided in Table 2. (Also see Table A in Appendix A for a complete distribution of variables, including the percentage of missing data.)

TABLE 2: Number of live births, fetal deaths, and infant deaths
2010-2014[a]: St. Louis City and County, MO | n=81,733

	Birth weight (g)	Live Births	Fetal Deaths	Infant Deaths	By BW Live Births + Fetal Deaths	By sub-group, overall Live Births + Fetal Deaths
All						
	500 - 1,499	1,275	85	150	1,360	81,733
	1,500+	80,240	133	244	80,373	
Residence County						
St. Louis County	500 - 1,499	788	60	89	848	57,926
	1,500+	56,997	81	144	57,078	
St. Louis City	500 - 1,499	487	25	61	512	23,807
	1,500+	23,243	52	100	23,295	
Race						
White, non-Hispanic	500 - 1,499	362	26	27	388	42,113
	1,500+	41,675	50	85	41,725	
Black, non-Hispanic	500 - 1,499	821	52	110	873	31,065
	1,500+	30,119	73	137	30,192	
Other, non-Hispanic	500 - 1,499	47	3	7	50	4,604
	1,500+	4,549	5	9	4,554	
Hispanic	500 - 1,499	34	1	4	35	3,267
	1,500+	3,230	2	11	3,232	
Unknown	500 - 1,499	11	3	2	14	684
	1,500+	667	3	2	670	
All PPOR eligible		**81,515**	**218**	**374**	**81,733**	**81,733**

[a] Fetal death - 500+ grams birth weight and 24+ weeks gestation; live births - 500+ grams birth weight

The fetal infant mortality rate (FIMR) for the 2010-2014 time period was 7.5 fetal-infant per 1,000 live births. The category with the largest proportion of fetal and infant deaths was the maternal/health prematurity category, with 2.9 of the 7.5 deaths within this category. The remaining fetal and infant deaths were fairly evenly split between the maternal care (1.6), newborn care (1.5), and Infant Health (1.5) categories.

The distribution of FIMR over time is fairly consistent, although because the numbers are much smaller within each PPOR category these rates by year are unstable and only provided for contextual information. When comparing St. Louis City to St. Louis County, the FIMR in the County is lower (6.5) than the City (10.0), rates which have dropped since the 2000-2009 analysis, which were 9.1 in the County and 13.0 in the City. When comparing Black to White, the White FIMR was 4.5 while the Black FIMR was 12.0, a nearly 2.8:1 Black-White disparity that has decreased slightly since the 2000-2009 analysis when the disparity rate was 2.8:1. These details are provided in Table 3.

It is notable that there were 146 excess deaths overall, during the time period under study in comparison of the national referent group, with the greatest excess in the maternal health and prematurity category, followed by the Infant Health category. When considering place (maternal residence), the City had 102 excess deaths while the County had 44 excess deaths. When considering race, there were a total of 195 excess deaths among Black women while the White groups resulted in 52 fewer deaths than the referent group. The categories with the greatest excess should point to community interventions, as depicted in Figure 2.

FIGURE 2: PPOR Interventions
Phase 1 Narrows the Choices of Action

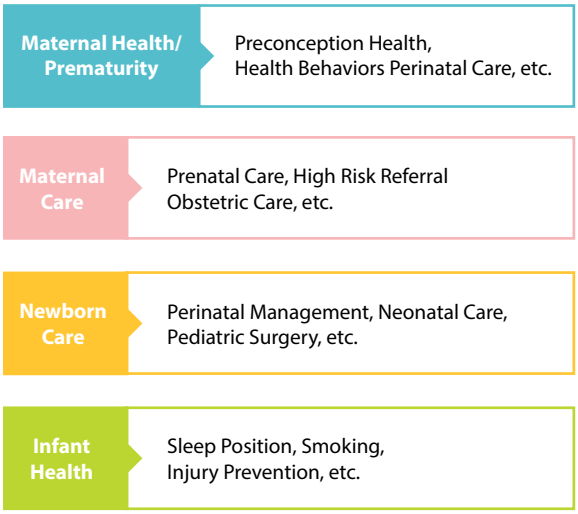


TABLE 3: Fetal-Infant Mortality Rates and excess deaths by risk period and population characteristics.
2010-2014[a,b]: St. Louis City and County, MO | Per 1,000 live births and fetal deaths, n=81,733

	FIMR			Numbers			
	Maternal Health/ Prematurity	**Maternal Care**	**Newborn Care**	**Infant Health**	**Total**	**Feto-Infant Deaths**	**Fetal Deaths-Live Births**
All	**2.9**	**1.6**	**1.5**	**1.5**	**7.5**	**612**	**81,733**
Residence County							
St. Louis County	2.6	1.4	1.3	1.1	6.5	374	57,926
St. Louis City	3.6	2.2	2.0	2.2	10.0	238	23,807
Race/Ethnicity							
White, non-Hispanic	1.3	1.2	1.2	0.8	4.5	188	42,113
Black, non-Hispanic	5.2	2.3	1.9	2.5	12.0	372	31,065
US Reference, 2000 – 2002	2.2	1.5	1.1	0.9	5.7	-	-
	Excess Deaths vs. US Reference	Excess FIMR		Total Excess Deaths		Fetal Deaths-Live Births	
All	**0.7**	**0.1**	**0.4**	**0.6**	**1.8**	**146**	**81,733**
Residence County							
St. Louis County	0.4	-0.1	0.2	0.2	0.8	44	57,926
St. Louis City	1.4	0.7	0.9	1.3	4.3	102	23,807
Race/Ethnicity							
White, non-Hispanic	-0.9	-0.3	0.1	-0.1	-1.2	-52	42,113
Black, non-Hispanic	3.0	0.8	0.8	1.6	6.3	195	31,065

[a] Fetal deaths - 500+ grams birth weight and 24+ weeks gestation; live births - 500+ grams birth weight; [b] Referent category = US reference group of White, non-Hispanic women greater than 20 years of age with 13 or more years of education, 2000-2002

See Appendix A for a breakout of death by period of risk.

FIGURE 3: Percent of Excess Deaths by County

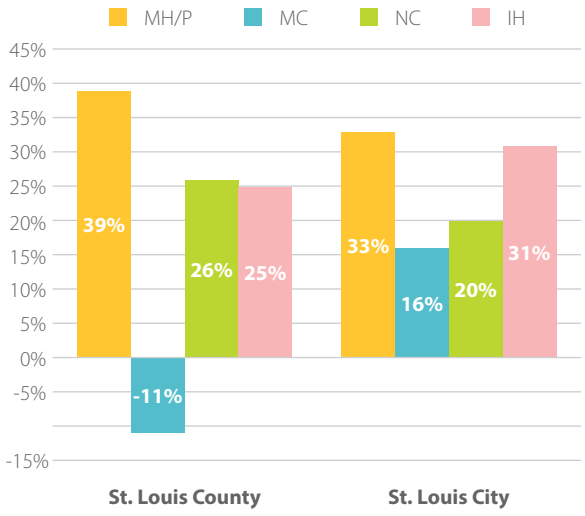
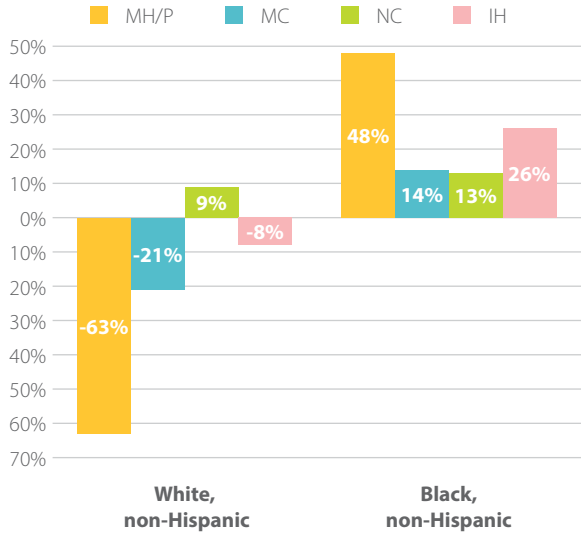


FIGURE 4: Percent of Excess Deaths by Race



In evaluating excess deaths by place, the greatest percentage of excess remains in the maternal health and prematurity category for both the County (38.8%) and City (32.9%). In the County, excess in the Infant Health (24.9%) and newborn care categories (25.7%) were comparable, with 10.1% improvement in the maternal care category. In the City, the Infant Health category has 30.9% of the excess death, followed by the newborn care category (20.3%), and 15.9% in the maternal care category.

In evaluating excess deaths by race/ethnicity, the greatest percentage of excess remains among Black women. Within the maternal health and prematurity category, there was 48.1% excess death, 25.7% in the Infant Health category, 13.5% in the maternal care category, and 12.7% in the newborn care category. There were improvements for White women in all categories except newborn care, which has 9.0% excess death in comparison with the referent population.

In the graphs provided, the yellow box represents the maternal health/prematurity category, the blue box represents the maternal care category, the green box represents the newborn care category, and the pink box represents the Infant Health category. The boxes with the heading St. Louis City and St. Louis County show the rates in our community, which then subtract the rates from the national reference group, leaving the excess infant mortality in our community.

When comparing the FIMR in our community to the national referent group, we find that 146 babies died in our community that may not have died if they had the privileges associated with referent group. This number has decreased from 415 in the 2000-2004 and 316 in 2005-2009. Importantly, the PPOR categories with the greatest excess are associated with potential interventions, with preconception health and behaviors associated with the Maternal Health/Prematurity category; prenatal and obstetric

care, and high-risk referral for the Maternal Care category; perinatal management, neonatal care, and pediatric surgery for the Newborn Care category; and sleep position, breast feeding and injury prevention with the and Infant Health category.

FIGURE 5: The distribution of FIMR by each of the four PPOR categories, including a reminder of findings from earlier PPOR analysis.

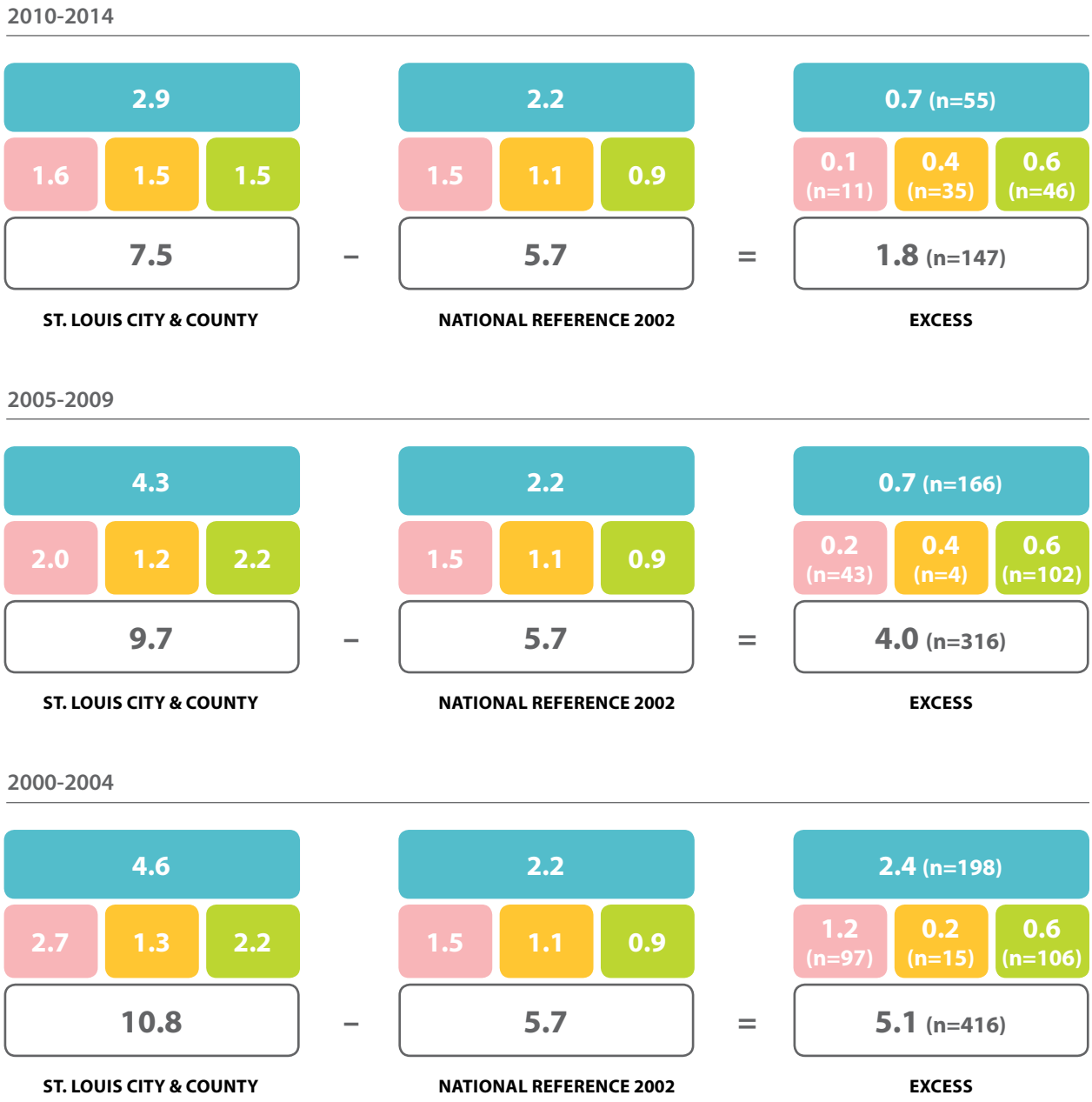
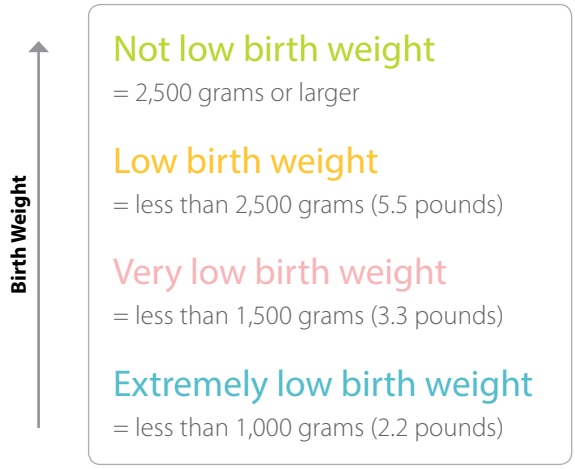


FIGURE 6: Phase 2 Analysis: Material Health/ Prematurity Risk and Preventative Factors.

Birth Weight Distribution (VLBW Births)	Birth Weight - Specific Mortality
• Smoking	• Gestational age
• Prenatal care	• Referral system
• Race	• Perinatal care
• Maternal age	• Mat. complications
• Parity	• Neonatal conditions
• STD/bacterial vag.	• Pay source
• Multiple preg.	
• SES/education	
• Birth interval	
• Maternal HTN/ diabetes	

CityMatCH (retrieved on 8/11/16 at www.citymatch.org/sites/default/files/documents/mcHEPITraining/2015/3%20Tuesday/5.%20PPOR%20PHase?101,%20TU.pdf)

FIGURE 7: Birth Weight Categories



(3,400 grams is 7.5-pounds)

Phase 2

Phase 2 of PPOR is designed to identify causal pathways or biologic mechanisms for excess mortality. To do this, the Kitagawa method of analyzing excess death is used to partition excess mortality into two portions: (1) birth weight distribution, and (2) birth weight-specific mortality. For excess mortality due to birth weight distribution, risk and preventive factors explored include smoking, prenatal care, race, maternal age, parity, STI, multiples, education, birth interval, and maternal chronic conditions.

For excess mortality due to birth weight-specific mortality, gestational age, referral systems, perinatal care, maternal complications, neonatal conditions, and payer sources are often explored in more detail. To investigate if there were any disparities in excess deaths for Maternal Health/Prematurity period by race and county, chi-square analysis was conducted (results provided in Appendix C).

From the summary figures of excess deaths for the target populations (by race and county), the largest contributors to excess deaths are Maternal Health/ Prematurity (500-1,499 grams) and Infant Health (1,500+ grams and post-neonatal) PPOR categories. A Kitagawa analysis and an Infant Health category death analysis were conducted.

The high-risk target populations we are focusing on are Black women and St. Louis City. The Kitagawa method was applied to the 2010-2014 live birth and fetal deaths. This method used the U.S. reference group of White women greater than 20 years of age with 13 or more years of education. Target groups used in the analysis were: 1) Black women and 2) St. Louis City. This analysis helps explain differences in feto-infant mortality rates for the target groups, compared to the U.S. reference group, in terms of birth weight distribution and birth weight-specific mortality. Table 4 shows the percentage contribution to the difference in excess feto-infant mortality rates for the target populations.

Table 4 shows that for Black women and St. Louis City, about 84.4% and 79.4%, respectively, of the mortality can be attributed to birth weight distribution. Among Maternal Health/Prematurity (i.e. VLBW) births, about 62.5% of Maternal Health/Prematurity infant mortality for Black women and 53.7% of Maternal Health/Prematurity in St. Louis City can be attributed to birth weight distribution. Results for St. Louis City and Black women are similar, indicating that there are many VLBW babies being born, so further analysis should focus on evaluating risk factors for VLBW.

The greatest contribution to mortality rates is among VLBW births within the maternal health and prematurity category, which accounts for 62.5% of the birth weight distribution, but 13.2% less of the excess mortality when compared with the referent population. It is similar in the City too, where there is an 18.8% improvement in excess mortality within these birth weight categories of 500-749 grams, 750-999 grams, 1,000-1,249 grams, and 1,250-1,499 grams. Babies larger than 1,499 grams account for an additional 11.9% of the excess distribution among Black births and 26.7% of the excess distribution in St. Louis City, with the greatest excess deaths at 26.9% of babies greater than 2,500 grams among Black births and 34.3% among births in the City, in comparison with the referent population. See Table 4.

TABLE 4: Percentage contribution to the difference in excess mortality rates.
2010-2014: Black and St. Louis City, MO | n=81,733

	Birth weight Distribution	Excess Mortality Rate	Total Contribution	Birth weight Distribution	Excess Mortality Rate	Total Contribution
Birth weight (BW) (grams)	**Black Race**			**St. Louis City**		
500 - 749	35.8%	-7.7%	28.0%	30.1%	-9.2%	20.8%
750 - 999	14.0%	-4.0%	10.0%	12.2%	-5.2%	7.0%
1,000 - 1,249	6.5%	-2.9%	3.6%	5.3%	-4.0%	1.4%
1,250 - 1,499	6.2%	1.5%	7.7%	6.1%	-0.4%	5.8%
MH/P (VLBW) Total	**62.5%**	**-13.2%**	**49.3%**	**53.7%**	**-18.8%**	**34.9%**
1,500 - 1,999	11.1%	2.9%	14.0%	12.8%	4.1%	16.9%
2,000 - 2,499	15.6%	-1.0%	14.5%	17.6%	1.0%	18.7%
2,500+	-4.7%	26.9%	22.2%	-4.8%	34.3%	29.5%
Total	**84.4%**	**15.6%**	**100.0%**	**79.4%**	**20.6%**	**100.0%**

Table 5 assesses the differences in risk and preventive factors in the target populations. Race compared White versus Black and county compared St Louis City and County. Differences were assessed using a chi-square test. The distribution of risk and preventive factors were significantly different by race and place, except among diabetes and pre-pregnancy hypertension with the place comparisons.

TABLE 5: Prevalence of risk and preventive factors for Birth Weight distribution among all live births/fetal deaths.
2010-2014: St. Louis City and County, MO | Comparing maternal residence county and Black vs. White, non-Hispanic Race, n=81,733

	Race			County		
	White (n=42,113)	Black (n=31,065)		St. Louis County (n=57,926)	St. Louis City (n=23,807)	
Risk/Preventive Factors	%	%	p-value	%	%	p-value
Maternal residence county	-	-	-	-	-	<.0001
St. Louis County	79.9	58.4	-	-	-	-
St. Louis City	20.1	41.6	-	-	-	-
Maternal Race	-	-	<.0001	-	-	-
White, non-Hispanic	-	-	-	58.1	35.6	-
Black, non-Hispanic	-	-	-	31.3	54.2	-
Other, non-Hispanic	-	-	-	6.0	4.7	-
Hispanic	-	-	-	3.7	4.7	-
Maternal Age	-	-	<.0001	-	-	<.0001
< 20	2.8	14.4	-	6.2	10.5	-
20 - 34	78.2	77.5	-	77.4	78.0	-
> 34	19.1	8.1	-	16.4	11.5	-
Maternal Education < HS grad	5.3	20.1	<.0001	9.0	20.8	<.0001
Married (yes)	78.2	20.0	<.0001	61.0	40.0	<.0001
Participate in government program (yes)	24.1	87.9	<.0001	43.6	69.0	<.0001
Kotelchuck Index: Inadeq PNC	4.9	21.3	<.0001	9.5	17.8	<.0001
Parity (previous live births)	-	-	<.0001	-	-	<.0001
Nulliparous	43.8	37.0	-	40.3	42.6	-
Primiparous	31.9	26.7	-	30.9	27.4	-
Multiparous	23.3	35.0	-	27.6	29.4	-
Smoking during pregnancy (yes)	10.0	13.3	<.0001	9.0	14.7	<.0001
Insulin dependent diabetes (yes)	0.5	1.1	<.0001	0.7	0.8	.383
Other diabetes (yes)	4.2	5.5	<.0001	5.0	4.9	.900
Pre-pregnancy hypertension (yes)	1.0	2.9	<.0001	1.7	1.9	.075
Gestational hypertension (yes)	4.3	9.6	<.0001	5.4	8.6	<.0001
Hypertension eclampsia (yes)	0.5	1.2	<.0001	0.7	1.0	<.0001

Multivariable logistic regression was used to assess the magnitude of association of the risk and preventive factors with VLBW (BWT<1,500 grams) in St. Louis City and County. Three separate multivariable models were calculated: 1) All races in the City and County; 2) By race (White and Black); and 3) By county (St. Louis City and St. Louis County). Population Attributable Risk Percent (PAR%) was calculated for each risk factor that was a significant contributor to VLBW because communities or sub-populations vary according to risk factor distribution. Using the adjusted odds ratio (aOR) for each risk factor that is significant and the prevalence of the risk factor in the target community of interest, PAR was calculated as follows: PAR% = P(OR-1)/[P(OR-1) + 1]. The PAR% represents the proportion of VLBW births that can be attributed to the risk factor of interest. If PAR% is negative (i.e. indicates a protective factor), PAR% becomes difficult to interpret, but roughly indicates the proportion increase in VLBW in the population if the protective factor were not present. PAR% is useful to aid in prioritizing intervention and prevention efforts because it is an estimate of the factor's effect on the outcome. Tables 5 through 7 show results of each of these models. Bolded risk factors are significant in each model.

St. Louis City and County: Overall Comparisons

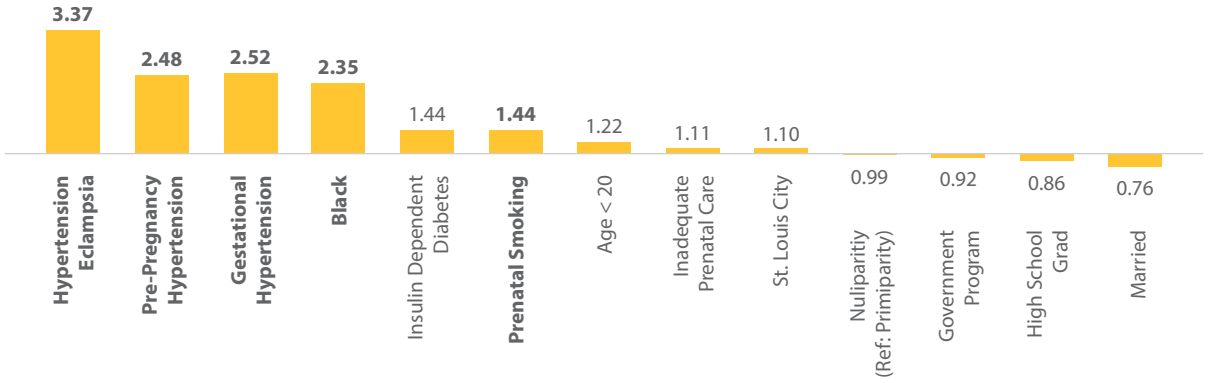
A higher positive PAR% means that a higher proportion of VLBW can be attributable to the risk factor of interest (for significant factors in model). Table 6 and Figure 8 show that almost 34% of the PAR for VLBW is among Black women.

TABLE 6: Adjusted odds ratios (AOR), 95% confidence intervals (CI), prevalence and population attributable risk percent (PAR%) for risk and preventive factors associated with very low birth weight.
2010-2014: St. Louis City and County, MO | Overall, n=81,733 | Outcome is VLBW

Risk/Preventive Factors	AOR	95% CI	Prevalence Proportion a	PAR%
County: St. Louis City (ref: County)	1.10	0.98-1.23	.29	-
Maternal Race: Black (ref: White)	**2.35**	**2.00-2.76**	**0.38**	**33.91**
Maternal Race: Other (ref: White)	1.18	0.87-1.59	0.06	-
Maternal Race: Hispanic (ref: White)	1.13	0.79-1.61	0.04	-
Maternal Age: < 20 (ref: 20-34)	1.22	1.01-1.48	0.07	1.52
Maternal Age: > 34 (ref: 20-34)	1.05	0.88-1.24	0.15	-
Maternal Education: < HS graduate (≥ HS graduate)	0.86	0.73-1.02	0.12	-
Married: Yes (ref: No)	**0.76**	**0.65-0.89**	**0.55**	**-15.21**
Government program: Yes (ref: No)	0.92	0.77-1.10	0.51	-
Prenatal Care: Inadequate (ref: else)	1.11	0.95-1.29	0.12	-
Previous live births: Nulliparous (ref: Primiparous)	0.99	0.86-1.14	0.41	-
Previous live births: Multiparous (ref: Primiparous)	1.01	0.87-1.17	0.28	-
Smoking during pregnancy: Yes (ref: No)	**1.44**	**1.23-1.68**	**0.11**	**4.62**
Insulin dependent diabetes: Yes (ref: No)	**1.44**	**0.87-2.39**	**0.01**	**-**
Other diabetes: Yes (ref: No)	0.97	0.75-1.26	0.05	-
Pre-pregnancy hypertension: Yes (ref: No)	**2.48**	**1.91-3.22**	**0.02**	**2.87**
Gestational hypertension: Yes (ref: No)	**2.52**	**2.16-2.93**	**0.06**	**8.36**
Hypertension eclampsia: Yes (ref: No)	**3.37**	**2.52-4.51**	**0.01**	**2.32**

*Bolded risk factors are significant at p<.05 a Prevalence of group of interest in overall population, denominator = 81,733

FIGURE 8: Adjusted Odds Ratios for Risk and Preventative Factors for Very Low Birth Weight over Total Sample.
2010-2014: St. Louis City and County, MO | n=81,733 | Significance noted by bold aORs



Place Stratified Risk for Very Low Birth Weight (VLBW) (St. Louis City and St. Louis County) Table 7 and Figures 9 and 10

St. Louis County

In St. Louis County, 32% of the PAR for VLBW is among Black women. The odds of having a VLBW baby for Black women in the County is 2.51 greater (aOR-2.51, CI 2.08-3.03) than that of a White woman. Marital status was protective against VLBW for women living in the County, reducing their risk for VLBW by 25% in comparison with women who are not married (AOR 0.75, CI 0.62-0.91). Smoking during pregnancy increased the risk for VLBW by 41% in reference to women who did not smoke during pregnancy (zOR 1.41, CI 1.14-1.75). Insulin-dependent diabetes (aOR 2.30, CI 1.29-4.12), pre-pregnancy hypertension (aOR 2.09, CI 1.47-2.97), gestational hypertension (aOR 2.49, CI 2.03-3.04), and hypertension eclampsia (aOR 3.94, CI 2.72-5.71) all significantly increased the odds for VLBW when compared with women who did not have these health conditions during pregnancy.

TABLE 7a: Adjusted odds ratios (AOR), 95% confidence intervals (CI), prevalence and population attributable risk percents (PAR%) for risk and preventive factors associated with very low birth weight.
2010-2014: St. Louis City and County, MO | By County, n=81,733 | Outcome is VLBW

Risk/Preventive Factors	AOR	95% CI	Prevalence	PAR%
St. Louis County (n=57,926)				
Maternal Race: Black (ref: White)	**2.51**	**2.08-3.03**	**0.31**	**31.88**
Maternal Race: Other (ref: White)	0.87	0.58-1.28	0.06	-
Maternal Race: Hispanic (ref: White)	1.03	0.64-1.63	0.04	-
Maternal Age: < 20 (ref: 20-34)	1.11	0.85-1.44	0.06	-
Maternal Age: > 34 (ref: 20-34)	1.11	0.91-1.36	0.16	-
Maternal Education: < HS graduate (≥ HS graduate)	0.85	0.67-1.09	0.09	-
Married: Yes (ref: No)	**0.75**	**0.62-0.91**	**0.61**	**-17.99**
Government program: Yes (ref: No)	0.86	0.70-1.07	0.44	-
Prenatal Care: Inadequate (ref: else)	1.10	0.89-1.37	0.10	-
Previous live births: Nulliparous (ref: Primiparous)	1.16	0.97-1.38	0.40	-
Previous live births: Multiparous (ref: Primiparous)	1.13	0.94-1.37	0.28	-
Smoking during pregnancy: Yes (ref: No)	**1.41**	**1.14-1.75**	**0.09**	**3.56**
Insulin dependent diabetes: Yes (ref: No)	**2.30**	**1.29-4.12**	**0.01**	**1.28**
Other diabetes: Yes (ref: No)	0.88	0.63-1.23	0.05	-
Pre-pregnancy hypertension: Yes (ref: No)	**2.09**	**1.47-2.97**	**0.02**	**2.13**
Gestational hypertension: Yes (ref: No)	**2.49**	**2.03-3.04**	**0.05**	**6.93**
Hypertension eclampsia: Yes (ref: No)	**3.94**	**2.72-5.71**	**0.01**	**2.86**

* Bolded risk factors are significant at p<.05 a Prevalence of group of interest in subpopulation, denominator =subpopulation sample size

St. Louis City

In St. Louis City, 38% of the PAR is due to Black maternal race, with the odds of having a VLBW baby 2.14 that of a White woman (aOR 2.14, CI 1.58-2.90). Maternal age under 20 was also a significant risk factor for VLBW (aOR 1.39, CI 1.05-1.85) in reference with women aged 20-34. Women who smoked during pregnancy had a 49% increased odds for VLBW compared with women that did not smoke during pregnancy (aOR 1.49, CI 1.18-1.87). Pre-pregnancy hypertension (aOR 3.13, CI 2.10-4.66), gestational hypertension (aOR 2.56, CI 2.03-3.21), and hypertension eclampsia (aOR 2.74, CI 1.71-4.40) all significantly increased the odds for VLBW when compared with women who did not have these health conditions during pregnancy. Having had one previous birth was protective against VLBW (aOR 0.77, CI 0.61-0.96).

TABLE 7b: Adjusted odds ratios (AOR), 95% confidence intervals (CI), prevalence and population attributable risk percents (PAR%) for risk and preventive factors associated with very low birth weight.
2010-2014: St. Louis City and County, MO | By County, n=81,733 | Outcome is VLBW

Risk/Preventive Factors	AOR	95% CI	Prevalence	PAR%
St. Louis City (n=23,807)				
Maternal Race: Black (ref: White)	**2.14**	**1.58-2.90**	**0.54**	**38.10**
Maternal Race: Other (ref: White)	**2.09**	**1.29-3.40**	**0.05**	**5.17**
Maternal Race: Hispanic (ref: White)	1.29	0.73-2.30	0.05	-
Maternal Age: < 20 (ref: 20-34)	**1.39**	**1.05-1.85**	**0.10**	**3.75**
Maternal Age: > 34 (ref: 20-34)	0.92	0.66-1.27	0.11	-
Maternal Education: < HS graduate (≥ HS graduate)	0.85	0.68-1.07	0.21	-
Married: Yes (ref: No)	0.76	0.58-1.01	0.40	-
Government program: Yes (ref: No)	1.01	0.71-1.43	0.69	-
Prenatal Care: Inadequate (ref: else)	1.11	0.88-1.39	0.18	-
Previous live births: Nulliparous (ref: Primiparous)	**0.77**	**0.61-0.96**	**0.43**	**-10.98**
Previous live births: Multiparous (ref: Primiparous)	0.83	0.66-1.05	0.29	-
Smoking during pregnancy: Yes (ref: No)	**1.49**	**1.18-1.87**	**0.15**	**6.85**
Insulin dependent diabetes: Yes (ref: No)	0.45	0.14-1.51	0.01	-
Other diabetes: Yes (ref: No)	1.15	0.78-1.70	0.05	-
Pre-pregnancy hypertension: Yes (ref: No)	**3.13**	**2.10-4.66**	**0.02**	**4.09**
Gestational hypertension: Yes (ref: No)	**2.56**	**2.03-3.21**	**0.09**	**12.31**
Hypertension eclampsia: Yes (ref: No)	**2.74**	**1.71-4.40**	**0.01**	**1.71**

* Bolded risk factors are significant at p<.05 a Prevalence of group of interest in subpopulation, denominator =subpopulation sample size

FIGURE 9: Adjusted odds ratios for risk and preventative factors for Very Low Birth Weight (aOR) among women in St. Louis County.

2010-2014: St. Louis City and County, MO | Per 1,000 live births, n=57,926 | Restricted PPOR sample

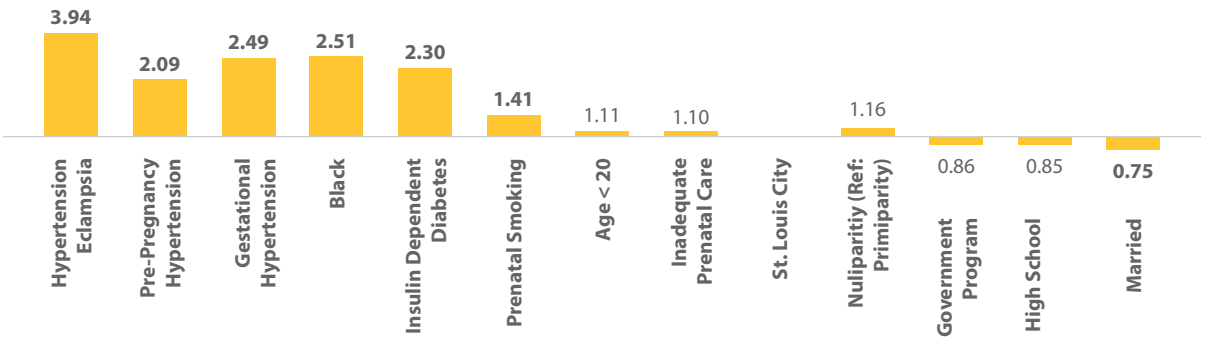
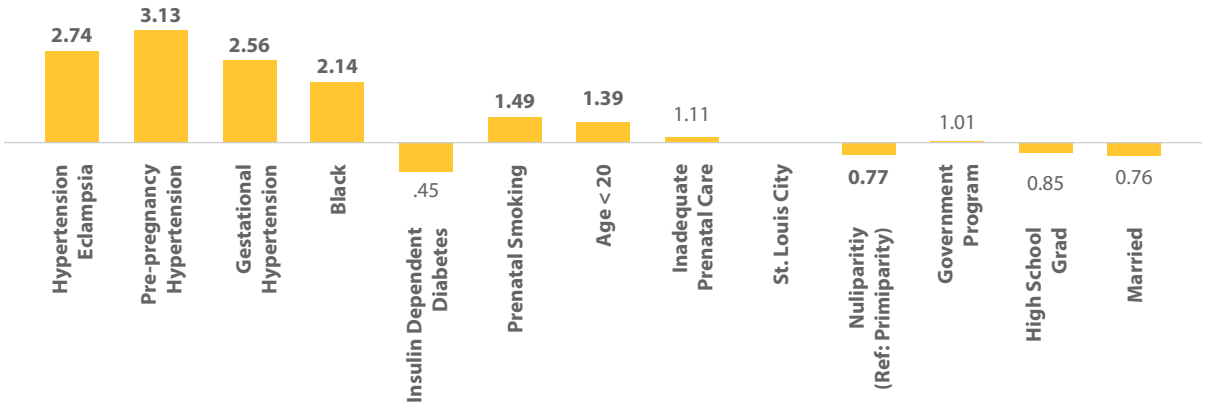


FIGURE 10: Adjusted odds ratios for risk and preventative factors for Very Low Birth Weight (aOR) among women in St. Louis City.

2010-2014: St. Louis City, MO | Per 1,000 live births, n=23,807 | Significance noted by bold aORs



Race Stratified Risk for Very Low Birth Weight (VLBW) (Black and White) Table 8 and Figures 11 and 12

White

Among White women, being married was associated with a 25% reduced risk for VLBW in reference with unmarried women (zOR 0.75, CI 0.56-0.99). Pre-pregnancy hypertension (aOR 2.97, CI 1.64-5.38), gestational hypertension (aOR 2.24, CI 1.547-3.20), and hypertension eclampsia (aOR 4.79, CI 2.64-8.72) were the significant predictors of VLBW births.

TABLE 8a: Adjusted odds ratios (AOR), 95% confidence intervals (CI), prevalence and population attributable risk percent (PAR%) for risk and preventive factors associated with very low birth weight.
2010-2014: St. Louis City and County, MO | By Race (Black and White), n=81,733 | Outcome is VLBW

Risk/Preventive Factors	AOR	95% CI	Prevalence	PAR%
White, non-Hispanic (n=42,113)				
County: St. Louis City (ref: County)	**1.02**	**0.80-1.31**	**0.20**	**-**
Maternal Age: < 20 (ref: 20-34)	0.96	0.52-1.76	0.03	-
Maternal Age: > 34 (ref: 20-34)	0.95	0.72-1.25	0.19	-
Maternal Education: < HS graduate (≥ HS graduate)	1.12	0.72-1.76	0.05	-
Married: Yes (ref: No)	**0.75**	**0.56-0.99**	**0.78**	**-24.22**
Government program: Yes (ref: No)	0.86	0.63-1.16	0.24	-
Prenatal Care: Inadequate (ref: else)	1.41	0.93-2.14	0.05	-
Previous live births: Nulliparous (ref: Primiparous)	0.98	0.77-1.25	0.44	-
Previous live births: Multiparous (ref: Primiparous)	0.98	0.74-1.30	0.23	-
Smoking during pregnancy: Yes (ref: No)	1.17	0.83-1.64	0.10	-
Insulin dependent diabetes: Yes (ref: No)	0.95	0.22-4.23	0.01	-
Other diabetes: Yes (ref: No)	0.82	0.54-1.55	0.04	-
Pre-pregnancy hypertension: Yes (ref: No)	**2.97**	**1.64-5.38**	**0.01**	**1.93**
Gestational hypertension: Yes (ref: No)	**2.24**	**1.57-3.20**	**0.04**	**4.73**
Hypertension eclampsia: Yes (ref: No)	**4.79**	**2.64-8.72**	**0.01**	**3.65**

* Bolded risk factors are significant at p<.05 a Prevalence of group of interest in subpopulation, denominator =subpopulation sample size

Black

For Black women, being under the age of 20 was a significant predictor of VLBW (aOR 1.30, CI, 1.05-1.61). Graduation from high school also significantly reduced a Black woman's risk for VLBW in reference to non-high school graduates (aOR 0.81, CI 0.67-0.97), as did being married (aOR 0.80, CI 0.66-0.98). Smoking during pregnancy was also a significant predictor of VLBW (aOR 1.56, CI 1.30-1.87), and with Black women smoking at significantly higher rates than White women, this accounted for almost 7% of the PAR for VLBW. Finally, pre-pregnancy hypertension (aOR 2.28, CI 1.69-3.08), gestational hypertension (aOR 2.45, CI 2.05-2.92), and hypertension eclampsia (aOR 3.15, CI 2.24-4.43) were significant predictors of VLBW for Black women.

TABLE 8b: Adjusted odds ratios (AOR), 95% confidence intervals (CI), prevalence and population attributable risk percent (PAR%) for risk and preventive factors associated with very low birth weight.
2010-2014: St. Louis City and County, MO | By Race (Black and White), n=81,733 | Outcome is VLBW

Risk/Preventive Factors	AOR	95% CI	Prevalence	PAR%
Black, non-Hispanic (n=31,065)				
County: St. Louis City (ref: County)	1.06	0.92-1.22	0.42	-
Maternal Age: < 20 (ref: 20-34)	**1.30**	**1.05-1.61**	**0.14**	**4.03**
Maternal Age: > 34 (ref: 20-34)	1.22	0.96-1.55	0.08	-
Maternal Education: < HS graduate (≥ HS graduate)	**0.81**	**0.67-0.97**	**0.20**	**-3.95**
Married: Yes (ref: No)	**0.80**	**0.66-0.98**	**0.20**	**-4.17**
Government program: Yes (ref: No)	1.03	0.79-1.35	0.88	-
Prenatal Care: Inadequate (ref: else)	1.06	0.89-1.26	0.21	-
Previous live births: Nulliparous (ref: Primiparous)	0.96	0.80-1.15	0.37	-
Previous live births: Multiparous (ref: Primiparous)	0.95	0.79-1.14	0.36	-
Smoking during pregnancy: Yes (ref: No)	**1.56**	**1.30-1.87**	**0.13**	**6.79**
Insulin dependent diabetes: Yes (ref: No)	1.53	0.88-2.65	0.01	-
Other diabetes: Yes (ref: No)	1.07	0.79-1.46	0.05	-
Pre-pregnancy hypertension: Yes (ref: No)	**2.28**	**1.69-3.08**	**0.03**	**3.70**
Gestational hypertension: Yes (ref: No)	**2.45**	**2.05-2.92**	**0.10**	**12.66**
Hypertension eclampsia: Yes (ref: No)	**3.15**	**2.24-4.43**	**0.01**	**2.10**

* Bolded risk factors are significant at p<.05 a Prevalence of group of interest in subpopulation, denominator =subpopulation sample size

FIGURE 11: Adjusted odds ratios for risk and preventative factors for Very Low Birth Weight (aOR) among white non-Hispanic women in St. Louis City.

2010-2014: St. Louis City and County, MO | White, Non-Hispanic, n=42,113 | Significance noted by bold aORs

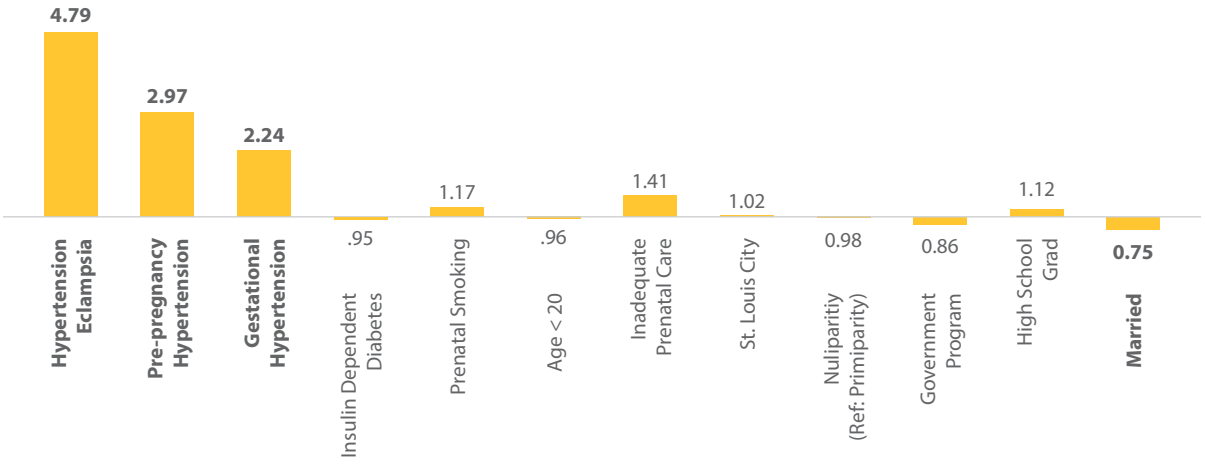
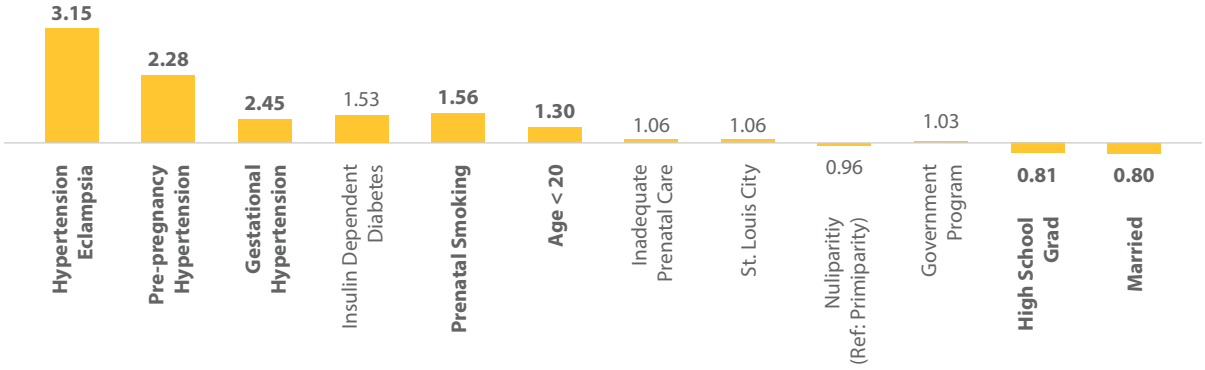


FIGURE 12: Adjusted odds ratios for risk and preventive factors for Very Low Birth Weight (aOR) among ,black non-Hispanic women in St. Louis City.

2010-2014: St. Louis City and County, MO | black, Non-Hispanic, n=31,065 | Significance noted by bold aORs



Excess Death in the Infant Health Category

A cause of Infant Health death (PPOR Category Infant Health death) analysis was also conducted among Black race and St. Louis City Infant Health deaths. Using the ICD-10 cause of death codes provided by the dataset and the categorization scheme proposed by the CDC Post-Neonatal Mortality Surveillance System, cause of death was coded into 7 categories: Perinatal Conditions, Congenital Anomalies, Infections, Injury, SUIDS, Ill-Defined, and Other (all else). Table 9 shows percent of deaths accounted for by each category of death cause.

TABLE 9: Underlying causes of Infant Health category death for target population groups, percent due to each cause of death category.
2010-2014: St. Louis City and County, MO | n=81,733

	Total Population		Black Race		St. Louis City		Internal Referent*	
Underlying cause of death	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Perinatal Conditions	2	1.7	1	1.3	1	1.9	1	3.6
Congenital Anomalies	25	21.0	14	17.9	11	20.8	8	28.6
Infections	5	4.2	3	3.8	1	1.9	1	3.6
Injury	25	21.0	17	21.8	9	17.0	4	14.3
SUIDS	48	40.3	35	44.9	23	43.4	9	32.1
Ill-defined	0	0.0	0	0.0	0	0.0%	0	0.0
Other	14	11.8%	8	10.3	8	15.1	5	17.9
All Cause, Infant Health Deaths	**119**		**78**		**53**		**28**	

* Referent: White, non-Hispanic, 20+ years of age; 13+ years of education (n=39,166)

Tables 10 and 11 show cause specific mortality rates for St. Louis City, Black, and internal referent populations (per 10,000 live births and fetal deaths). The internal reference population for this analysis was white, 20+ years old, and had 13+ years (at least a high school graduate) education. Excess rate and percent of excess rate were also calculated.

TABLE 10: Mortality and excess mortality rates (per 10,000 live births and fetal deaths) for Infant Health category deaths by underlying cause of death for the Black, non-Hispanic population.
2010-2014: St. Louis City and County, MO | Live births + fetal deaths, n=31,065

	Black Rate	Internal Ref. Rate	Escess Rate	% Overall Excess
Underlying Cause of Death				
Perinatal Conditions	0.3	0.3	0.1	0.4
Congenital Anomalies	4.5	2.0	2.5	13.7
Infections	1.0	0.3	0.7	4.0
Injury	5.5	1.0	4.5	24.8
SUIDS	11.3	2.3	9.0	49.9
Ill-defined	0.0	0.0	0.0	0.0
Other	2.6	1.3	1.3	7.2
All Causes	**25.1**	**7.1**	**18.0**	**100.0**

Rates are per 10,000 live births and fetal deaths for population of interest
* Referent: White, non-Hispanic, 20+ years of age; 13+ years of education (n=39,166)

TABLE 11: Mortality and excess mortality rates for Infant Health category deaths by underlying cause of death for the Black, non-Hispanic population.

2010-2014: St. Louis City and County, MO | Black, non-Hispanic, Per 10,000 live births and fetal deaths, n=31,065

	St. Louis City Rate	Internal Reference Rate*	Excess Rate	% Overall excess
Underlying Cause				
Perinatal Conditions	0.3	0.3	0.1	0.4
Congenital Anomalies	4.5	2.0	2.5	13.7
Infections	1.0	0.3	0.7	4.0
Injury	5.5	1.0	4.5	24.8
SUIDS	11.3	2.3	9.0	49.9
Ill-defined	0.0	0.0	0.0	0.0
Other	2.6	1.3	1.3	7.2
All Causes	**25.1**	**7.1**	**18.0**	**100.0**

Rates are per 10,000 liver births and fetal deaths for population of interest

* Referent: White, non-Hispanic, 20+ years of age; 13+ years of education (n=39,166)

FIGURE 13: Excess mortality in the Infant Health category among Black, non-Hispanic births.
2010-2014: St. Louis City and County | n=31,065

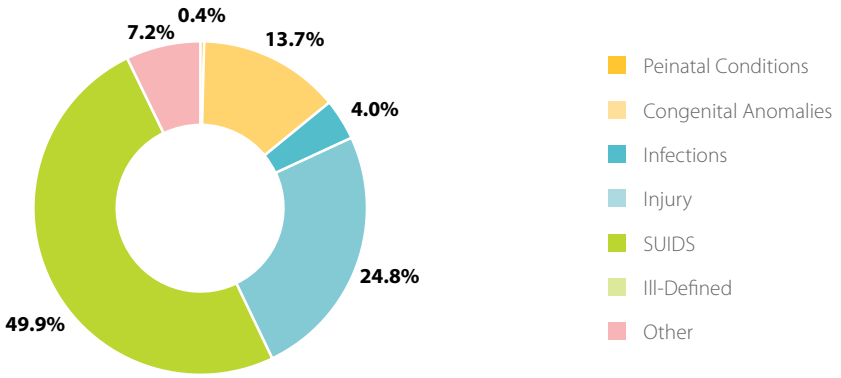
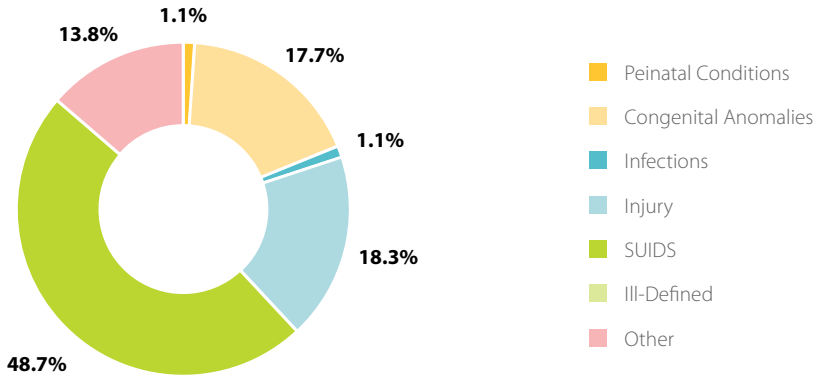


FIGURE 14: Excess mortality in the Infant Health categories.
2010-2014: St. Louis City | n=23,807



3 | Infant Health PPOR Sample

To determine which risk factors were most important in predicting neonatal mortality and post-neonatal mortality for White and Black only, we fit separate logistic regression models for each of the two infant outcomes (neonatal mortality and post-neonatal mortality) for the most recent five years of data used in the PPOR analysis.[32] Included in each initial model were the following potential risk factors: county of residence (St. Louis County, St. Louis City); race/ethnicity (White; Black); maternal age (<18, 18-34, >34 years); maternal education (<12 years, >12 years); paternal information not included; mother in 0, 1, 2, or 3 of 3 government assistance programs (WIC, Medicaid and food stamps); maternal cigarette use; prenatal care (adequate, inadequate and adequate plus); inadequate maternal weight gain for pre-pregnancy weight category (underweight, normal, overweight, and obese); gestational hypertension; hypertension eclampsia; gestational diabetes; and any sexually transmitted infection (STI) (Model 1). Adjusted odds ratios (aOR) were calculated for each risk factor, adjusting for the effects of all other factors simultaneously, along with their 95% confidence intervals (CI).

Sample and Calculations

The data presented here are based on a birth cohort, meaning all babies born in a year are matched case-by-case with death certificates for any babies who died within a year of birth. Records are available for St. Louis County and City births and fetal deaths from 2010-2014.

The sample for these calculations is restricted based on PPOR analytic restrictions: 1) Live births at least 500 grams; 2) Fetal deaths at least 500 grams and at least 24 weeks gestation; 3) Only plausible birth weight-gestational age combinations; and 4) Non-missing birth weight and gestational age. Final sample size is 81,515 live births and 218 fetal deaths (n=81,733 live births and fetal deaths). Only Black and White live births and fetal deaths are used for this analysis (n=73,178 live births and fetal deaths for Black and White mothers).

Mortality rates are presented as race-location specific rates. Black and White are both non-Hispanic. Groupings are: overall Black and White, White County, Black County, White City, and Black City. Mortality rates are calculated as "Birth Cohort Specific" rates. An example of what is meant as birth cohort specific mortality rate is presented below in the context of birth cohort specific infant mortality rate (IMR):

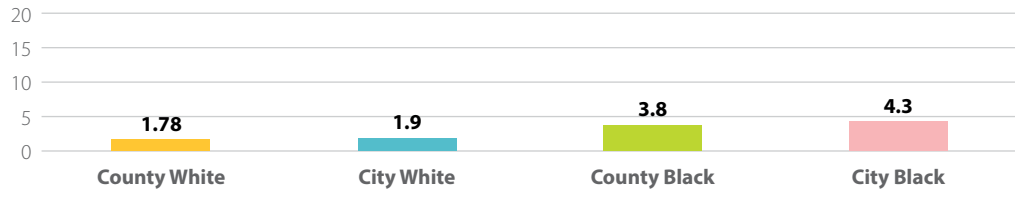
IMR for year Y = 1,000* (Babies born in Y that died in Y + babies born in Y that died in Y+1)/ Babies born in Y

Rates are presented per 1,000 live births (or live births + fetal deaths, where applicable). However, SGA is the only outcome represented as rate per 100. Risk factors were computed as the percentage of live births with the risk factor of interest. Crude and adjusted logistic regression models for Black and White mothers only were examined for neonatal mortality and post-neonatal mortality.

32 It is important to note that the Infant Health analysis was conducted in two ways, to be better aligned with the PPOR methodology (PPOR restricted analysis) as well as to be comparable to with the Flick-Leet Report of 2007 (unrestricted sample). To see more details regarding how restricted affected the sample, see Appendix D.

Infant Outcomes

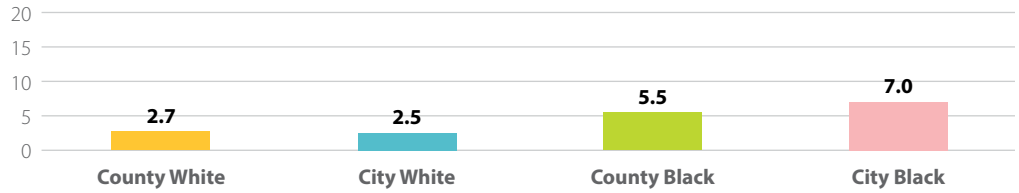
FIGURE 15: Fetal Mortality by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 1,000 live births plus fetal deaths, n=73,178 | Restricted PPOR sample



Fetal Deaths

Examining infant mortality without also looking at pregnancy loss prior to birth can present an incomplete picture, so we first examined trends in fetal deaths. These are deaths occurring at 24 or more weeks of gestation and prior to birth. Rates for White fetal deaths varied somewhat from period to period, but overall rates were fairly stable, with a slightly decreasing trend for the state (Figure 15). The rate for the most recent period (2010-2014) was small range for White pregnancies (1.2-2.6 per 1,000 live births plus fetal deaths). Black fetal deaths showed a slightly larger (2.4-4.8 per 1,000 live births plus fetal deaths). Racial disparities in fetal death rates were 2.2:1.0 overall.

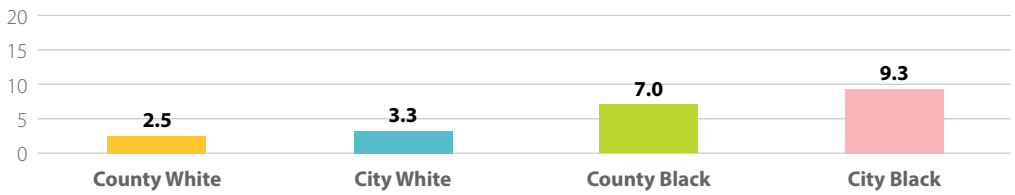
FIGURE 16: Perinatal Mortality by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 1,000 live births, n=72,977 | Restricted PPOR sample



Perinatal Mortality

Perinatal mortality rates provide a way to examine deaths that occur around the time of birth: deaths later in pregnancy (>28 weeks) and deaths within the first 6 days of life. White perinatal mortality has been fairly stable, although rates vary persistently by race/ethnicity. Black rates had a higher range (5.5-7.0 per 1,000 fetal deaths and live births). Racial disparities are 2.8:1.0 for the City, and 2.0:1.0 for the County. See Figure 16.

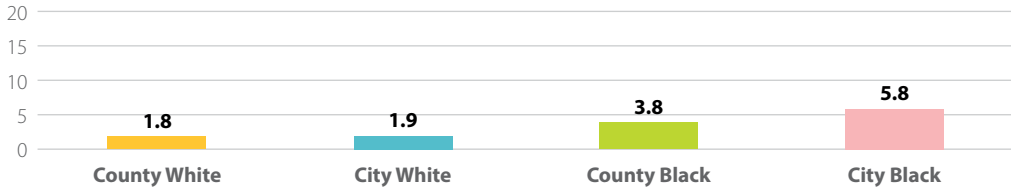
FIGURE 17: Infant Mortality by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 1,000 live births, n=72,977 | Restricted PPOR sample



Infant Mortality

Infant mortality rates are defined as death among live births during the first year of life. An important finding is that the overall disparity ratio is 3.0:1.0, although the infant mortality rate is lower for Black women in the County (7.0) than Black women living in the City (9.3). The infant mortality rate for White babies born in the County was 2.5 deaths per 1,000 live births, while the infant mortality for White babies in the City was 3.3 per 1,000 live births. See Figure 17.

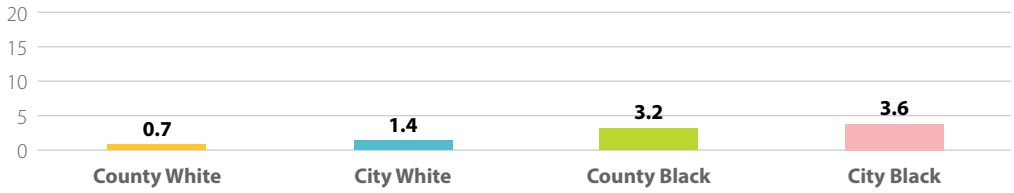
FIGURE 18: Neonatal Mortality by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 1,000 live births, n=72,977 | Restricted PPOR sample



Neonatal Mortality

Infant deaths were divided into neonatal and post-neonatal deaths to determine whether the observed pattern was attributable to infant deaths in the first month of life or to deaths occurring later. The neonatal mortality rate per 1,000 live births remains at a 2.5:1.0 disparity ratio overall, and a 3.0:1.0 disparity ratio in the City. For White babies born in the City, the neonatal mortality rate was 1.9 per 1,000 live births in contrast with 5.8 deaths per 1,000 live births for Black births in the City. See Figure 18.

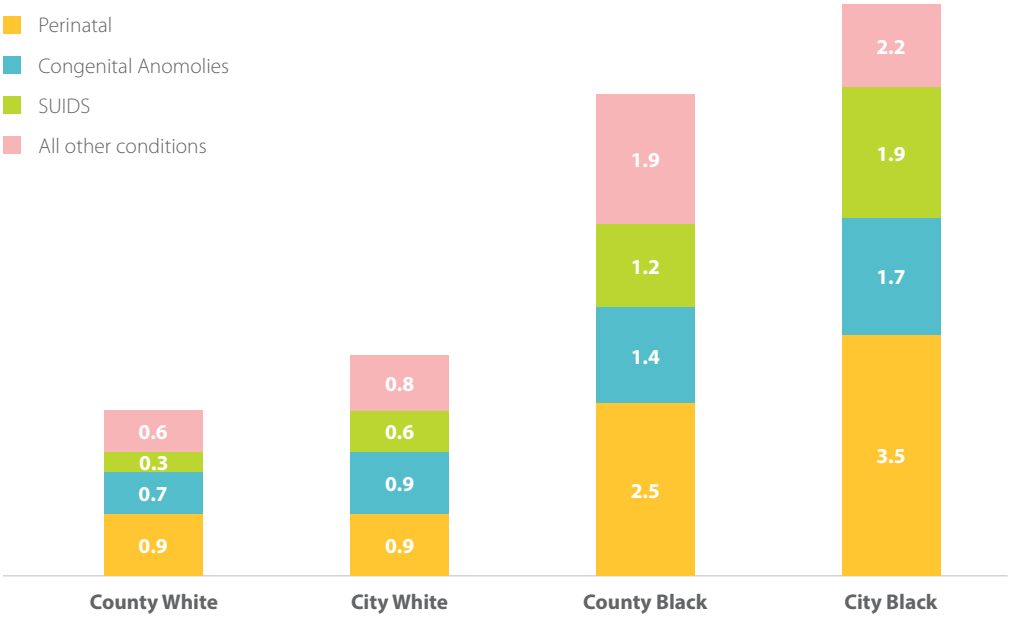
FIGURE 19: Post-Neonatal Mortality by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 1,000 live births, n=72,977 | Restricted PPOR sample



Post-Neonatal Mortality

Post-neonatal mortality rate has maintained an overall disparity ratio of 4.9:1.0, with a White rate in the County of 0.7 per 1,000 in contrast with a Black rate of 3.6 in the City. The disparity ratio was higher in the County (4.9:1.0) than the City (2.5:1.0). The rates were highest in the City, with White births at a rate of 1.4 and 3.6 for Black births. See Figure 19.

FIGURE 20: Cause of death, by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 1,000 live births, n=72,977 | Restricted PPOR sample



Infant Mortality Due to Perinatal Conditions

As one might expect, the infant mortality rate due to perinatal conditions resembles the neonatal mortality rate. The disparities of Black to White death rates for perinatal conditions was 3.3:1.0. See Figure 20.

Infant Mortality Due to Congenital Anomalies

Deaths of infants attributed to congenital anomalies appear fairly stable over the five-year time period under study. However, for Black infants, the rates are 1.4 deaths per 1,000 live births in the County and 1.7 deaths per 1,000 live births in the City. The disparity ratio is 2.0:1.0.

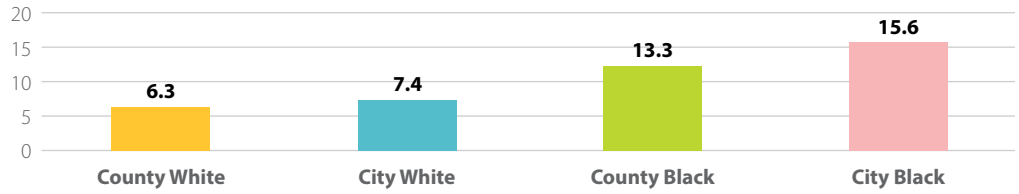
Infant Mortality Due to SUIDS

Deaths from SUIDS includes deaths due to SIDS, suffocation in the crib, and other unexplained deaths. Death rates from SUIDS for Black infants were at 1.2 per 1,000 live births in the County and 1.9 deaths per 1,000 live births in the City in contrast with 0.3 and 0.6, per 1,000 births for White births in the County and City, respectively. On average, racial disparities was at a rate of 4.2:1.0.

Infant Mortality Due to All Other Causes of Death

Deaths from all other causes have been fairly stable among White infants, with the rate among Black infants appearing to trend downward (per 1,000 live births: 3.0 deaths in 2010, 2.3 deaths in 2012, and 1.1 deaths in 2014). The racial disparity has been 3.2:1.0 during this overall time period.

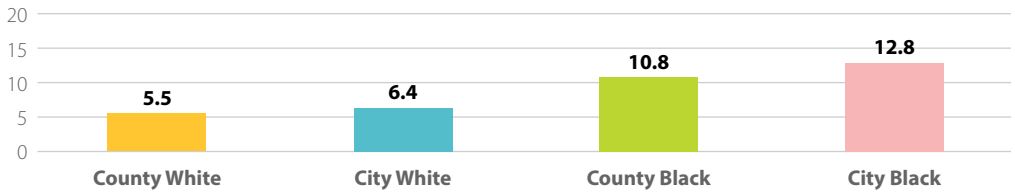
FIGURE 21: Low Birth Weight by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Low Birth Weight

Since low birth weight (defined as infants born weighing at least 500 grams and less than 2,500 grams) is a major contributor to infant mortality risk, the rates were calculated and plotted for low birth weight and then for two subcategories within the usual definition of low birth weight to see if there were differences between the subgroups. Black babies continue to be born at low birth weight twice as often as White infants, with rates slightly higher in the City. See Figure 21.

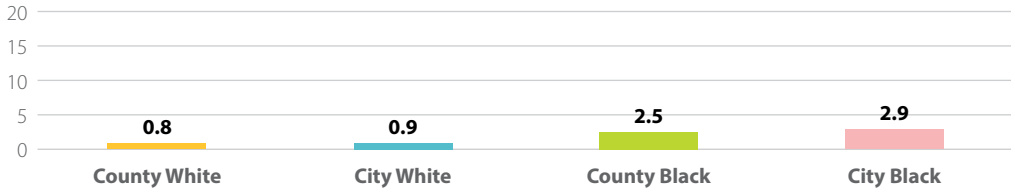
FIGURE 22: Moderately Low Birth Weight by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Moderately Low Birth Weight

Among infants born at moderately low birth weight (1,500 to 2,500 grams) the rates have remained fairly stable, with persistent Black to White disparities. This disparity remained at 1.8:1.0 over this time period, with slightly higher rates in the City than the County. See Figure 22.

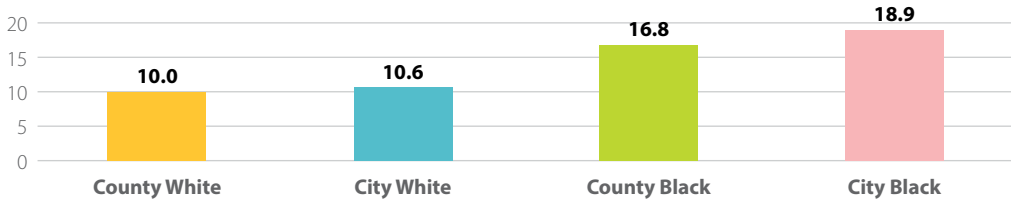
FIGURE 23: Very Low Birth Weight, by race and place, restricted sample
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Very Low Birth Weight

The rate of White infants born between 500 and 1,500 grams has remained fairly stable over the five-year time period under study. The Black to White disparities are 3.1:1.0 overall, with similar disparity rates in both the City and County. See Figure 23.

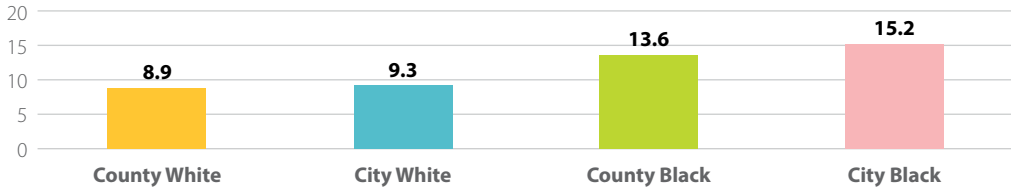
FIGURE 24: Preterm Delivery, by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Preterm Birth

Birth before 37 completed weeks of gestation has remained fairly stable over the time period of study. Among Black births, rates have remained persistently higher, with the average rate for Black births in the City at 18.9 per 100 live births in contrast with 10.6 among White births in the City. With the Black rates greater than White, racial disparities have persisted in both the City and County at 1.8:1.0 overall. See Figure 24.

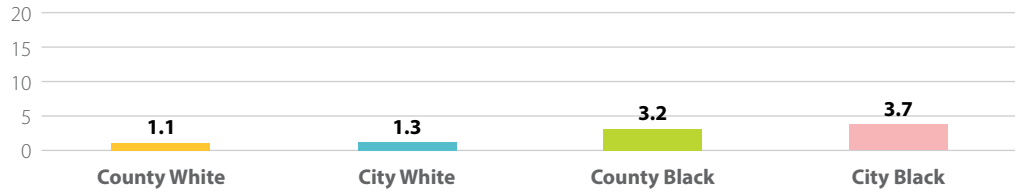
FIGURE 25: Preterm Delivery 32-36 weeks, by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Moderately Preterm Birth (32 to 36 weeks)

To explore differing patterns by race or locality, preterm birth was further divided into moderately preterm and very preterm. Moderately preterm mirrored trends over time displayed for the larger preterm birth category (>37 weeks) with fairly stable rates over time. Racial disparity persisted at a 1.6:1.0 ratio. See Figure 25.

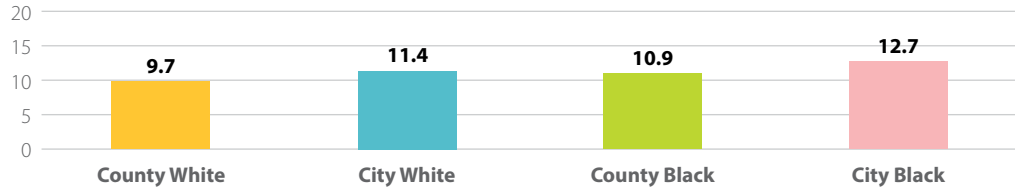
FIGURE 26: Preterm Delivery <32 weeks, by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Very Preterm Birth (<32 weeks)

For Whites, the rate of preterm births was slightly higher than 1 per 100 births in both the City and County. Among Black births, the rates are three times the White rates, in both the City and the County. Racial disparities have been fairly persistent over time at a ratio of 3.1:1.0. See Figure 26.

FIGURE 27: Small for Gestational Age, by race and place, restricted sample.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



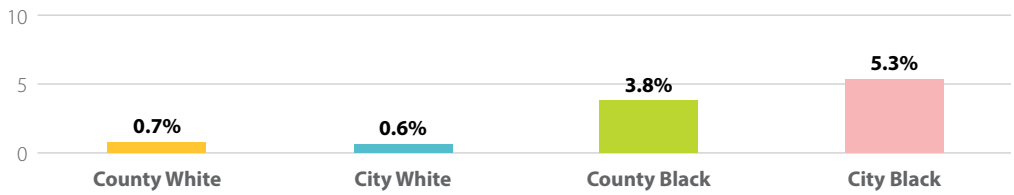
Small for Gestational Age

Infants who are born small for gestational age (SGA) are assumed to have had restricted growth in utero. They are at greater risk of morbidity and mortality than infants whose growth had been within normal bounds. In all groups monitored, the prevalence of SGA births has been fairly stable. There is little difference by race in this outcome. The lowest prevalence was among White women in the County, at 9.7% of live births. Black births are similar in the City and County (10.9% and 12.7% respectively). The disparity ratio was about 1.2:1.0. See Figure 27.

Risk Factors

Tracking factors known or suspected to be associated with adverse pregnancy outcomes and infant mortality allow us to spot changes in communities that may precede important changes in morbidity and mortality.

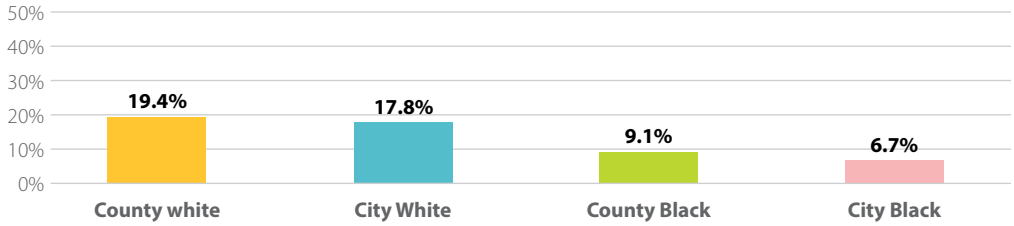
FIGURE 28: Very Low Birth Weight, by race and place restricted sample.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Percent of Births to Mothers Under Age 18

(Note: This is not a true rate since it is affected by the number of older mothers who give birth in each year.) The percent of White women giving birth who are under the age of 18 is 0.7% while the percent of Black women giving birth who are under the age of 18 is 4.4%. Racial disparities are high in the City (8.8:1.0) and County (5.6:1.0). See Figure 28.

FIGURE 29: Proportion of women that were 35 years older, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample

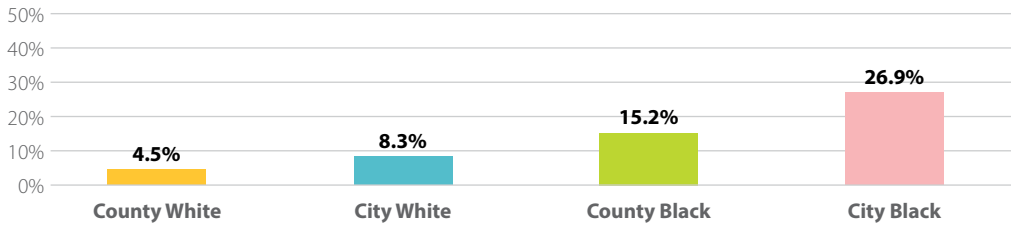


Maternal Age Over 34 Years

Older maternal age is associated with higher rates of Down's Syndrome and complications of pregnancy and birth (CDC, 1994). Older age at first and subsequent births is also associated with higher education and greater affluence. In our data, while 6-7% of Black births are to women over the age of 34, the percent is more than twice as high for White women (17-19%). The percent of births that are to women over the age of 34 is slightly higher in the County, than in the City, with a disparity ratio of 0.4:1.0. See Figure 29.

FIGURE 30: Proportion of women that did not graduate from High school, by race and place.

2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample

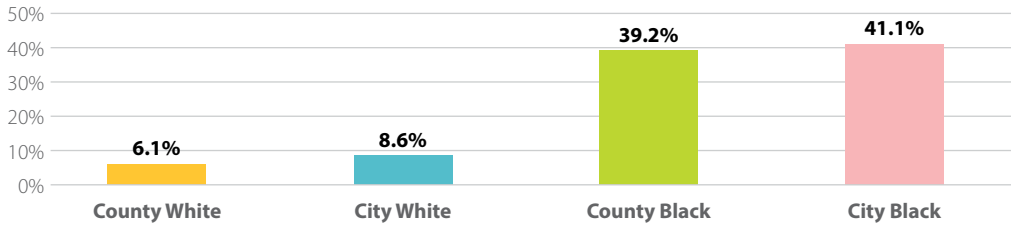


Mothers Not Completing High School

The education level of women is considered a key health indicator for populations worldwide. Our sample showed that fewer White women (4-8%) did not complete high school than Black women (15-27%), with a disparity ratio of 3.8:1.0. Rates were higher than 1 in 4 among Black women living in the City. See Figure 30.

FIGURE 31: Percent of birth certificates with paternity not acknowledged, by race and place.

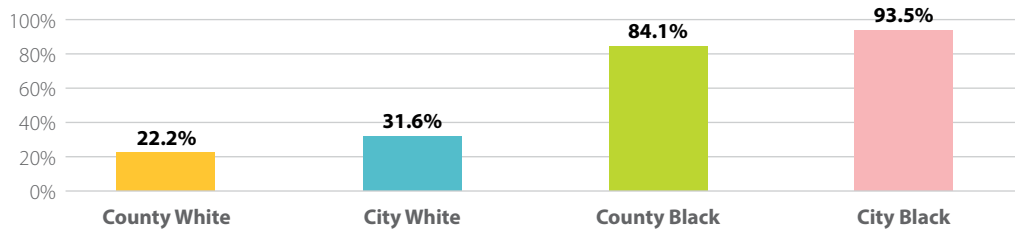
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



No Paternal Information on the Birth Certificate

Several studies have shown that infant mortality occurs more frequently when the paternal information on the birth certificate is not completed. As Figure 31 shows, Black rates are considerably higher than the White rates. Racial disparity is highest in the County (6.5:1.0), followed by the City (1.6:1.0).

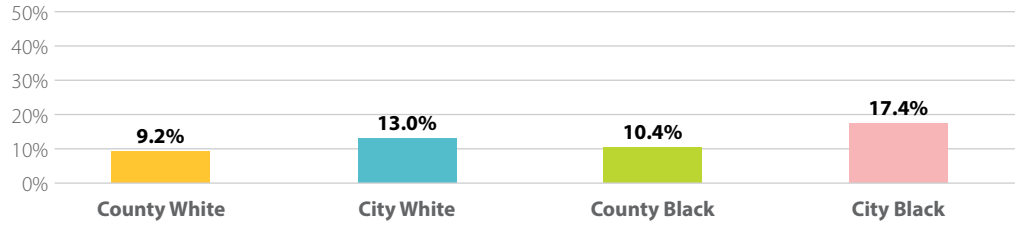
FIGURE 32: Maternal participation in government programs by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Participation in 1 of 3 Government Assistance Programs

There are three poverty assistance programs (Medicaid, WIC or Food Stamps), that have historically been shown to reduce the risk of having an infant die in the first year of life. As shown in Figure 32, on average, Black women have a higher participation in government assistance programs overall. Within each racial/ethnic category, participation is slightly lower in the County than the City. White women in the County reported the lowest utilization of a government program (22.2%), followed by White women in the City (31.6%). The rate among Black women in the County was 84.1% and in the City at 93.5%. The fact that close to 100% of Black women in the City are using poverty assistance is an indication of widespread distress. The disparity ratio is 3.6:1.0.

FIGURE 33: Maternal Cigarette use, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample

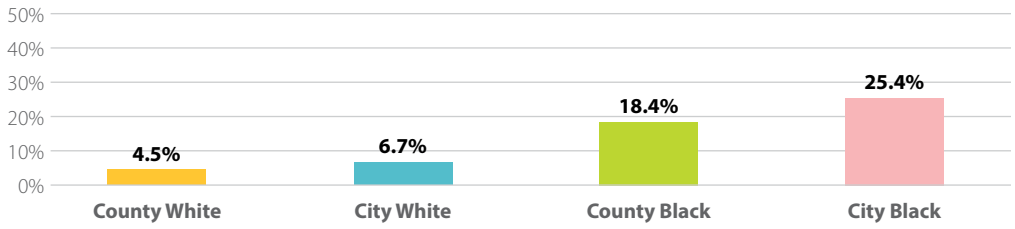


Maternal Cigarette Use

Tobacco use in pregnancy is considered the single most important modifiable risk factor in pregnancy.[33] Historically, tobacco use among Missouri Black pregnant women of childbearing age has been low and rates for White women much higher.[34] However, this trend has changed, and on average, 13.3% of Black women reported smoking during pregnancy in contrast with 9.9% of White women. Rates are highest in the City, with 17.4% of Black women and 13.0% of White women reporting smoking. The disparity ratio is approximately 1.3:1.0. See Figure 33.

33 CDC, 2004
34 Land & Stockbauer, 1993; Flick et al., 2006

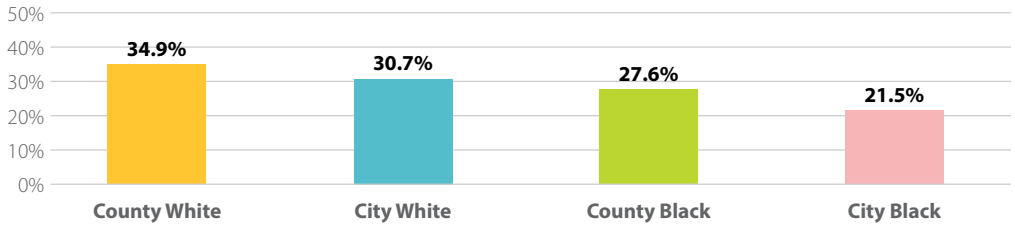
FIGURE 34: Inadequate prenatal care, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Inadequate Prenatal Care Utilization

Inadequate prenatal care utilization has been associated with higher rates of preterm birth, low birth weight and infant mortality.[35] In the County and City, rates of inadequate prenatal care were at 4.9% for White women and 21.3% for Black women. While the disparity ratio is highest in the County (4.1:1.0), the rates are highest in the City, at 6.7% for White births and 25.4% for Black births. See Figure 34.

FIGURE 35: Adequate Plus prenatal care, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample

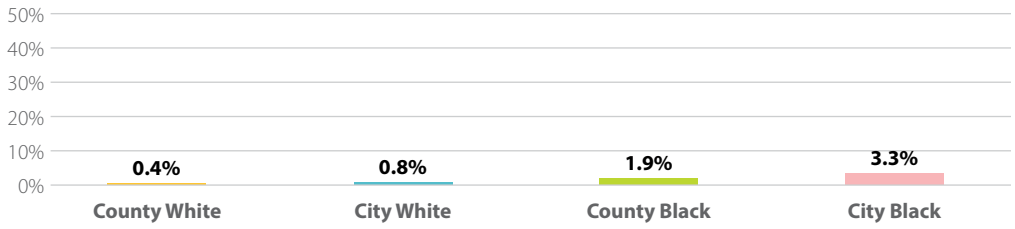


Adequate Plus Prenatal Care Utilization

This category on the Kotelchuck prenatal care index[36] identifies cases where the mothers total number of prenatal care visits exceed those recommended for the length of gestation at delivery. These pregnancies are assumed to have been identified prenatally as medically complicated and, therefore, to require more frequent medical supervision. Even with more prenatal visits, the expectation is that complicated pregnancies would have poorer birth outcomes than uncomplicated pregnancies. Rates have increased steadily for White women in Missouri and for both race groups in the County. Among both race groups in the City and for Blacks in the state, rates hit a peak in 1997-1998 and then leveled off or increased only slightly thereafter. In the Flick-Leet report of 2007,[37] Black women in the County showed the highest rates of this characteristic at 48.5% with all other groups having from 42-44% of pregnancies receiving adequate plus prenatal care. As shown in Figure 35, data for 2010-2014 shows Black women in the City with a rate of 21.5% in contrast with 34.9% for White women in the County. This indicator shows a reverse disparity ratio of 0.7:1.0, when comparing Black to White rates.

35 CDC, 1994
36 1994
37 Data 2003-2004

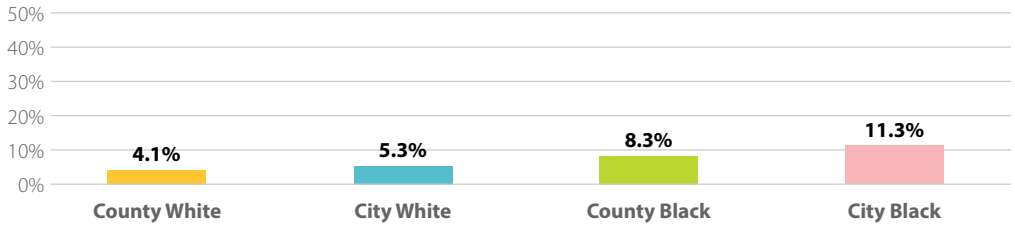
FIGURE 36: No prenatal care, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



No Prenatal Care

Women who receive no prenatal care have higher rates of complications and adverse outcomes than women in care. While the majority of this effect is due to social risks associated with women who do not enter care (greater likelihood of drug use, very young age, high parity, or women in chaotic social circumstances) some of the effect is due to not receiving the early detection and preventive services in prenatal care.[38] Rates of receiving no prenatal care are usually quite low, but are important because of the strong association with poor birth outcomes and infant mortality. Rates of receiving no prenatal care have remained stable since 2003 in both the County and City, with rates for White women at 0.4% and 0.8%, respectively, in contrast with rates for Black women at 1.9% and 3.3%, respectively. The disparity ratio has remained very stable between the Black and White rates, with the City at 5.2:1.0, and the County at 3.9:1.0. See Figure 36.

FIGURE 37: Gestational Hypertension, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample

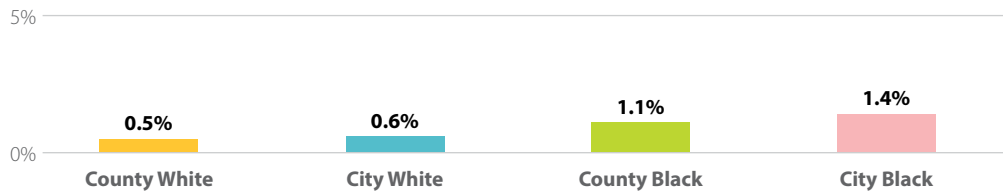


Gestational Hypertension

Gestational hypertension is usually defined as having a blood pressure higher than 140 over 90 measured at two different time points and more than 6 hours apart, without the presence of protein in the urine, and diagnosed after 20 weeks of gestation.[39] Risk factors include obesity, advanced maternal age, teen-aged, and history of gestational hypertension, which underscores the importance of reducing maternal risk and environmental stress before entering pregnancy. In our analysis, 11.3% of Black women in the City had gestational hypertension in comparison with 8.3% in the County. The rate for White women in the City was 5.3% in comparison with 4.1% in the County. The disparity ratio was fairly stable between places, at 2.2:1.0. See Figure 37.

38 CDC, 1994
39 Lo, Mission, & Caughey, 2013

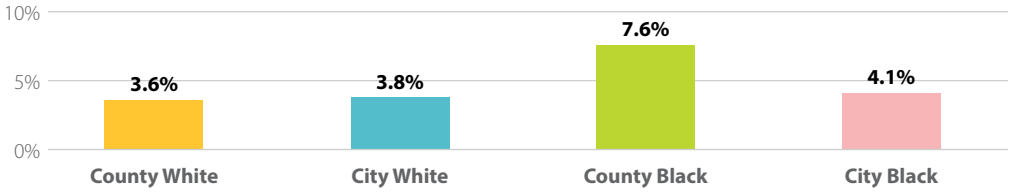
FIGURE 38: Hypertension eclampsia, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Hypertension Eclampsia

Eclampsia is the onset of seizures in women with pre-eclampsia, which is a disorder of pregnancy in which there is high blood pressure and either larger amounts of protein in the urine or other organ dysfunction.[40] While the rates are low in our community, at 1.4% of births to Black women in the City and 1.1% of Black women in the County, the disparities persist within in this indicator as well, at 2.3:1.0. See Figure 38.

FIGURE 39: Gestational Diabetes Mellitus (GDM).
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample

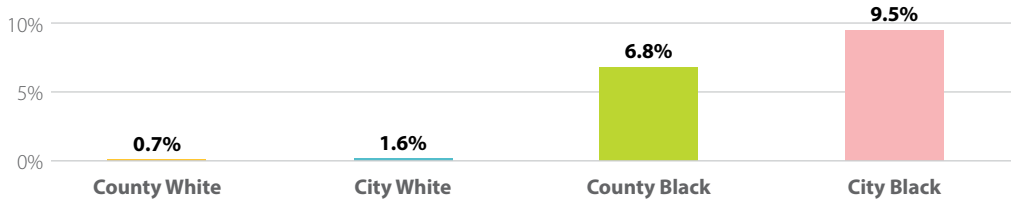


Gestational Diabetes Mellitus (GDM)

Most women are tested for gestational diabetes at 24 to 28 weeks of pregnancy as part of standard prenatal care. Chances for developing gestational diabetes are higher among overweight women, with a history of GDM, having given birth to a baby weighing more than 9 pounds, pre-diabetes, and Black and Hispanic women according to the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). Chances of developing GDM are reduced by losing extra weight and increasing physical activity before pregnancy.[41] See Figure 39.

40 ACOG, 2013
41 NIDDK, 2013

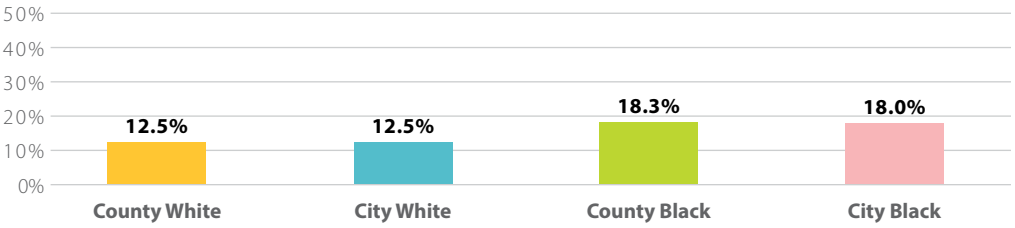
FIGURE 40: Any STI, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Any Sexually Transmitted Infection (STI)

The percentage of mothers with any STI present and/or treated during pregnancy (i.e., gonorrhea, syphilis, chlamydia, hepatitis b or c, HIV) is an important consideration of health during pregnancy. If a woman is pregnant and has an STI, it can cause serious effects on the mother and developing baby. Importantly, chlamydia, gonorrhea and syphilis can be treated and cured safely during pregnancy. Hepatitis B or HIV cannot be cured, but with proper prenatal care treatment and monitoring, the potential detrimental complication can reduce the risk of passing the infection to the baby.[42] Of all the indicators explored, this indicator had the highest disparity ratio of 9.2:1.0 overall, and at 10.0:1.0 in the City. Black women in the County had an STI percentage of 6.8%, going up to 9.5% in the City. The rate for White women was 0.7% in the County and 1.6% in the City. See Figure 40.

FIGURE 41: Inadequate weight gain, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample

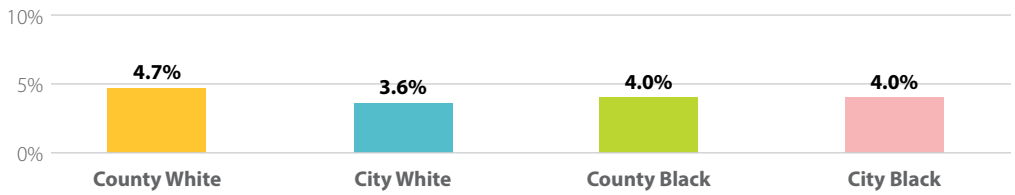


Inadequate Gestational Weight Gain (Under Gain)

The amount of weight gained during pregnancy has an impact on the pregnant woman and her infant, and thus is an important indicator of health on the causal pathway between pregnancy and healthy birth outcomes. Given changes in the proportion of women who are entering pregnancy within the overweight and obese risk categories, weight gain guidelines now are tiered according to BMI: underweight (BMI less than 18.5) recommended weight gain range of 28-40 lbs.; normal weight (BMI 18.5-24.9) recommended range of 25-35 lbs.; overweight (BMI 25-29.9) recommended range of 15-25 lbs., and overweight (BMI 30 and greater) recommended weight gain of 11-20 lbs.[43] The highest proportion of women with inadequate weight gain are Black women (18.0-18.3%) and lowest are White women (12.5%). The disparity ratio is 1.5:1.0. See Figure 41.

42 CDC, 2016
43 ACOG, 2015

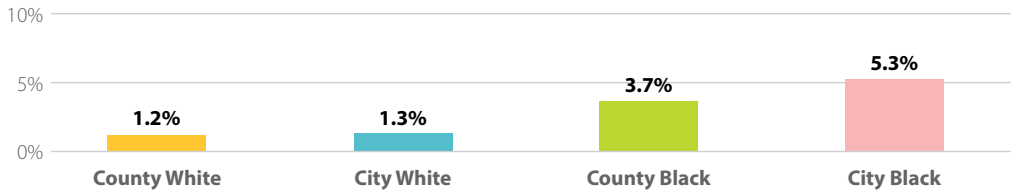
FIGURE 42: Multiple gestations, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Multiple Gestations

Twin, triplet and higher order multiple births increase the likelihood of giving birth preterm, or to a small infant, which increases the risk of infant mortality. For White women in the County, the 2003-2004 rate (4.8% of live births) was 46% higher than the rate observed in 1989-1990 (3.3% of live births). The current 2010-2014 rate is 4.7% among White women in the County and 3.6% of White women in the City, rates which have remained stable. Rates among Black women in the County and City remained stable and comparative at 4.0%. The overall disparity ratio was 0.9:1.0. See Figure 42.

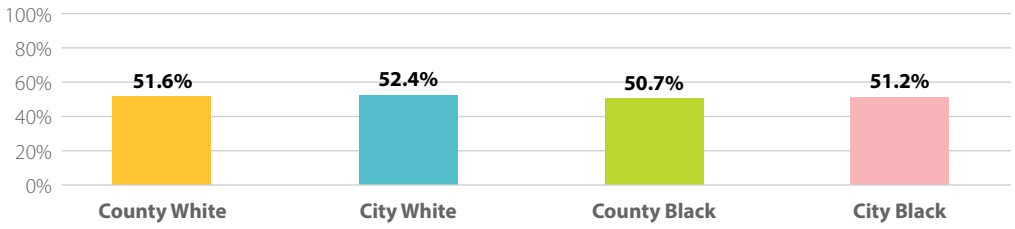
FIGURE 43: Parity is five or more, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Five or More Prior Live Births

Few women report having had five or more prior live births, but high parity is associated with poor birth outcomes and greater mortality risk to the infant. In Missouri, rates for White women were 1.1% in 1989-1990 and 1.5% in 2003-2004. Among White women in the County and City, the 2010-2014 rates are 1.2% and 1.3%, respectively. Among Black mothers in the City, 5.3% reported 5 or more prior live births, and in the County, it was 3.7%. The disparity ratios are 3.5:1.0. See Figure 43.

FIGURE 44: Male infant gender, by race and place.
2010-2014: St. Louis City and County, MO | Per 100 live births, n=72,977 | Restricted PPOR sample



Infant Gender Male

Infant mortality is higher in boys than girls in most parts of the world,[44] which is largely explained by genetic and biologic differences.[45] In our study, there was no statistically significant difference in the distribution of male infants by race or place. See Figure 44.

John Snow's Water Pump
An iconic image in Epidemiology

Epidemiologic Study of Risk Factors for Infant Mortality. (2010-2014)

To determine which risk factors were most important in predicting neonatal mortality and post-neonatal mortality in the City and County, we fit separate logistic regression models for each of the two infant outcomes (neonatal and post-neonatal mortality). Included in each initial model were the following potential risk factors: maternal age (<18, 18-35, >35 years), maternal education (<12 years, >12 years), paternal information not included, mother in 0, 1, 2, or 3 of 3 government assistance programs (WIC, Medicaid and Food Stamps). Maternal cigarette use, prenatal care (adequate, inadequate and adequate plus), inadequate (under gaining) maternal weight gain for pre-pregnancy weight BMI category (underweight, normal, overweight, obese), gestational hypertension, hypertension eclampsia, gestational diabetes, an STI, prior live births ≥5, multiple gestations, male gender infant, gestational age (<29, 29-32, 33-36, 37-41, >41), and small for gestational age were all included in the adjusted model.[46] Adjusted odds ratios (aOR) were calculated for each risk factor, adjusting for the effects of all other factors simultaneously, along with their 95% confidence intervals (CI).[47]

44 NVSR, 2013
45 Pongou, 2013
46 Fully adjusted model
47 Tables 12 and 13

Neonatal Mortality

Table 12 shows both crude and fully adjusted risks for neonatal mortality.

TABLE 12: Neonatal mortality prenatal risk factors - distribution and logistic regression, all live births at least 500g for White and Black only.
2010-2014 | n=72,977

	Controls (n=72,756)	Neonatal Mortality (n=221)	Crude Associations	Fully Adjusted Model
Maternal Risk Factors	**n (%)**	**n (%)**	**cOR (95%CI)**	**aOR (95% CI)**
County of residence				
St. Louis County	51,536 (70.8)	131 (59.3)	1.00	1.00
St. Louis City	21,220 (29.2)	90 (40.7)	**1.68 (1.29-2.20)**	1.13 (0.84-1.52)
Race/ethnicity				
White	41,959 (57.7)	78 (35.3)	1.00	1.00
Black, non-Hispanic	30,797 (42.3)	143 (64.7)	**2.48 (1.88-3.27)**	0.99 (0.67-1.46)
Age (years)				
< 18	1,631 (2.2)	6 (2.7)	1.19 (0.53-2.68)	0.67 (0.27-1.68)
18-34	60,603 (83.3)	189 (85.5)	1.00	1.00
> 34	10,518 (14.5)	26 (11.8)	0.80 (0.53-1.20)	1.02 (0.66-1.59)
Education < high school graduate	8,376 (11.5)	45 (20.4)	**2.02 (1.45-2.80)**	1.22 (0.82-1.81)
No paternal acknowledgment	16,254 (22.3)	99 (44.8)	**2.84 (2.17-3.70)**	1.41 (1.01-1.97)
Enrollment in poverty programs (WIC, Food Stamps, Medicaid)				
0 of 3 programs	35,474 (48.8)	65 (29.4)	1.00	1.00
1 of 3 programs	7,949 (10.9)	32 (14.5)	**2.23 (1.46-3.41)**	0.97 (0.59-1.61)
2 of 3 programs	12,775 (17.6)	51 (23.1)	**2.21 (1.53-3.20)**	0.91 (0.56-1.48)
3 of 3 programs	16,482 (22.7)	73 (33.0)	**2.46 (1.75-3.44)**	1.05 (0.66-1.68)
Cigarette use	8,262 (11.4)	47 (21.3)	2.16 (1.56-2.99)	1.31 (0.90-1.89)
Prenatal Care				
Inadequate	8,614 (11.8)	45 (20.4)	**3.41 (2.29-5.07)**	1.15 (0.73-1.79)
Intermediate/adequate	34,546 (47.5)	53 (24.0)	1.00	1.00
Adequate Plus	21,999 (30.2)	76 (34.4)	**2.25 (1.59-3.20)**	0.91 (0.62-1.34)
Inadequate weight gain	10,817 (14.9)	48 (21.7)	**1.63 (1.18-2.26)**	1.14 (0.81-1.61)
Gestational hypertension	4,750 (6.5)	23 (10.4)	**1.67 (1.08-2.58)**	0.82 (0.51-1.32)
Hypertension eclampsia	584 (0.8)	5 (2.3)	**2.88 (1.18-7.00)**	0.69 (0.26-1.83)
Gestational diabetes	2,897 (4.0)	10 (4.5)	1.03 (0.53-2.01)	0.80 (0.40-1.63)
Any STI	2,805 (3.9)	11 (5.0)	1.31 (0.72-2.41)	0.78 (0.41-1.49)

TABLE 12 (CONTINUED): Neonatal mortality prenatal risk factors — distribution and logistic regression, all live births at least 500g for White and Black only.
2010-2014 | n=72,977

	Controls (n=72,756)	Neonatal Mortality (n=221)	Crude Associations	Fully Adjusted Model
Fetal Risk Factors				
Prior live births ≥ 5	1,858 (2.6)	11 (5.0)	**2.01 (1.09-3.69)**	1.21 (0.63-2.35)
Multiple gestations	3,086 (4.2)	36 (16.3)	**4.42 (3.09-6.33)**	1.10 (0.74-1.64)
Male gender	37380 (51.4)	126 (57.0)	1.27 (0.97-1.66)	1.45 (1.09-1.92)
Gestational age (weeks)				
< 29	647 (0.9)	100 (45.3)	**151.61 (109.07-210.73)**	**160.39 (108.76-236.52)**
29-32	1,285 (1.8)	19 (8.6)	**14.51 (8.64-24.38)**	**13.39 (7.74-23.13)**
33-36	7,643 (10.5)	35 (15.8)	**4.49 (2.96-6.82)**	**4.14 (2.66-6.46)**
37-41	58,860 (80.9)	61 (27.6)	1.00	1.00
> 41	4,321 (5.9)	6 (2.7)	**1.36 (0.59-3.15)**	1.25 (0.54-2.90)
Small for gestational age	7,765 (10.7)	51 (23.1)	**2.46 (1.79-3.38)**	**3.98 (2.78-5.70)**

cOR = crude odds ratio, aOR=adjusted odds ratio, CI=confidence interval; Significant odds ratios bolded

Maternal Risk Factors: Crude Associations

When evaluating the crude associations, we found that infants born in the County had a 68% increased odds to die in their first 30 days of life in comparison to infants born in the City (cOR 1.68, CI 1.29-2.20). Black infants had a 2.48 increased odds when compared with White infants (cOR 2.48, CI 1.88-3.27). Mothers who did not graduate from high school had a 2.02 increased odds for neonatal mortality (cOR 1.45-2.80) for neonatal mortality. Among mothers who were enrolled in at least one (cOR 2.23, CI 1.46-3.41) of the three poverty programs (WIC, Medicaid and Food Stamps), those who were enrolled in two of the three (cOR 2.2.21, CI 1.53-3.20) and those enrolled in all three (aOR 2.46, CI 1.75-3.44) infants had greater risk of death than infants whose mothers were not enrolled in any programs.

We found no progressive protective effect from being enrolled in these government assistance programs, as the confidence intervals between the number of programs overlapped, suggesting we are 95% confident that there is no difference in the odds of neonatal death based upon number of programs enrolled. This suggests that it may be poverty that puts women in excess risk for neonatal mortality. Cigarette use also predicted a twofold greater risk of neonatal death (aOR 2.16, CI 1.56-2.8). Inadequate prenatal care utilization reached significance for neonatal mortality (cOR 3.41, CI 2.29-5.07), as did adequate

plus prenatal care utilization (cOR 2.25, CI 1.59-3.20). Women who did not attend the recommended number of prenatal visits had a 3.4 increased odds for neonatal mortality in reference with women who had the recommended number of visits. Women who attended more than the standard recommendation for the number of prenatal visits had more than twice the risk of a neonatal death than women with the recommended number of visits. These women are assumed to have medical complications of pregnancy warranting greater medical surveillance, so would be expected to have poorer infant outcomes despite more than adequate care utilization. In addition, women whose weight gain in pregnancy fell below the recommended level for her pre-pregnancy BMI were 1.6 times (CI 1.18-2.26) more likely to lose their infant within a month of birth. Gestational hypertension (cOR 1.67, CI 1.08-2.58) and hypertension eclampsia (cOR 2.88, CI 1.18-7.00) were also significant predictors of neonatal mortality while gestational diabetes (cOR 1.03, CI 0.53-2.01) and having an STI (cOR 1.31, CI 0.72-2.41) were not.

Fetal Risk Factors: Crude Associations

Having at least five prior births resulted in a twofold increase in the risk for neonatal mortality in comparison with women who had four or less births (cOR 2.01, CI 1.09-3.69). Multiple gestations (cOR 4.42, CI 3.09-6.33) resulted in over fourfold increased odds for neonatal mortality in reference with singleton births. The effect of gestational age on neonatal mortality was proportional with the earliness of gestation, with babies born at <29 weeks at a 152-fold increased odds for neonatal mortality (cOR 141.61, CI 109.047-210.73), babies born at 29-32 weeks gestation at a 15-fold increased odds (cOR 14.51, CI 8.64-24.38), babies born at 33-36 at an almost fivefold increased odds (cOR 4.49, CI 2.96-6.82), babies born at more than 41 weeks at a 1.4 increased odds (cOR 1.36, CI 0.59-3.15), and babies born at small for gestational age at a 2.5 increased odds for neonatal mortality (cOR 2.49, CI 1.79-3.38), in reference with full term of size of age infants respectively.

Maternal and Fetal Risk Factors: Fully Adjusted Associations

In the fully adjusted model, only four variables remained significant predictors of neonatal mortality. These include paternity acknowledgement, male gender, gestational age and small for gestational age. Infant survival is predicated on size and gestation, and influenced by gender, which can readily explain the persistent risk for neonatal death associated with weight, age and gender. It is notable, however, that even after adjusting for all other variables under study, not having the father acknowledged on a birth certificate is associated with a 41% increased odds (aOR 1.41, 1.01-1.97) for neonatal death. Acknowledgement of the father on the birth certificate may be proxy for social support and stability, which when lacking may be on the causal pathway towards infant survival.

Post-neonatal Mortality

Table 13 provides the crude and adjusted associations between maternal and infant risk factors for babies who lived through their first month of life, but died before their first birthday (i.e., the post-neonatal period).

TABLE 13: Post-Neonatal mortality prenatal risk factors - distribution and logistic regression, all live births at least 500g for White and Black only.
2010-2014 | n=72,977

	Controls (n=72,839)	Post-Neonatal Mortality (n=138)	Crude Associations	Fully Adjusted Model
Maternal Risk Factors	**n (%)**	**n (%)**	**cOR (95%CI)**	**aOR (95% CI)**
County of residence				
St. Louis County	51,587 (70.8)	80 (58.0)	1.00	1.00
St. Louis City	21,252 (29.2)	58 (42.0)	**1.76 (1.26-2.47)**	1.06 (0.74-1.53)
Race/ethnicity				
White	42,003 (57.7)	34 (24.6)	1.00	1.00
Black, non-Hispanic	30,836 (42.3)	104 (75.4)	**4.17 (2.83-6.14)**	**2.37 (1.44-3.91)**
Age (years)				
< 18	1,633 (2.2)	4 (2.9)	1.22 (0.45-3.30)	0.85 (0.29-2.52)
18-34	60,670 (83.3)	122 (88.4)	1.00	1.00
> 34	10,532 (14.5)	12 (8.7)	0.57 (0.31-1.03)	0.80 (0.43-1.48)
Education < high school graduate	8,392 (11.5)	29 (21.0)	**2.04 (1.35-3.07)**	0.95 (0.60-1.52)
No paternal acknowledgment	16,296 (22.4)	57 (41.3)	**2.56 (1.82-3.61)**	1.09 (0.74-1.61)
Enrollment in poverty programs (WIC, Food Stamps, Medicaid)				
0 of 3 programs	25,511 (48.7)	28 (20.3)	1.00	1.00
1 of 3 programs	7,968 (10.9)	13 (9.4)	**2.07 (1.07-4.00)**	0.92 (0.45-1.87)
2 of 3 programs	12,783 (17.6)	43 (31.2)	**4.27 (2.65-6.87)**	1.45 (0.80-2.63)
3 of 3 programs	16,502 (22.7)	53 (38.4)	**4.07 (2.58-6.44)**	**1.27 (0.70-2.32)**
Prenatal Care				
Inadequate	8,635 (11.9)	24 (17.4)	**2.67 (1.59-4.48)**	1.02 (0.59-1.76)
Intermediate/adequate	34,563 (47.5)	36 (26.1)	1.00	1.00
Adequate Plus	22,028 (30.2)	47 (34.1)	**2.05 (1.33-3.16)**	1.39 (0.88-2.22)
Inadequate weight gain	10,838 (14.9)	27 (19.6)	**1.58 (1.03-2.42)**	1.15 (0.74-1.78)
Gestational hypertension	4,761 (6.5)	12 (8.7)	1.36 (0.75-2.46)	0.73 (0.39-1.35)
Hypertension eclampsia	586 (0.8)	3 (2.2)	2.74 (0.87-8.63)	1.04 (0.32-3.41)
Gestational diabetes	2,902 (4.0)	5 (5.6)	0.91 (0.37-2.22)	0.79 (0.32-1.96)
Cigarette use	8,265 (11.4)	44 (31.9)	**3.62 (2.53-5.18)**	2.54 (1.71-3.78)
Any STI	2,809 (3.9)	7 (5.1)	1.33 (0.62-2.85)	0.68 (0.31-1.47)

TABLE 13 (CONTINUED): Post-Neonatal mortality prenatal risk factors - distribution and logistic regression, all live births at least 500g for White and Black only.
2010-2014 | n=72,977

	Controls (n=72,839)	Post-Neonatal Mortality (n=138)	Crude associations	Fully adjusted model
Fetal Risk Factors				
Prior live births ≥ 5	1,863 (2.6)	6 (4.4)	1.72 (0.76-3.89)	0.86 (0.36-2.02)
Multiple gestations	3,110 (4.3)	12 (8.7)	**2.14 (1.18-3.86)**	0.86 (0.46-1.61)
Male gender	37,432 (51.4)	74 (53.6)	1.09 (0.78-1.53)	1.16 (0.82-1.63)
Gestational age (weeks)				
< 29	724 (1.0)	23 (16.7)	**27.49 (17.04-44.36)**	**19.22 (11.36-32.52)**
29-32	1,293 (1.8)	11 (8.0)	**7.37 (3.89-13.96)**	**4.94 (2.53-9.63)**
33-36	7,648 (10.5)	30 (21.7)	**3.39 (2.21-5.22)**	**2.63 (1.66-4.15)**
37-41	58,853 (80.8)	68 (49.3)	1.00	1.00
> 41	4,321 (5.9)	6 (4.4)	1.20 (0.52-2.77)	1.17 (0.50-2.71)
Small for gestational age	7,785 (10.7)	31 (22.5)	**2.42 (1.62-3.61)**	**2.39 (1.57-3.66)**

cOR = crude odds ratio, aOR=adjusted odds ratio, CI=confidence interval; Significant odds ratios bolded

Maternal Risk Factors: Crude Associations

Between 2010 and 2014, there was a 76% increased risk for post-neonatal mortality among infants born in St. Louis City in reference with infants born in St. Louis County (cOR 1.76, CI 1.26-2.47). Furthermore, there was a fourfold increased odds for a baby to die in the post-neonatal period if they were Black in reference with White (cOR 4.17, CI 23.83-6.14). Not graduating from high school was also associated with increased risk for post-neonatal death (cOR 23.04, CI 1.35-3.07). Lack of paternal acknowledgement was associated with a 2.56 increased odds for later death (cOR 2.56, CI 1.82-3.61). Similar to neonatal mortality, enrollment in one (cOR 2.07, CI 1.07-4.00), two (cOR 4.27, CI 2.65-6.87), or three (cOR 3.62, CI 2.53-5.18) government programs (WIC, Medicaid or Food Stamps) was associated with a significantly increased risk for post-neonatal death.

Again, we suspect that this relationship between increased utilization of government programs and post-neonatal death may be influenced by unmeasured confounders, such as the physical and socio-economic conditions in which one lives (not provided on birth certificate), in addition to the lifestyle and health care conditions (provided on the birth certificate).[48] Cigarette use was associated with a 3.62 increased odds for neonatal mortality (cOR 3.62, CI 2.53-5.18). Inadequate prenatal care (cOR 2.67, CI 1.59-4.48) and adequate plus prenatal care (cOR 2.05, CI 1.33-3.16) were also associated with significantly increased risk for

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post-neonatal mortality in reference to women with intermediate and adequate prenatal care. Inadequate weight gain was also associated with increased risk for post-neonatal mortality, resulting in a 1.6 times increased risk for death during the post-neonatal period.

Fetal Risk Factors: Crude Associations

Multiple gestations, gestational age and small for gestational age were all significant predictors in the crude associations. Multiple gestations were associated with a 2.14 increased odds for post-neonatal mortality in reference to singleton gestations (cOR 2.15, 1.18-3.86). Being less than 29 weeks gestation (cOR 27.49, CI 17.04-44.36), 29-32 weeks gestation (cOR 7.37, CI 3.89-13.96), 33-36 weeks gestation (cOR 3.39, CI 2.21-5.22) were all associated with increased risk for post-neonatal mortality. Being small for gestational age was associated with a 2.42 increased odds for post-neonatal mortality (cOR 2.42, CI 1.62-3.61).

Maternal and Fetal Risk Factors: Fully Adjusted Associations

In the fully adjusted model, only four variables remained significant predictors of post-neonatal mortality. Black maternal race remained at a 2.37 significantly increased odds for post-neonatal mortality in reference to White women (aOR 2.37, CI 1.44-3.91). Tobacco use during pregnancy also remained as a significant predictor of post-neonatal mortality in reference to non-tobacco users (aOR 2.54, CI 1.71-3.78). Gestational age also was a significant predictor (>29 weeks (aOR 19.2, CI 11.36-32.52); 29-32 weeks (aOR 4.94, CI 2.53-9.63); and 33-36 weeks (aOR 2.63, 1.66-4.15)) in reference to full term infants. Finally, being small for gestational age increased the odds for post-neonatal death 2.39 (CI 1.57-3.66) in reference with appropriate size for gestational age.

Discussion

Infant mortality, the primary focus of these analyses, is any death within the first year of life. Rates have been declining in the U.S. for many years. Given that the risks for death in the first 28 days of life may differ from the risks for death after the first 28 days of life, but before ones first birthday, we conducted bivariate and multivariate logistic regression to assess the risks for these two outcomes. We determined when infant deaths occurred to look for clues that may help explain trends in infant mortality. Neonatal mortality (death in the first 28 days of life) trends for Whites are fairly similar to fetal mortality. Perinatal mortality rates, which take into consideration fetal death and death within the first 28 days of life, also show much higher risk for Black women and babies than White women and babies, with those living in the City at slightly higher risk than those living in the County. Neonatal mortality rates were higher for Black infants although rates, again, were slightly lower in the County than the City.

For all groups, post-neonatal mortality rates have been low for the last five years, so it would appear that neonatal mortality contributes most to the overall infant mortality rate than post-neonatal mortality. This, in turn, suggests that it is health prior to and during pregnancy and birth that is most impactful on the survivability of babies in the City and County.

Intermediate outcomes, like preterm birth and small-for-gestational-age births, also give us clues about infant mortality since their etiology can be quite different. Low birth weight births are made up of births that are either preterm, small-for-gestational-age, or both. Preterm births account for approximately 10% of the White births and 17-19% of the Black births in the City and County. Sub analyses suggest that moderately preterm births (32 to 36 weeks) account for most of the trend in preterm births. Very preterm (<32 weeks accounts for the smallest percentage of preterm births, although the disparity ratio remains constant between these moderately early and very early births. Small-for-gestational age is another important indicator of Infant Health, as even those babes who are early have a stronger chance of survivability if they are size-appropriate rather than small for gestational age. Although White rates are slightly higher than Black, there is little racial disparity for this outcome. In summary, preterm plays an important role in infant mortality and may have greater influence than does small-for-gestational-age births.

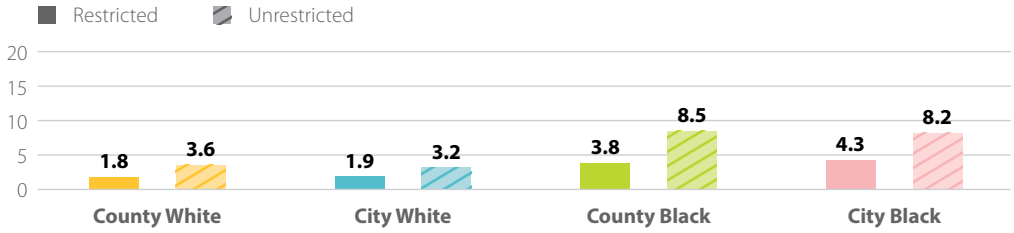
Many influences simultaneously affect risk of infant death and the relative influence of risk factors in the City and County. We used logistic regression methods to adjust statistically for the effects of a set of potential risk factors drawn from the literature. This allows estimation of the effect of each individual risk factor while holding constant the effects of the others. Tables 12 and 13 summarize results for assessing the risks for neonatal and post-neonatal mortality. Risk factors significant in both outcomes, after adjusting for potential confounders, were related to gestational age and gestational size. Among neonatal death, male gender and paternity acknowledgment only remained as significant predictors of death during this early period of life. Paternity acknowledgment, as mentioned earlier, may indicate significant social distress in the community. Among post-neonatal deaths, Black race remained the only other significant risk factor, with their odds 2.37 that of White women.

Trends in risk factors that do not contribute currently (as reflected in the multivariate analyses) are important in what they may reflect for future trends. For instance, the prevalence of births to young mothers has been declining for some time, but increased risk they are showing for Black women in the City are alarming. In addition, while the prevalence of women giving birth who have had at least five children does not show a clear trend, the fact that they represent 2.6% of the total population of births in the City and County is notable and worthy of continued surveillance. Lastly, the continued trend of increasing tobacco use among pregnant Black women is of great concern. Educational efforts, messages from prenatal care providers, warnings about pregnancy risk on tobacco products, and state run quit lines have brought about major declines in tobacco use in pregnancy. But, the targeting of tobacco companies to low-income minority communities and the observed significantly higher prevalence of tobacco use among Black women in our community in comparisons with White women may reflect the success of these marketing practices.

4 | Infant Health Unrestricted Sample

To help with the transition from an unrestricted sample used in previous data and the restricted used in this in-depth perinatal periods of risk study, we are providing comparisons here of the birth outcomes by restricted and unrestricted comparisons. The rate of Infant Health rates increase when the sample is no longer restricted to a birth weight of at least 500 grams and fetal deaths at 20-23 weeks are also added into the study population. This new sample is referred to as the unrestricted sample, and includes 82,206 live births and 466 fetal deaths. Only Black and White live births and fetal deaths are used for this analysis (n=74,026 live births and fetal deaths for Black and White mothers). The data presented here are based on a birth cohort, meaning all babies born in a year are matched case-by-case with death certificates for any babies that died within a year of birth. Records are available for the County and City births and fetal deaths from 2010-2014.

FIGURE 45: Fetal mortality, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



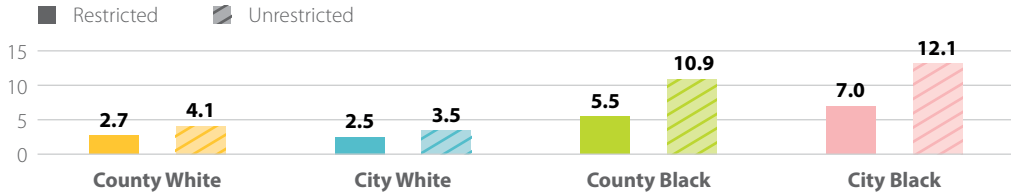
Mortality rates are presented as race-location specific rates. Black and White are both non-Hispanic. Groupings are: overall Black and White, White County, Black County, White City, and Black City. Mortality rates are calculated as "Birth Cohort Specific" rates. An example of what is meant as birth cohort specific mortality rate is presented below in the context of birth cohort specific infant mortality rate (IMR): IMR for year Y= 1,000* (Babies born in Y that died in Y + babies born in Y that died in Y+1)/Babies born in Y Rates are presented per 1,000 live births (or live births + fetal deaths, where applicable). However, SGA is the only outcome represented as rate per 100.[52]

Fetal Mortality

The fetal mortality rate increases from 1.8 to 3.6 deaths per 1,000 live births and fetal deaths among White women in the County. Among White women in the City, the rates increase from 1.9 to 3.2. Among Black women in the County, the rates increase from 3.8 to 8.5. Finally, among Black women in the City, the rates increase from 4.3 to 8.2. See Figure 45.

52 Note: Fetal mortality in this unrestricted analysis is now presented as at least 20 weeks (following what is presented in old report). These numbers can be compared with the Flick-Leet 2007 report. However, compare with caution as the old report presents rates in 2-year intervals (more stable) and we present a five-year average. Definitions for the outcomes are provided in Appendix E, and include fetal mortality, perinatal mortality, infant mortality, neonatal mortality, post-neonatal mortality, infant mortality- perinatal conditions, infant mortality congenital anomalies infant mortality SUIDS, infant mortality-all other causes, low birth weight, very low birth weight, preterm delivery, preterm delivery 32-36 weeks, preterm delivery <32 weeks, and small for gestational age.

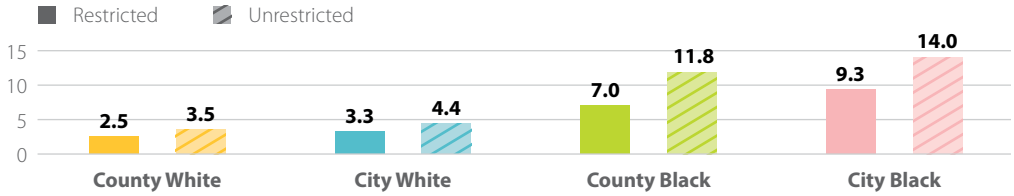
FIGURE 46: Perinatal mortality, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Perinatal Mortality

The perinatal mortality rate increases from 2.7 to 3.6 deaths per 1,000 fetal deaths and live births among White women in the County. Among White women in the City, the rates increase from 2.5 to 3.5. Among Black women in the County, the rates increase from 5.5 to 10.9. Finally, among Black women in the City, the rates increase from 7.0 to 12.1. See Figure 46.

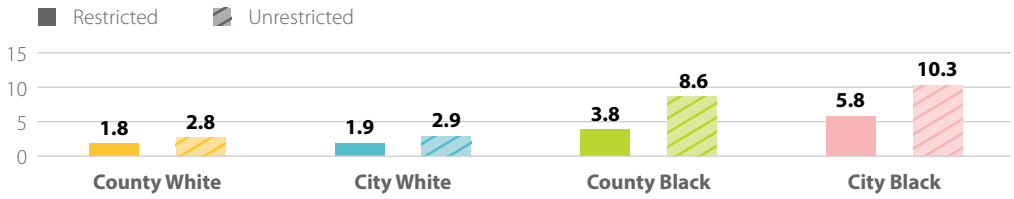
FIGURE 47: Infant mortality, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Infant Mortality

The infant mortality rate increases from 2.5 to 3.5 deaths per 1,000 live births among White women in the County. Among White women in the City, the rates increase from 3.3 to 3.4. Among Black women in the County, the rates increase from 7.0 to 11.8. Finally, among Black women in the City, the rates increase from 9.3 to 14.0. See Figure 47.

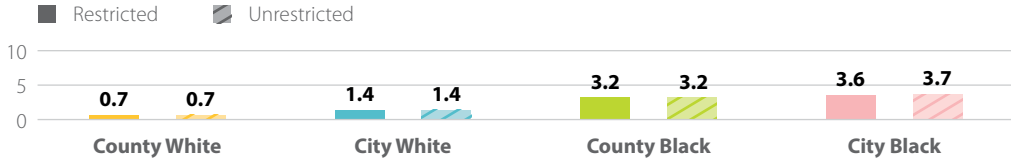
FIGURE 48: Neonatal Mortality, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Neonatal Mortality

The neonatal mortality rate increases from 1.8 to 2.8 deaths per 1,000 live births among White women in the County. Among White women in the City, the rates increase from 1.9 to 2.9. Among Black women in the County, the rates increase from 3.8 to 8.6. Finally, among Black women in the City, the rates increase from 5.8 to 10.3. See Figure 48.

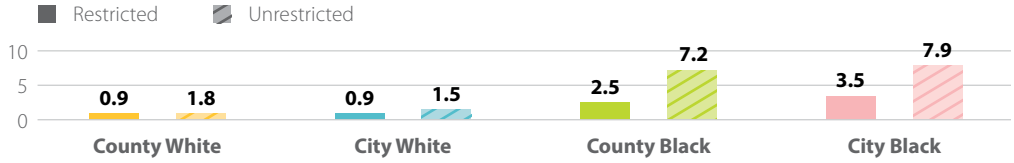
FIGURE 49: Fetal Mortality, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Post-Neonatal Mortality

The post-neonatal mortality rate does not increase among any of the groups between the restricted and unrestricted data, except among Black women living in St. Louis City. Among Black women in the City, the rates increase from 3.6 to 3.7. See Figure 49.

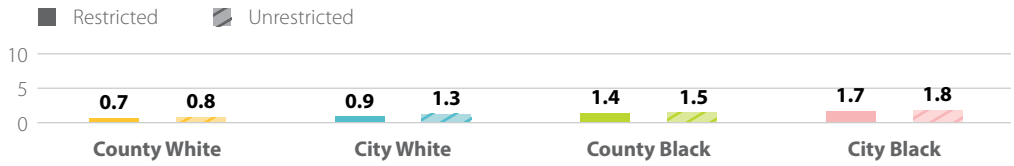
FIGURE 50: Infant Mortality-Perinatal conditions, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Infant Mortality-Perinatal Conditions

The infant mortality rate due to perinatal conditions increases from 0.9 to 1.8 deaths per 1,000 live births among White women in the County. Among White women in the City, the rates increase from 0.9 to 1.5. Among Black women in the County, the rates increase from 2.5 to 7.0. Finally, among Black women in the City, the rates increase from 3.5 to 7.9. See Figure 50.

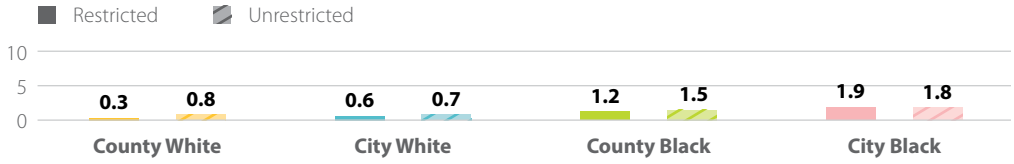
FIGURE 51: Infant Mortality-Congenital anomalies, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Infant Mortality - Congenital Anomalies

The infant mortality due to congenital anomalies rate increases from 0.7 to 0.8 deaths per 1,000 live births among White women in the County. Among White women in the City, the rates increase from 0.9 to 1.3. Among Black women in the County, the rates increase from 1.4 to 1.5. Finally, among Black women in the City, the rates increase from 1.7 to 1.8. See Figure 51.

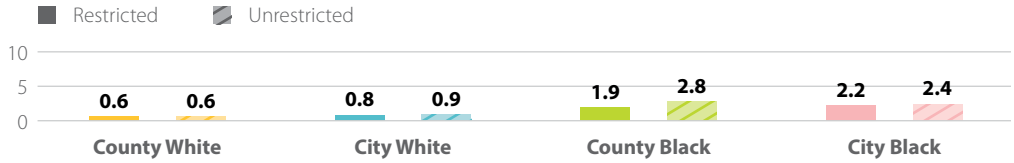
FIGURE 52: Infant Mortality - SUIDS, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Infant Mortality - SUIDS

The infant mortality due to rate increases from 0.3 to 0.8 deaths per 1,000 live births among White women in the County. Among White women in the City, the rates increase from 0.6 to 0.7. Among Black women in the County, the rates increase from 1.2 to 1.5. Finally, among Black women in the City, the rates increase from 1.9 to 1.8. See Figure 52.

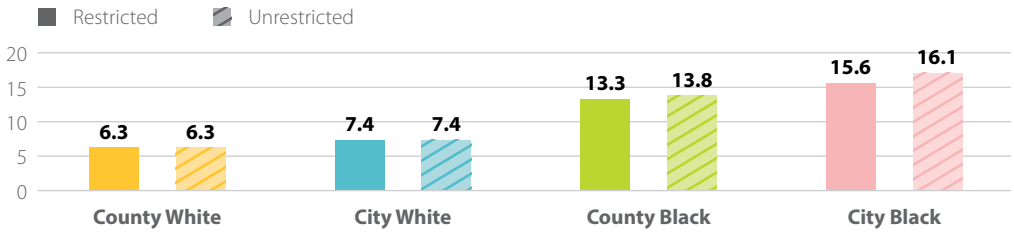
FIGURE 53: Infant mortality-other, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Infant Mortality - All Other Causes

The infant mortality due to all other causes does not change among White women in the County. Among White women in the City, the rates increase from 0.8 to 0.9. Among Black women in the County, the rates increase from 1.9 to 2.8. Finally, among Black women in the City, the rates increase from 2.2 to 2.4. See Figure 53.

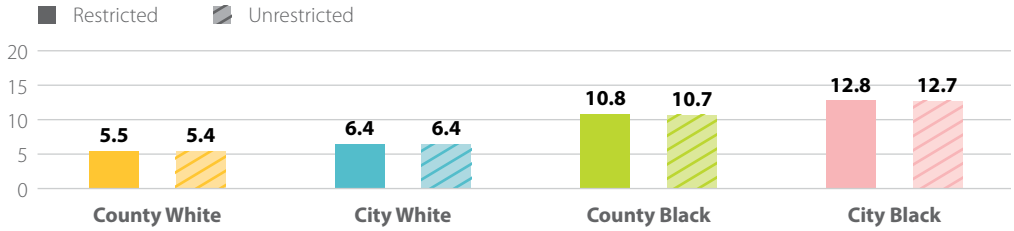
FIGURE 54: Low Birth Weight, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Low Birth Weight

The low birth weight rate does not increase among White women in the County or the City. The rates increase from 13.3 to 13.8 among Black women in the County, and among Black women in the City, the rates increase from 15.6 to 16.1. See Figure 54.

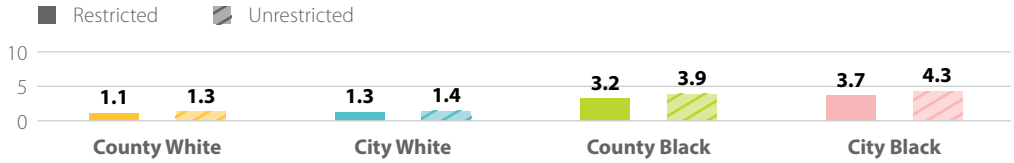
FIGURE 55: Moderately Low Birth Weight (1500 - 2499 grams), restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Moderately Low Birth Weight

The moderately low birth weight rate slightly decreases from 5.5 to 5.4 deaths per 100 live births among White women in the County. Among White women in the City, the rates remain the same. Among Black women in the County, the rates slightly decrease from 10.8 to 10.7. Finally, among Black women in the City, the rates also slightly decrease from 12.8 to 12.7. This suggests that the rates of moderately low birth weight are not influenced by the fetal death rate. See Figure 55.

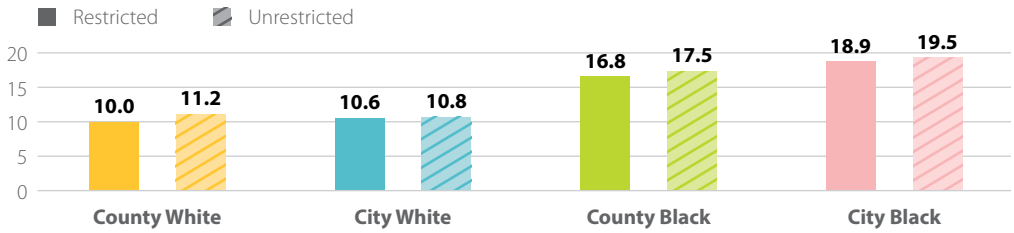
FIGURE 56: Very Low Birth Weight (<1500 grams), restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Very Low Birth Weight

The very low birth rate increases from 1.1 to 1.3 deaths per 100 live births among White women in the County. Among White women in the City, the rates increase from 1.3 to 1.4. Among Black women in the County, the rates increase from 3.2 to 3.9. Finally, among Black women in the City, the rates increase from 3.7 to 4.3. See Figure 56.

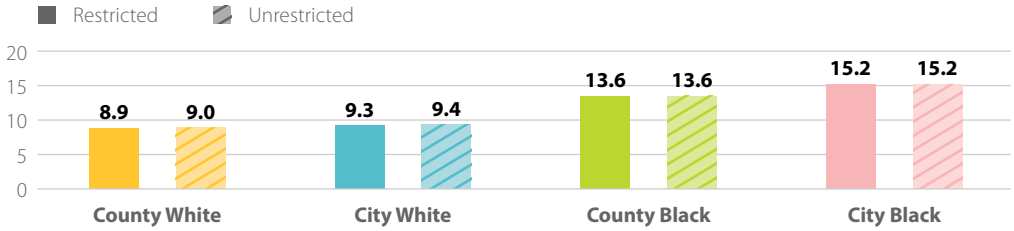
FIGURE 57: Preterm Delivery, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Preterm Delivery

The preterm delivery rate increases from 10.0 to 11.2 deaths per 100 live births among White women in the County. Among White women in the City, the rates increase from 10.6 to 10.8. Among Black women in the County, the rates increase from 16.8 to 17.5. Finally, among Black women in the City, the rates increase from 18.9 to 19.5. See Figure 57.

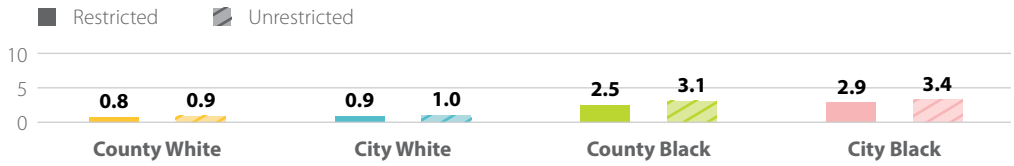
FIGURE 58: Preterm Delivery 32-36 Weeks, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Preterm Delivery 32-36 Weeks

The moderately preterm delivery rate increases from 8.9 to 9.0 deaths per 100 live births among White women in the County. Among White women in the City, the rates increase from 9.3 to 9.4. Among Black women in the County, the rates remain stable at 13.6, as well as among Black women in the City, where the rate remains at 15.2. See Figure 58.

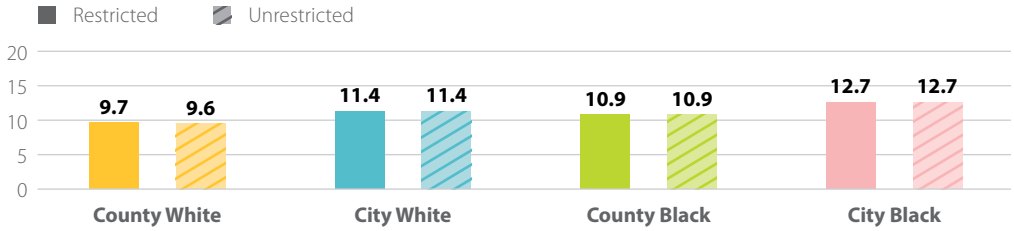
FIGURE 59: Extremely Preterm Delivery <32 Weeks, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Extremely Preterm Delivery <32 Weeks

The extremely preterm birth rate increases from 0.8 to 0.9 deaths per 100 live births among White women in the County. Among White women in the City, the rates increase from 0.9 to 1.0. Among Black women in the County, the rates increase from 2.5 to 3.1. Finally, among Black women in the City, the rates increase from 2.9 to 3.4. See Figure 59.

FIGURE 60: Small for Gestational Age, restricted-unrestricted data.
2010-2014: St. Louis City and County, MO | Restricted - Unrestricted Comparison



Small for Gestational Age

The small for gestational age rate does not change at all when infant births that were under 500 grams are included in the analysis, except for a slight decrease among White women in the County, going from 9.7 down to 9.6 per 100 births. See Figure 60.

Conclusions

When adding fetal deaths and live births that are under 500 grams into the analysis, several notable findings are observed. First, the fetal mortality rate almost doubles. The infant mortality rate also increased substantially, suggesting that these were live births that were too small to survive. Indeed, most of the infant deaths that are added to the rate are added during the neonatal period. Furthermore, these deaths are mostly added to the perinatal cause of death, further supporting the finding that maternal health may be driving the excesses in fetal and infant death in our community. Finally, the addition of live births under 500 grams are contributing the most to the extremely premature birth rate and the very low birth weight groups, suggesting that these small babies are being born before they are ready to survive.

5 | Geographic Analysis

This analysis included the use of geographic information system (GIS) software to allow visualization of the 2010-2014 linked birth and death data specific to St. Louis City and St. Louis County. GIS software can facilitate identification of 'hot-spots' or clusters of infant deaths or other outcomes from a geographical perspective.

Comparison among neighboring areas can highlight disparities. Rates for fetal death were computed per 1,000 live births plus fetal deaths. Rates for infant, neonatal, and post-neonatal deaths were computed per 1,000 live births and deaths per zip code. Rates for all other indicators were computed per 100 live births and deaths. We requested census tract data, but due to several errors in the data we received from the state, only received the updated data set after we had completed a detailed zip code-level analysis. All analyses were completed at the zip code level. Selected indicators from the U.S. Census were overlaid using proportional circles where larger circles typically point to increasing levels of less desirable outcomes. This project was approved by the Missouri Department of Health and Senior Services.

Zip code-specific rates of infant mortality, as well as additional key birth outcomes, were computed for 2010-2014. It is important to combine years to ensure stable rates from year to year. Zip codes with fewer than 10 births were excluded from analysis to increase rate stability.

Even though collapsing data over multiple years and eliminating zip codes with fewer than ten births improves rate stability, ranking zip codes with each other can aid in interpretation of geographic patterns across neighboring zip codes and the region overall. For Table 14 we ranked zip codes within either St. Louis City and in Table 15 for St. Louis County on the following 8 indicators (Infant Mortality, Fetal Death, Neonatal Death, Post-neonatal Death, Low Birth Weight, Very Low Birth Weight, Preterm Birth, and Very Preterm Birth). Zip codes were then ranked for each indicator (1=highest rate) and those with a top ten rank were included in the table. Additionally, we computed the total number of times each zip code appeared in at least one of the top 4 highest positions for each indicator. Zip codes were than presented in the sort order of top ten with the highest infant mortality rate, separately for city and county. Their total count of top four placements is included next, followed by their rank among other zip codes, using US Census data.

Those zip codes in St. Louis City, with the top five ranked infant mortality rank also had the most number of other poor birth outcomes while ranking high in poverty. The zip codes/ neighborhoods in St. Louis city with the poorest birth outcomes and greatest neighborhood poverty are:

- 63107(6) (Fairground)
- 63120(8) (Walnut Park East)
- 63113(7) (Lewis Place)
- 63115(5) (Penrose)
- 63118(1) (Benton Park)

TABLE 14: St. Louis City Zip Code Rankings for Birth Outcomes Among the 10 Zip Codes with the Highest Infant Mortality Rate.
2010-2014

Zip code	Primary Neighborhood	IM	FD	NND	PNND	LBW	VLBW	PB	VPB	# Top 4	% < FPL
63107	Fairground	1	2	1	8	5	3	1	2	6	2
63120	Walnut Park East	2	2	2	3	3	4	4	4	8	4
63113	Lewis Place	3	2	3	6	2	1	3	3	7	3
63115	Penrose	4	1	8	2	4	8	2	7	5	6
63118	Benton Park	5		6	4	7	10	10	10	1	5
63147	North Riverfront	6		10	1	1	5	5	1	3	10
63106	St. Louis Place	7		7	7	6	7	8		0	1
63111	Mount Pleasant	8	2	4		10	9	9	9	2	8
63110	Kings Oak	9		9						0	14
63139	The Hill	10			9					0	16

Those top five zip codes in St. Louis County, with the top four ranked infant mortality rank also had the most number of other poor birth outcomes while ranking high in poverty. The zip codes/primary City in St. Louis County with the poorest birth outcomes and greatest neighborhood poverty are:

- 63133(6) (Pagedale Wellston)
- 63044(3) (Bridgedon)
- 63136(5) (Jennings)
- 63138(2) (North County)
- 63135(2) (Ferguson)

TABLE 15: St. Louis County Zip Code Rankings for Birth Outcomes Among the 10 Zip Codes with the Highest Infant Mortality Rates.
2010-2014

Zip code	Primary City	IM	FD	NND	PNND	LBW	VLBW	PB	VPB	# Top 4	% < FPL
63133	Pagedale/ Wellston	1	7	1	6	2	3	1	2	6	2
63044	Bridgeton	2	4	2						3	11
63136	Jennings	3		3	3	4	5	5	3	5	3
63138	North County	4		7	1	6		8	9	2	6
63135	Ferguson	5	2	10	7	7	9	4	8	2	7
63125	Lemay	6	10	5						0	15
63134	Berkeley	7			4	8	8	7	5	1	8
63121	Normandy	8			2	3	2	2	1	5	5
63017	Chesterfield	9		8						0	31
63034	Florissant	10		4		9		9	10	1	32

Note: Excluded zip codes with fewer than 10 births (63045)

For Table 16, St. Louis-specific rates are compared to Healthy People 2020 (HP 2020) objectives, and we created five categories for each outcome based on the target rate. The first category represented zip codes meeting the objective and the lowest risk. Increasing in risk, the next categories represented 1.5 times the target rate, 2 times the target, 2.5 times the target, and greater than 2.5 times the target rate described in HP 2020. As an example, the HP 2020 objective for low birth weight babies is 7.8/100 births. In this case, the categories would be <7.8, 7.8-11.7, 11.7-15.6, 15.6-19.5, and greater than 19.5.

In Table 16, we present the HP 2020 objectives for comparison against City and County on eight key birth outcomes including and associated with infant mortality. Zip codes are compared for both achieving the target rate or less, or exceeding the target rate by 2.5 times or more.

- Only one zip code in the City (63109) met all HP 2020 objectives for birth outcomes. Only two City zip codes met six or more objectives (63109 & 63139).
- For the County, 53% of zip codes met all HP 2020 objectives compared for this analysis. Individually, for each outcome, County zip codes met the objective between 66% (Preterm Birth) and 100% (Fetal Death) of the time.
- Zip codes exceeding the target rate by 2.5 times or more offer a perspective into areas with the highest risk.
- It is important to note that comparisons with HP 2020 objectives should be interpreted with caution, as the data set used in this analysis was the restricted PPOR analysis.

TABLE 16: Summary of Progress Toward Healthy People 2020 Objectives.
2010-2014

	Percent of Zip Codes Meeting the HP 2020 Objective		Percent of Zip Codes with Rates More than 2.5 Times the HP 2020 Objective	
Outcome	**St. Louis City**	**St. Louis County**	**St. Louis City**	**St. Louis County**
Infant Mortality	50	85.4	0	0
Fetal Death	100	100	0	0
Neonatal Death	77.8	91.9	0	0
Post-Neonatal Death	27.8	82.3	0	0
Preterm Birth	5.6	66.1	0	0
Very Preterm	22.2	72.6	5.6	0
Low Birth Weight	16.7	69.4	0	1.6
Very Low Birth Weight	27.8	74.2	5.6	0

To follow are maps regarding the distribution of births sorted by demographic characteristics (Black births, teen births), socio-economic characteristics (Medicaid births, WIC births), and selected birth outcomes (infant mortality, neonatal mortality, post-neonatal mortality, preterm births, very preterm births, and low birth weight). Furthermore, for each indicator,

we provide an overlay independently of six neighborhood characteristics (female-headed households, high school graduation rates, percent of households in poverty, median income, unemployment, and vacant housing). We also provide a map of distribution of health care clinics through the City and County area of study.

The following section contains illustrations of GIS data analysis. Included are maps in the following categories:

Part 1. Distribution of Selected Demographic Characteristics

- Black Births Rate per 1,000 live births
  - Black births + Female-headed household, no husband present
  - Black births + Percent graduated high school or GED equivalent
  - Black births + Percent Annual Income below FPL
  - Black births + Median Household Income
  - Black births + Percent unemployed
  - Black births + Percent vacant housing units

Part 2. Distribution of Selected Socio-Economic Characteristics

- Teen Births
  - Teen births + Female-headed household, no husband present
  - Teen births + Percent graduated high school or GED equivalent
  - Teen births + Percent Annual Income below FPL
  - Teen births + Median Household Income
  - Teen births + Percent unemployed
  - Teen births + Percent vacant housing units
- Medicaid
  - Medicaid births + Female-headed household, no husband present
  - Medicaid births + Percent graduated high school or GED equivalent
  - Medicaid births + Percent Annual Income below FPL
  - Medicaid births + Median Household Income
  - Medicaid births + Percent unemployed
  - Medicaid births + Percent vacant housing units
- WIC Utilization
  - WIC births + Female-headed household, no husband present
  - WIC births + Percent graduated high school or GED equivalent
  - WIC births + Percent Annual Income below FPL
  - WIC births + Median Household Income
  - WIC births + Percent unemployed
  - WIC births + Percent vacant housing units

Part 3. Distribution of Selected Birth Outcomes

- Infant Mortality
  - WIC births + Female-headed household, no husband present
  - WIC births + Percent graduated high school or GED equivalent
  - WIC births + Percent Annual Income below FPL
  - WIC births + Median Household Income
  - WIC births + Percent unemployed
  - WIC births + Percent vacant housing units

- Neonatal Mortality
  - WIC births + Female-headed household, no husband present
  - WIC births + Percent graduated high school or GED equivalent
  - WIC births + Percent Annual Income below FPL
  - WIC births + Median Household Income
  - WIC births + Percent unemployed
  - WIC births + Percent vacant housing units

- Post-Neonatal Mortality
  - Preterm WIC births + Female-headed household, no husband present
  - WIC births + Percent graduated high school or GED equivalent
  - WIC births + Percent Annual Income below FPL
  - WIC births + Median Household Income
  - WIC births + Percent unemployed
  - WIC births + Percent vacant housing units

- Preterm Births
  - Preterm births + Female-headed household, no husband present
  - Preterm births + Percent graduated high school or GED equivalent
  - Preterm births + Percent Annual Income below FPL
  - Preterm births + Median Household Income
  - Preterm births + Percent unemployed
  - Preterm births + Percent vacant housing units

- Very Preterm Births
  - Very preterm births + Female-headed household, no husband present
  - Very preterm births + Percent graduated high school or GED equivalent
  - Very preterm births + Percent Annual Income below FPL
  - Very preterm births + Median Household Income
  - Very preterm births + Percent unemployed
  - Very preterm births + Percent vacant housing units

- Low Birth Weight
  - Low birth weight births + Female-headed household, no husband present
  - Low birth weight births + Percent graduated high school or GED equivalent
  - Low birth weight births + Percent Annual Income below FPL
  - Low birth weight births + Median Household Income
  - Low birth weight births + Percent unemployed
  - Low birth weight births + Percent vacant housing units

- Very Low Birth Weight
  - Very low birth weight births + Female-headed household, no husband present
  - Very low birth weight births + Percent graduated high school or GED equivalent
  - Very low birth weight births + Percent Annual Income below FPL
  - Very low birth weight births + Median Household Income
  - Very low birth weight births + Percent unemployed
  - Very low birth weight births + Percent vacant housing units

Part 4. Distribution of Health Care Clinics in St. Louis, Missouri*

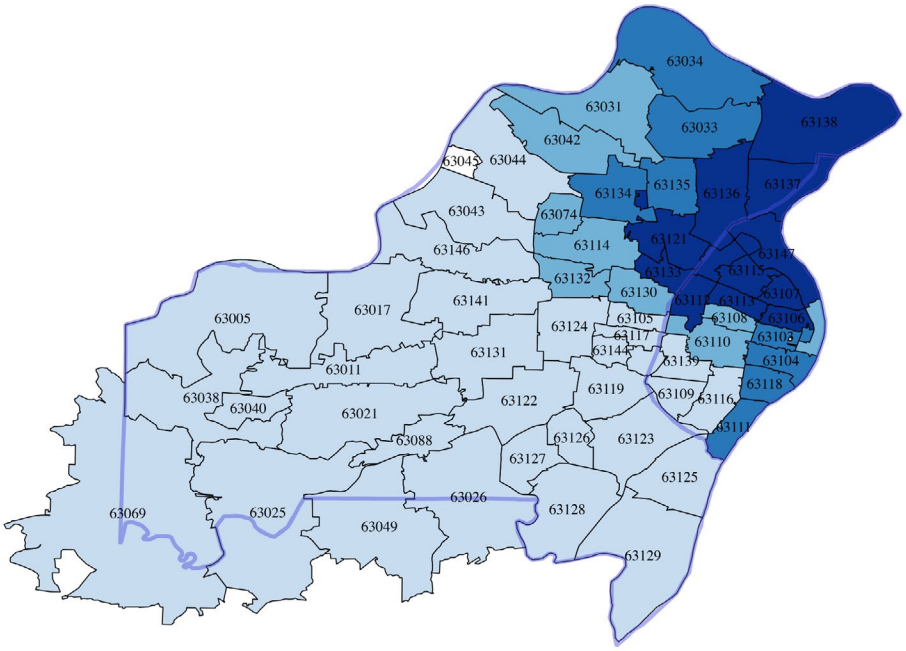
Black, Non-Hispanic Births

MAP 1: Black Only.

2010-2014: St. Louis City and County, MO | Births to African-American Mothers | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 30
- 30 - 50
- 50 - 75
- Greater than 75



* See Appendix F for maps that are created with the unrestricted data.

MAP 2: Race + Female-Headed Household.

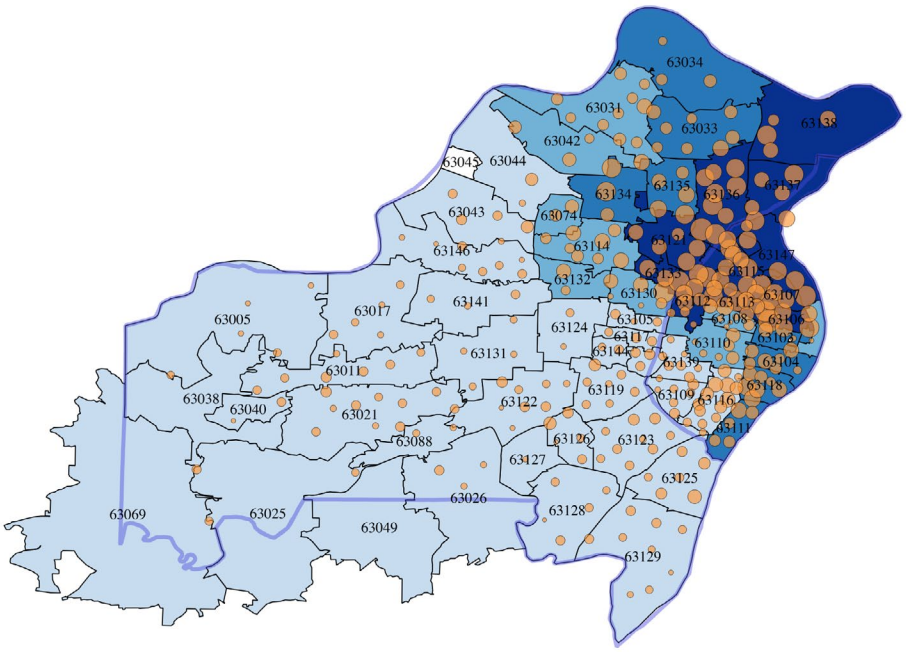
2010-2014: St. Louis City and County, MO | Births to African-American Mothers | By Zip code

Female-Headed Household,
No husband present
(By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 30
- 30 - 50
- 50 - 75
- Greater than 75



MAP 3: Race + High School Graduation Rates.

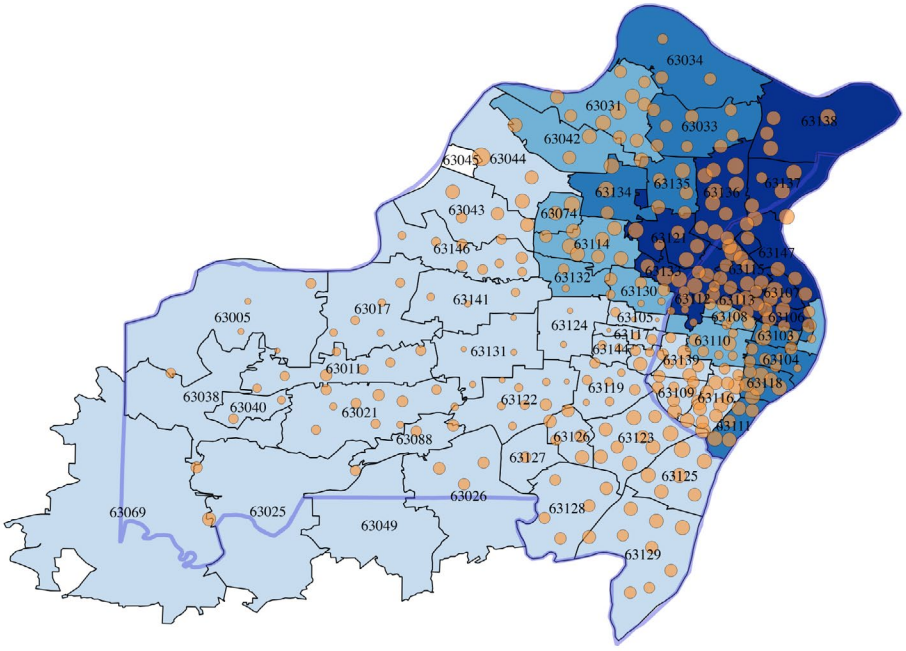
2010-2014: St. Louis City and County, MO | Births to African American Mothers | By Zip code

Percent Graduated High
School or GED Equivalent
(By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 30
- 30 - 50
- 50 - 75
- Greater than 75



MAP 4: Race + Percent of Households in Poverty.

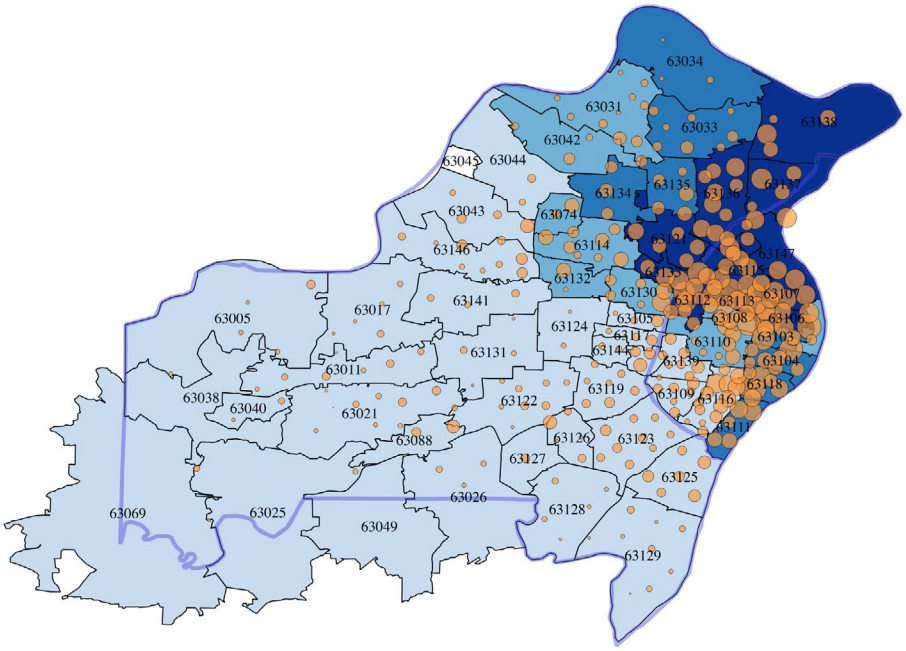
2010-2014: St. Louis City and County, MO | Births to African-American Mothers | By Zip code

Percent Annual Income
Below Federal Poverty Level
(By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 30
- 30 - 50
- 50 - 75
- Greater than 75



MAP 5: Race + Median Income.

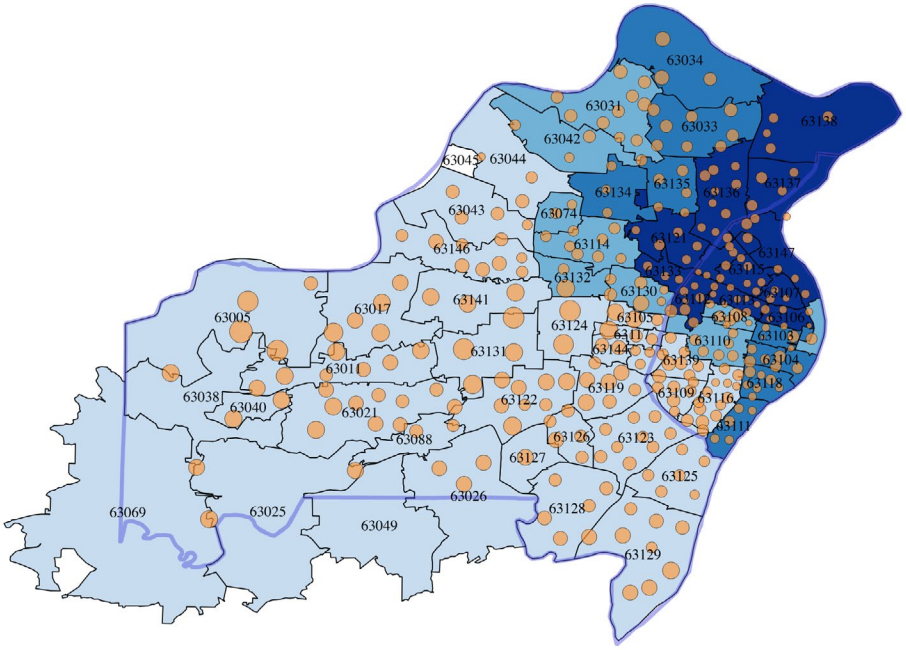
2010-2014: St. Louis City and County, MO | Births to African American Mothers | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 30
- 30 - 50
- 50 - 75
- Greater than 75



MAP 6: Race + Unemployment.

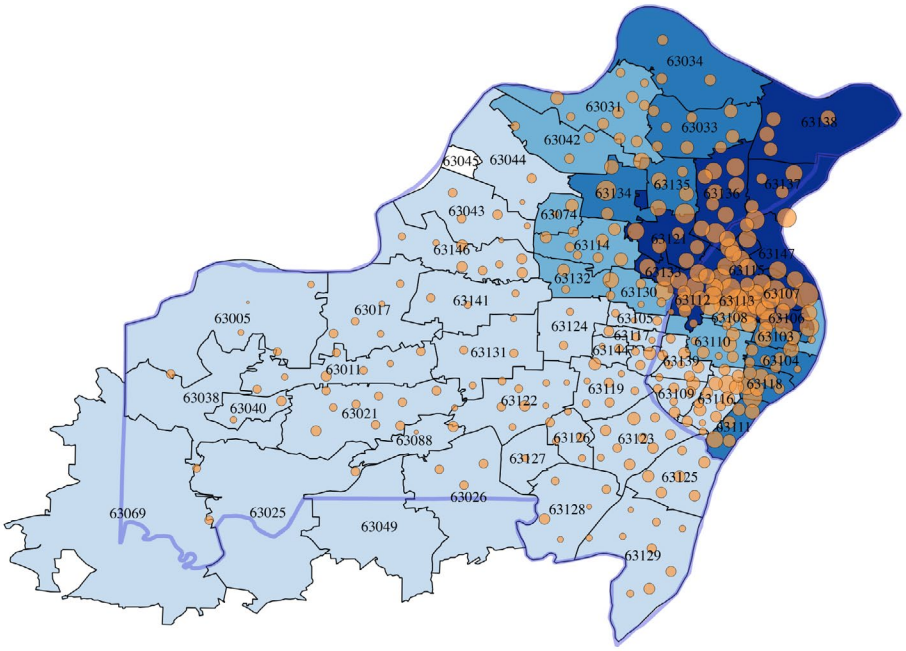
2010-2014: St. Louis City and County, MO | Births to African-American Mothers | By Zip code

Percent Unemployed
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 30
- 30 - 50
- 50 - 75
- Greater than 75



MAP 7: Race + Vacant Housing.

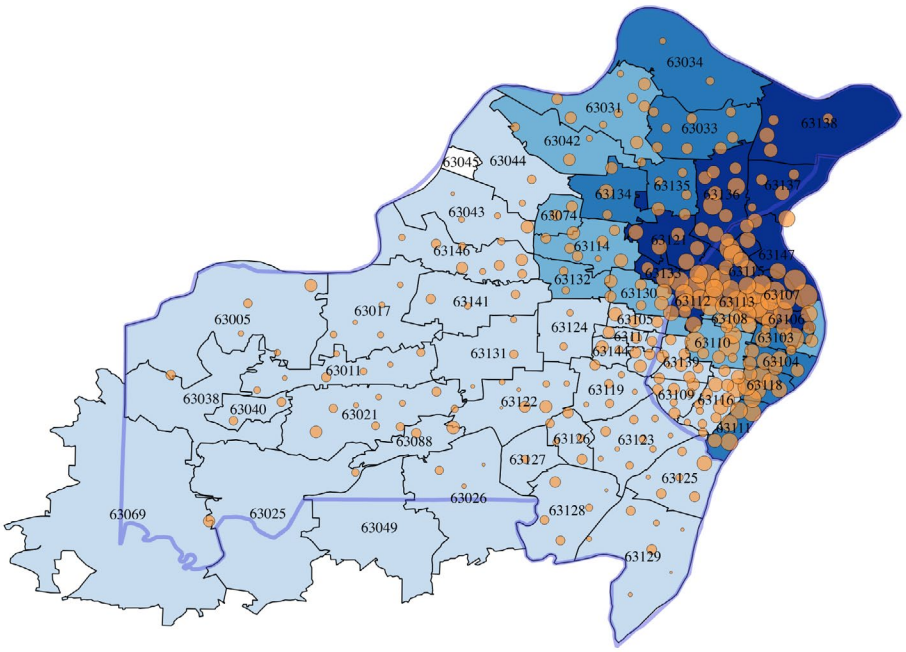
2010-2014: St. Louis City and County, MO | Births to African American Mothers | By Zip code

Percent Vacant Housing
Units (By Census Tract)

- Greater than 20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 30
- 30 - 50
- 50 - 75
- Greater than 75

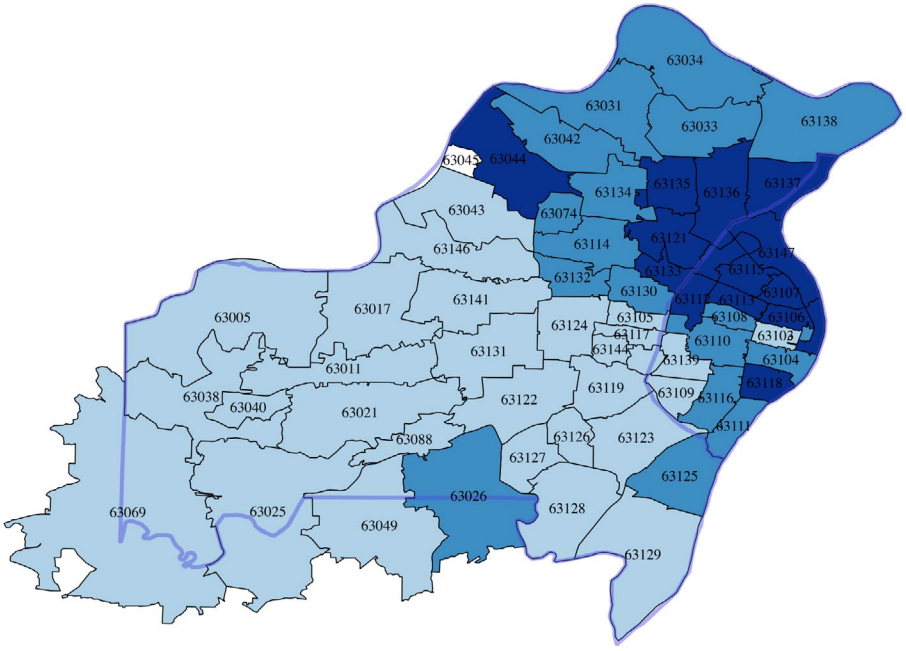


MAP 8: Teen Only.

2010-2014: St. Louis City and County, MO | Rate of Births to Teen Mothers (<18 years old) | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.0
- 1.0 - 4.0
- Greater than 4.0



MAP 9: Teen + Female-Headed Household.

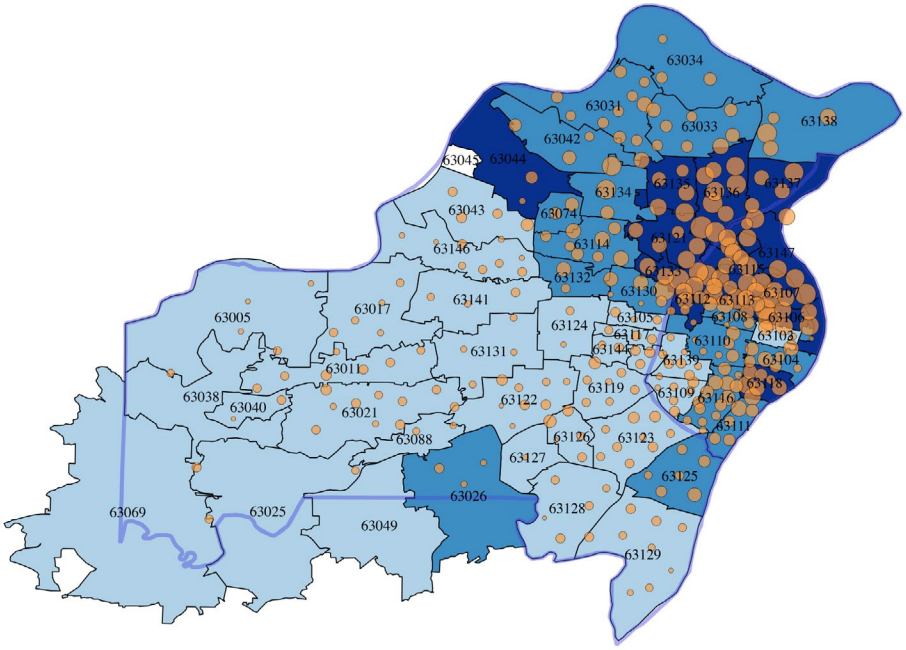
2010-2014: St. Louis City and County, MO | Rate of Births to Teen Mothers (<18 years old) | By Zip code

Female-Headed Household,
No husband present
(By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.0
- 1.0 - 4.0
- Greater than 4.0



MAP 10: Teen + High School Graduation Rates.

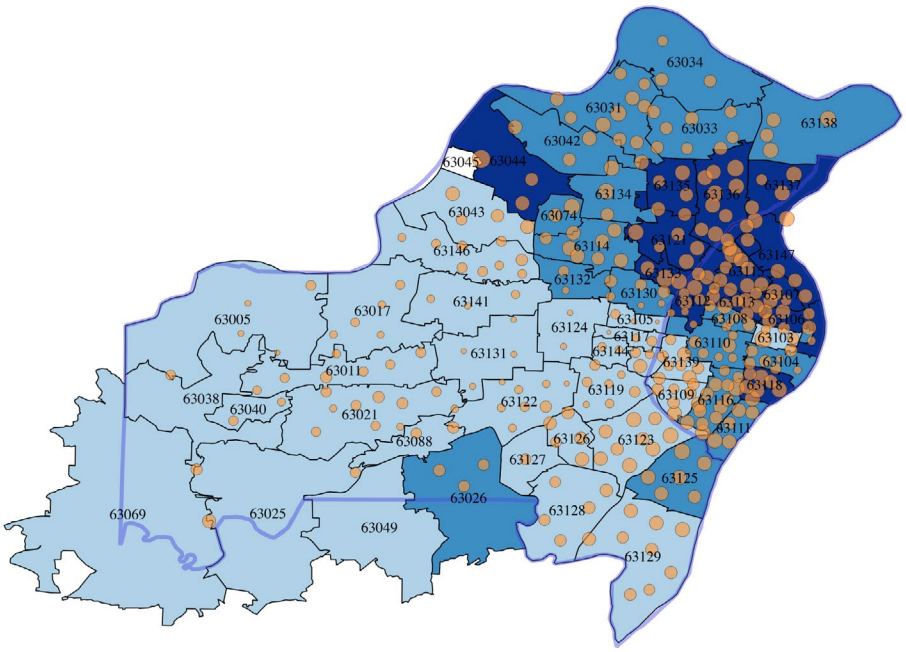
2010-2014: St. Louis City and County, MO | Rate of Births to Teen Mothers (<18 years old) | By Zip code

Percent Graduated High School or GED Equivalent (By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.0
- 1.0 - 4.0
- Greater than 4.0



MAP 11: Teen + Percent of Households in Poverty.

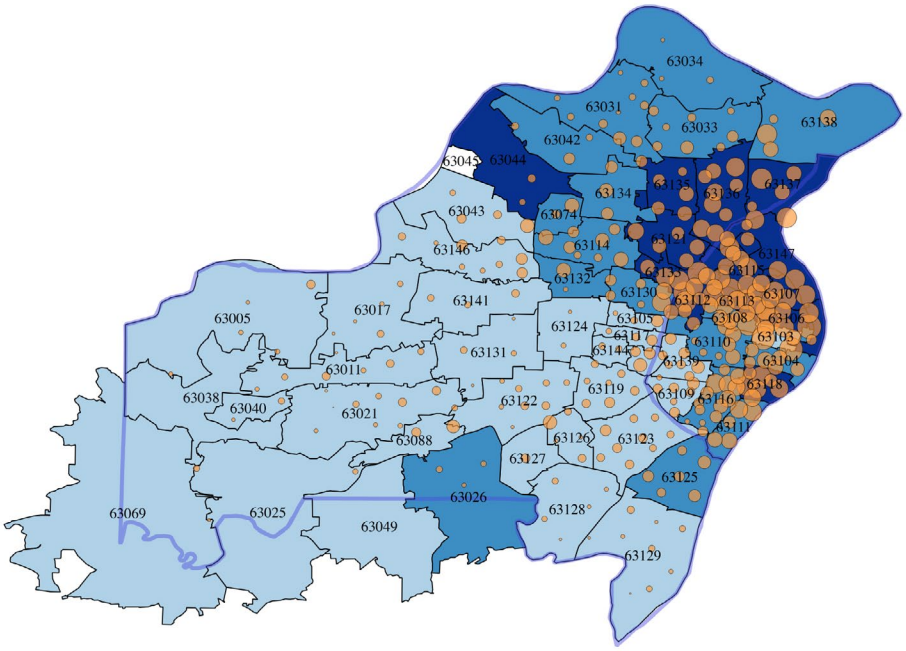
2010-2014: St. Louis City and County, MO | Rate of Births to Teen Mothers (<18 years old) | By Zip code

Percent Annual Income Below Federal Poverty Level (By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.0
- 1.0 - 4.0
- Greater than 4.0



MAP 12: Teen + Median Income.

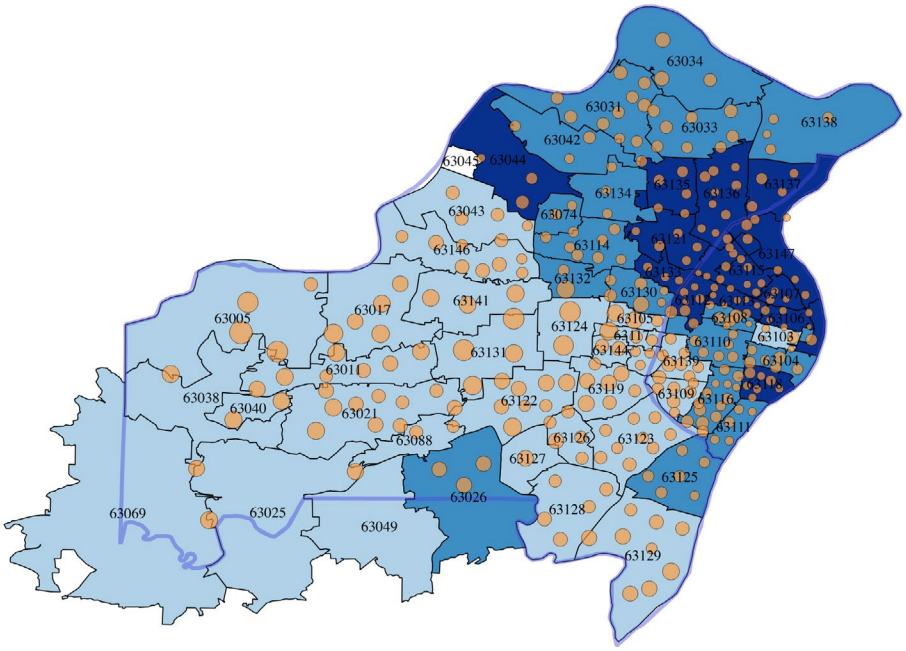
2010-2014: St. Louis City and County, MO | Rate of Births to Teen Mothers (<18 years old) | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.0
- 1.0 - 4.0
- Greater than 4.0



MAP 13: Teen + Unemployment.

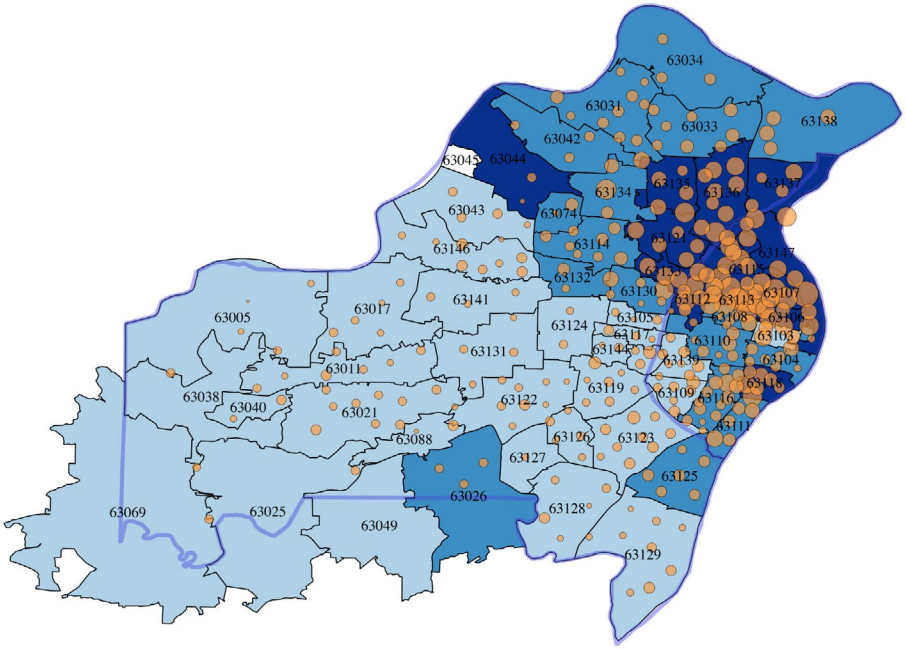
2010-2014: St. Louis City and County, MO | Rate of Births to Teen Mothers (<18 years old) | By Zip code

Percent Unemployed
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.0
- 1.0 - 4.0
- Greater than 4.0



MAP 14: Teen + Vacant Housing.

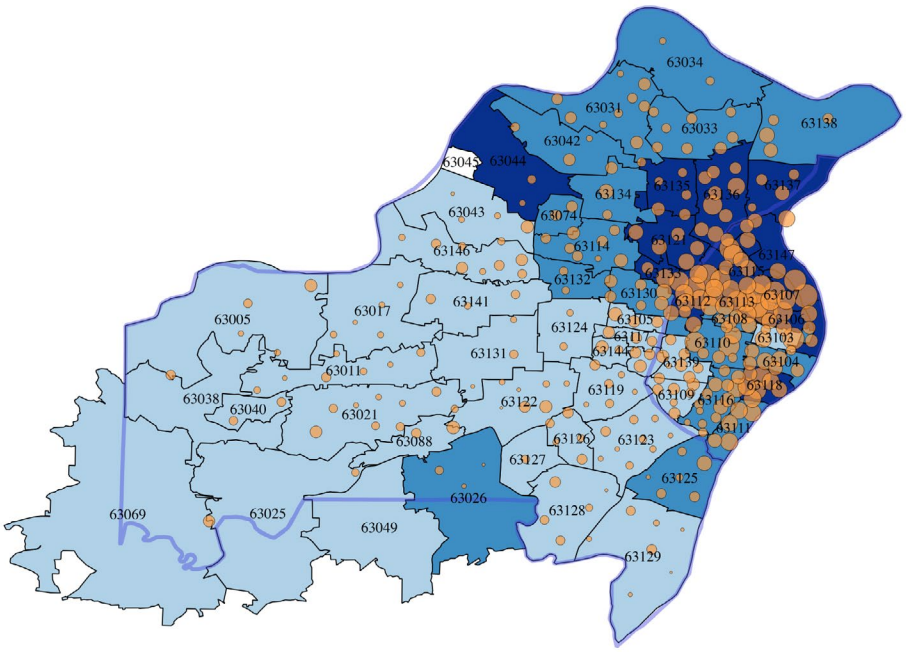
2010-2014: St. Louis City and County, MO | Rate of Births to Teen Mothers (<18 years old) | By Zip code

Percent Vacant Housing Units
(By Census Tract)

- Greater than 20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.0
- 1.0 - 4.0
- Greater than 4.0



Distribution of Selected Socio-Economic Characteristics

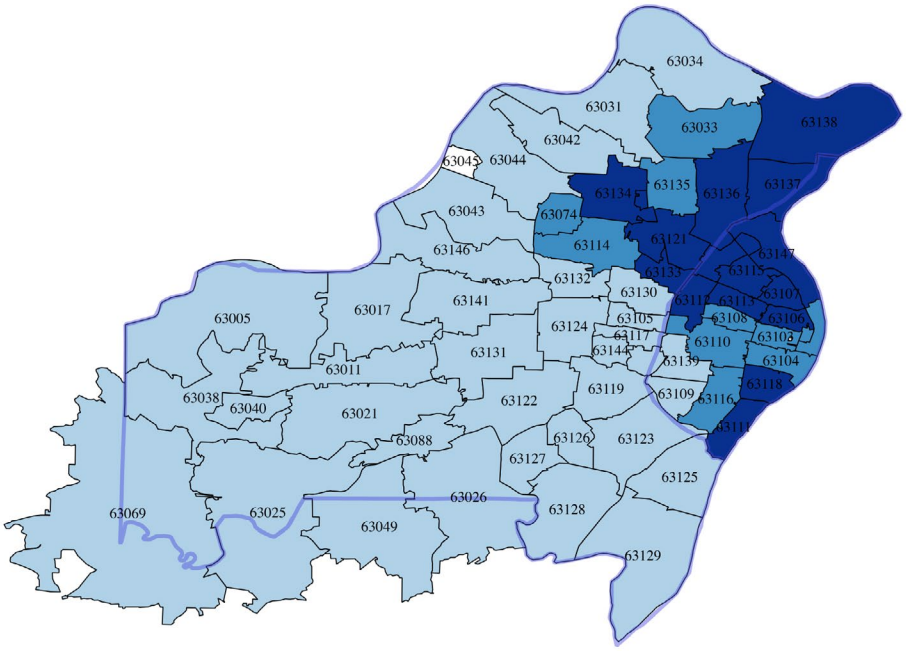
Medicaid

MAP 15: Medicaid Only.

2010-2014: St. Louis City and County, MO | Births to Mothers Receiving Medicaid | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 40
- 40 - 65
- Greater than 60



MAP 16: Medicaid + Female-Headed Household.

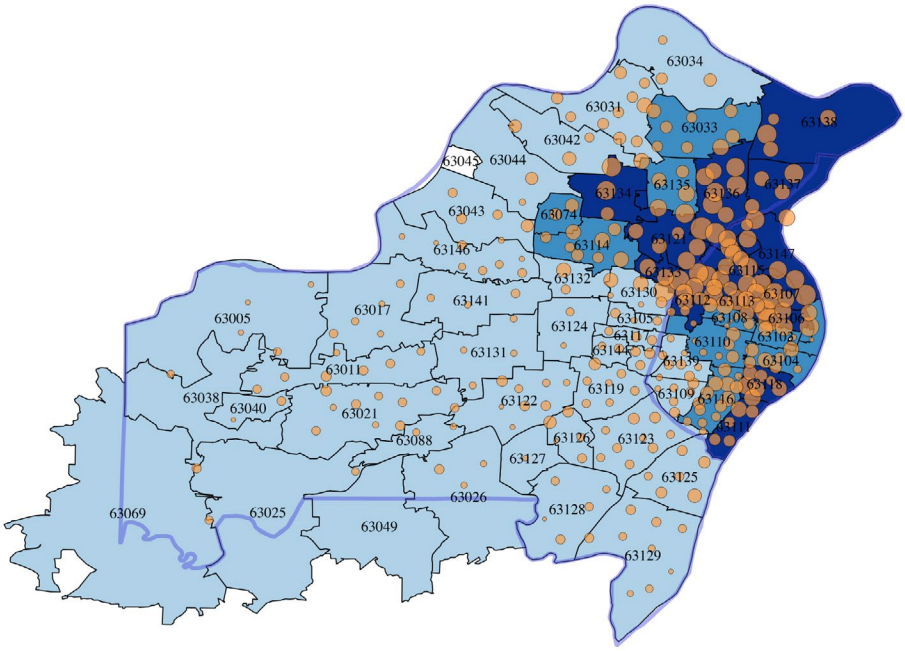
2010-2014: St. Louis City and County, MO | Births to Mothers Receiving Medicaid | By Zip code

Female-Headed Household,
No husband present
(By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 40
- 40 - 65
- Greater than 60



MAP 17: Medicaid + High School Graduation Rates.

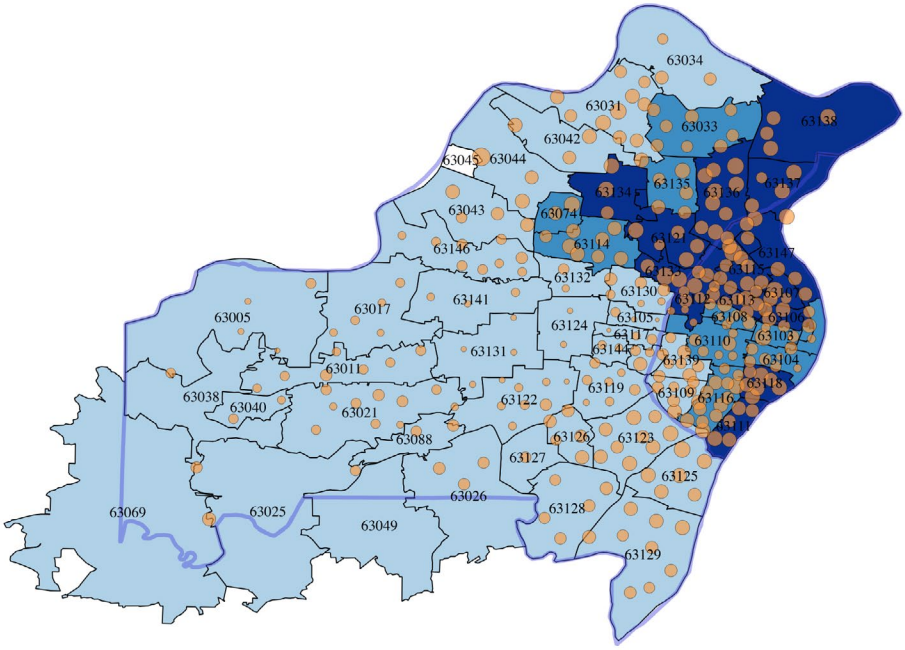
2010-2014: St. Louis City and County, MO | Births to Mothers Receiving Medicaid | By Zip code

Percent Graduated High School
or GED Equivalent
(By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 40
- 40 - 65
- Greater than 60



MAP 18: Medicaid + Percent of Households in Poverty.

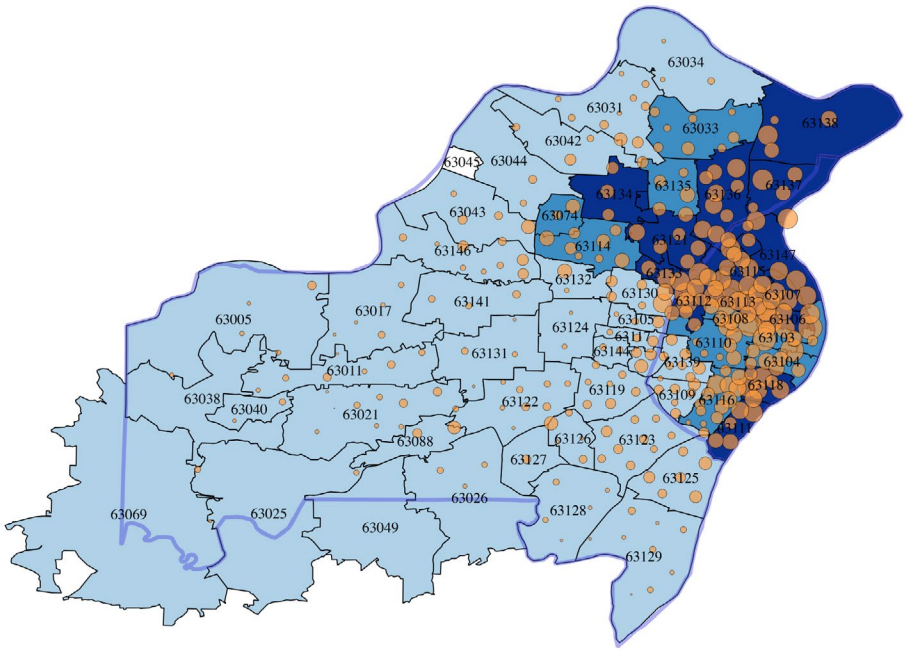
2010-2014: St. Louis City and County, MO | Births to Mothers Receiving Medicaid | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 40
- 40 - 65
- Greater than 65



MAP 19: Medicaid + Median Income.

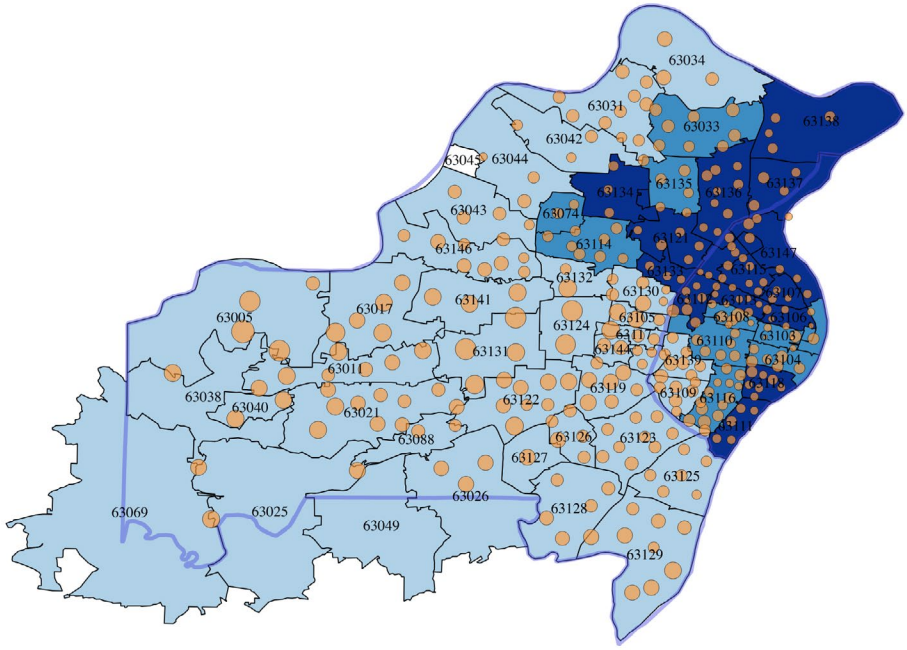
2010-2014: St. Louis City and County, MO | Births to Mothers Receiving Medicaid | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 40
- 40 - 65
- Greater than 65



MAP 20: Medicaid + Unemployment.

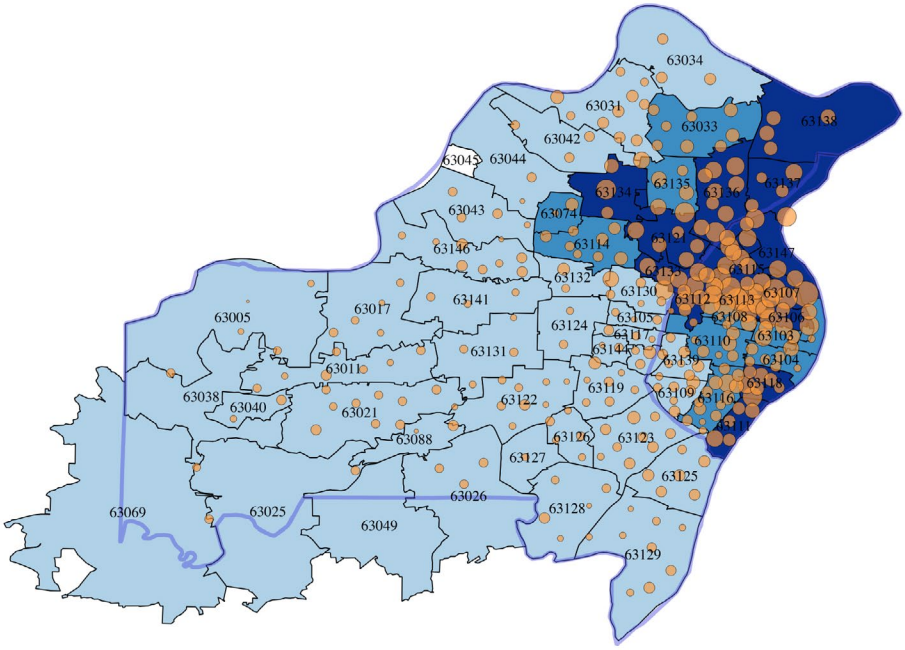
2010-2014: St. Louis City and County, MO | Births to Mothers Receiving Medicaid | By Zip code

Percent Unemployed
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 40
- 40 - 65
- Greater than 65



MAP 21: Medicaid + Vacant Housing.

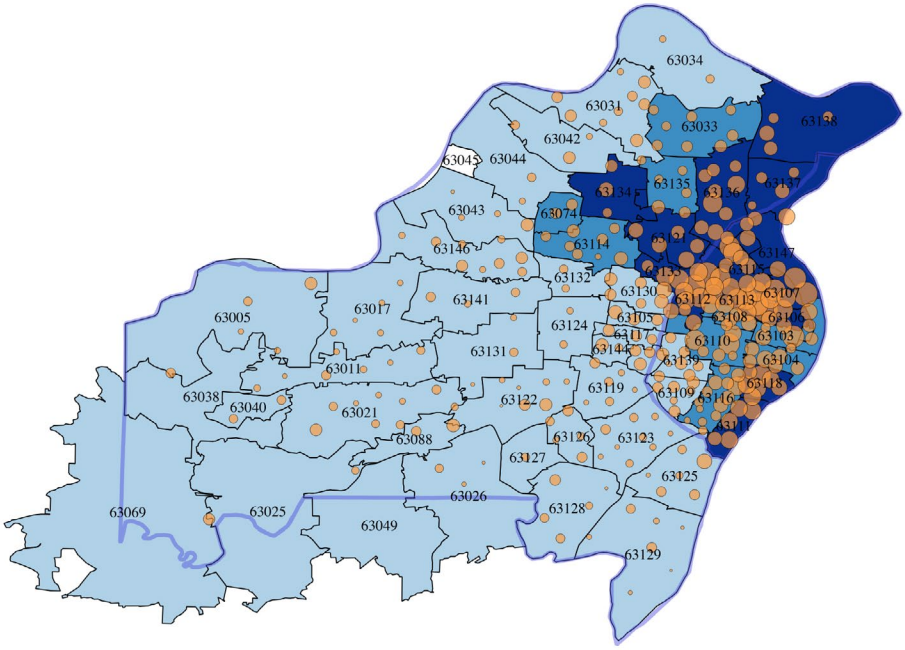
2010-2014: St. Louis City and County, MO | Births to Mothers Receiving Medicaid | By Zip code

Percent Vacant Housing Units
(By Census Tract)

- Greater than 20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 40
- 40 - 65
- Greater than 65



WIC Utilization

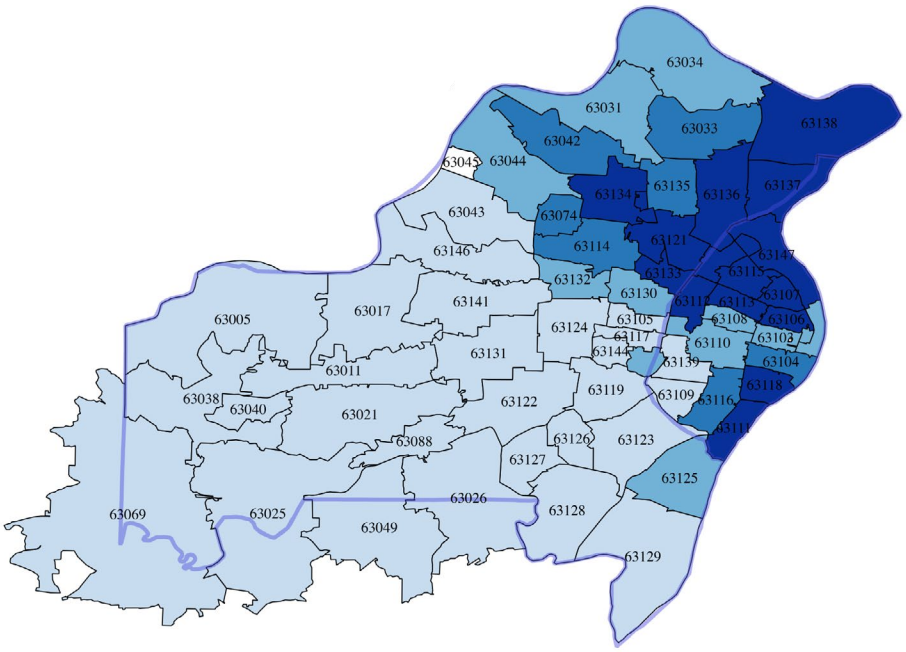
Mothers Receiving Women, Infants & Children (WIC) Assistance

MAP 22: WIC Only.

2010-2014: St. Louis City and County, MO | Rate of Births to Mothers Receiving WIC Assistance | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 25
- 25 - 45
- 45 - 60
- Greater than 60



MAP 23: WIC + Female-Headed Household.

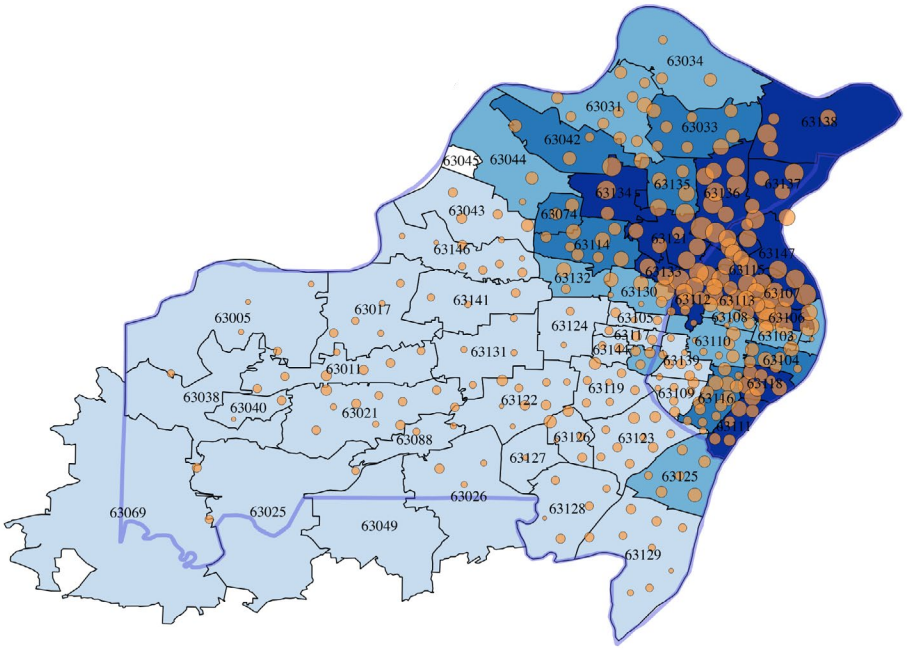
2010-2014: St. Louis City and County, MO | Rate of Births to Mothers Receiving WIC Assistance | By Zip code

Female-Headed Household, No husband present (By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 25
- 25 - 45
- 45 - 60
- Greater than 60



MAP 24: WIC + High School Graduation Rates.

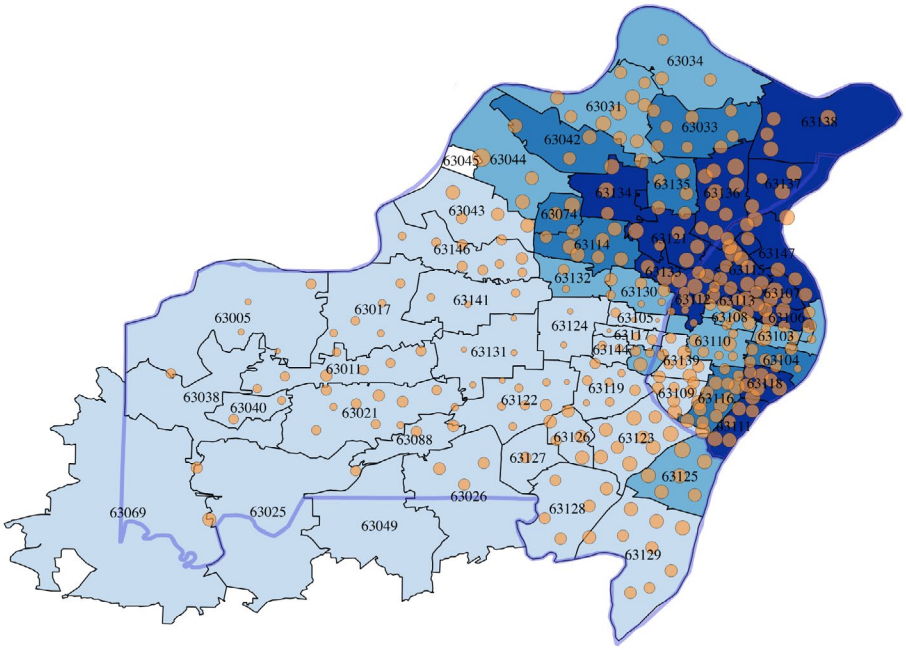
2010-2014: St. Louis City and County, MO | Rate of Births to Mothers Receiving WIC Assistance | By Zip code

Percent Graduated High School
or GED Equivalent
(By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 25
- 25 - 45
- 45 - 60
- Greater than 60



MAP 25: WIC + Percent of Households in Poverty.

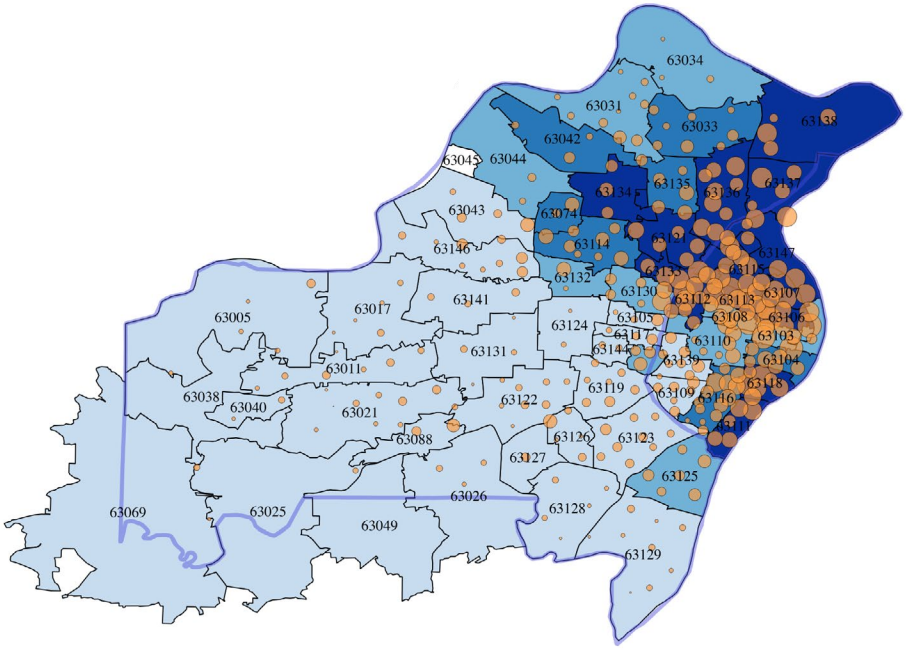
2010-2014: St. Louis City and County, MO | Rate of Births to Mothers Receiving WIC Assistance | By Zip code

Percent Annual Income Below
Federal Poverty Level
(By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 25
- 25 - 45
- 45 - 60
- Greater than 60



MAP 26: WIC + Median Income.

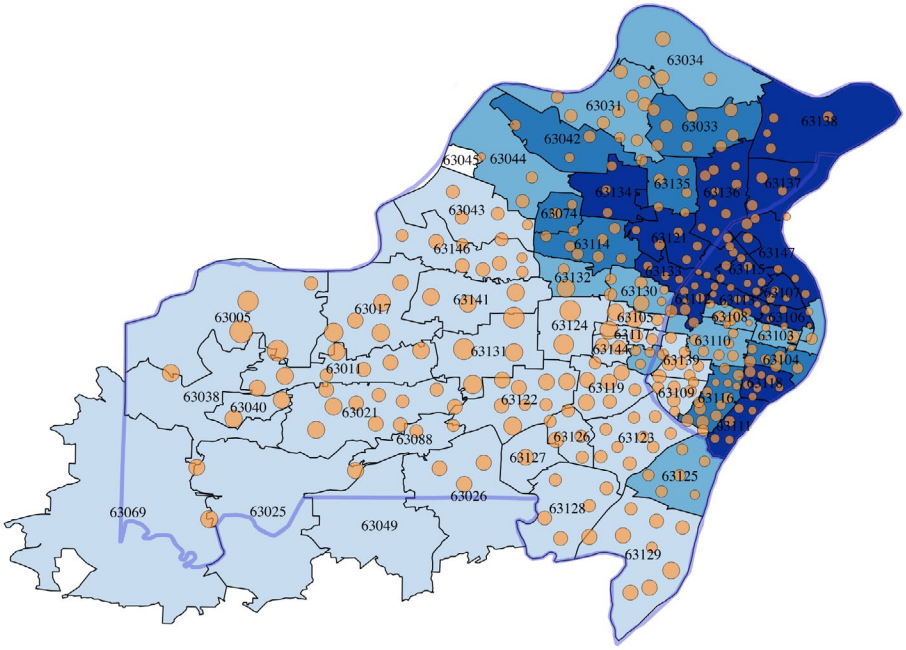
2010-2014: St. Louis City and County, MO | Rate of Births to Mothers Receiving WIC Assistance | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 25
- 25 - 45
- 45 - 60
- Greater than 60



MAP 27: WIC + Unemployment.

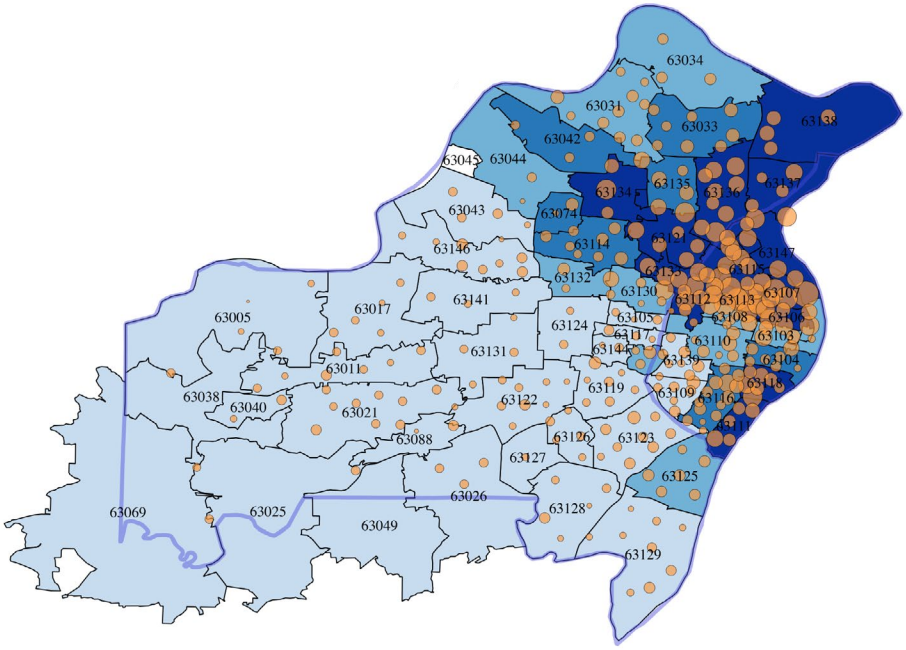
2010-2014: St. Louis City and County, MO | Rate of Births to Mothers Receiving WIC Assistance | By Zip code

Percent Unemployment
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 25
- 25 - 45
- 45 - 60
- Greater than 60



MAP 28: WIC + Vacant Housing.

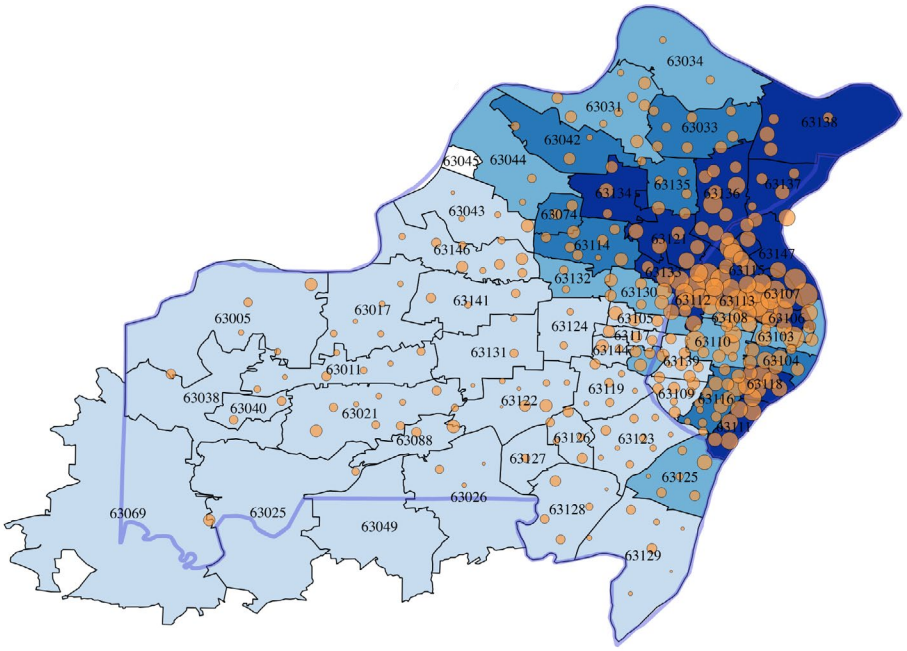
2010-2014: St. Louis City and County, MO | Rate of Births to Mothers Receiving WIC Assistance | By Zip code

Percent Vacant Housing Units
(By Census Tract)

- Greater than20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 25
- 25 - 45
- 45 - 60
- Greater than 60



Distribution of Selected Birth Outcomes

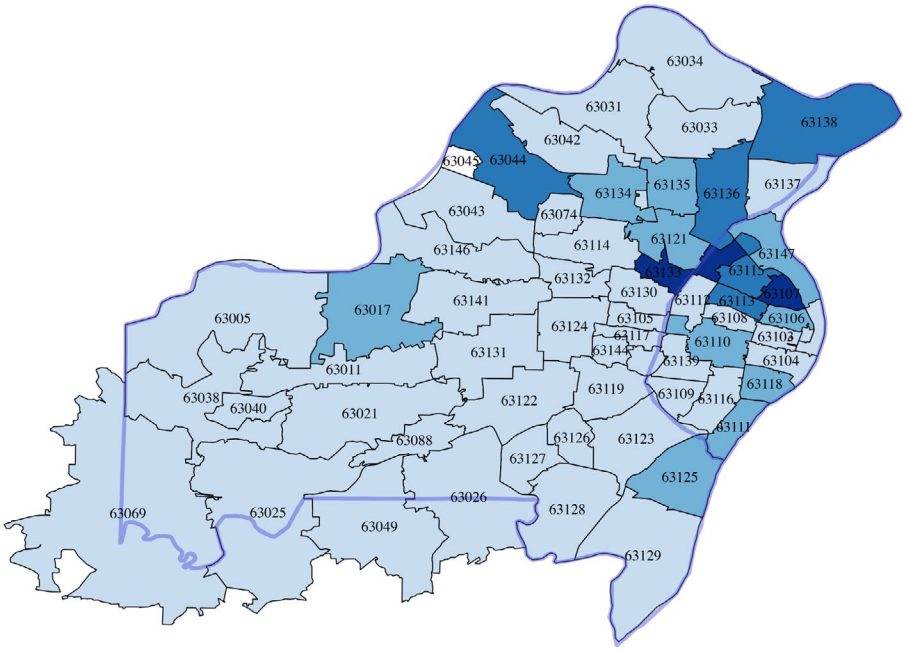
Infant Mortality

MAP 29: Infant Mortality Only.

2010-2014: St. Louis City and County, MO | Rate of Infant Deaths | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 6.0
- 6.0 - 9.0
- 9.0 - 12.0
- Greater than 12.0



MAP 30: Infant Mortality + Female-Headed Household.

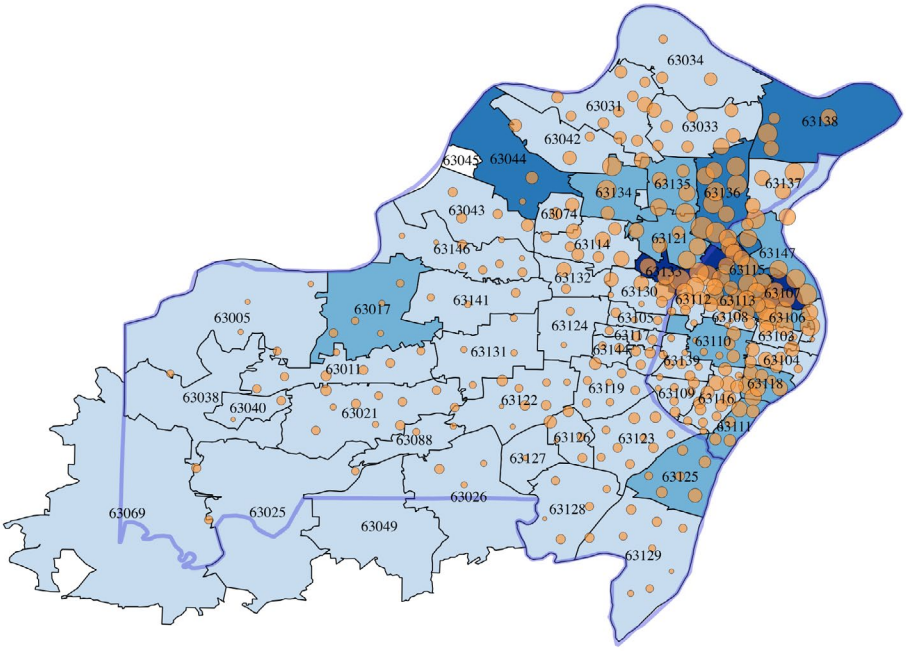
2010-2014: St. Louis City and County, MO | Rate of Infant Deaths | By Zip code

Female-Headed Household,
No husband present
(By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 6.0
- 6.0 - 9.0
- 9.0 - 12.0
- Greater than 12.0



MAP 31: Infant Mortality + High School Graduation Rates.

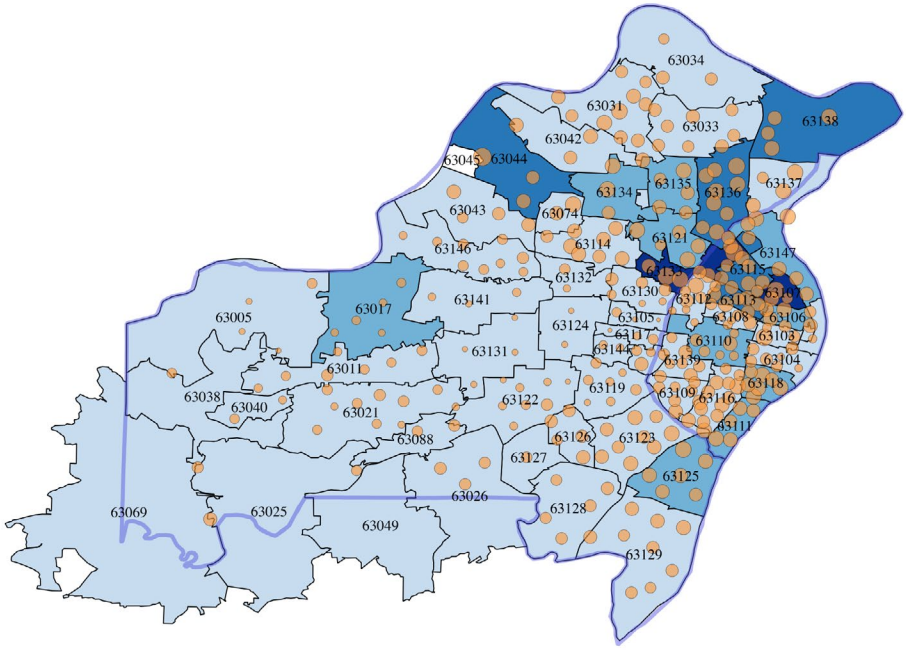
2010-2014: St. Louis City and County, MO | Rate of Infant Deaths | By Zip code

Percent Graduated High
School or GED Equivalent
(By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 6.0
- 6.0 - 9.0
- 9.0 - 12.0
- Greater than 12.0



MAP 32: Infant Mortality + Percent of Households in Poverty.

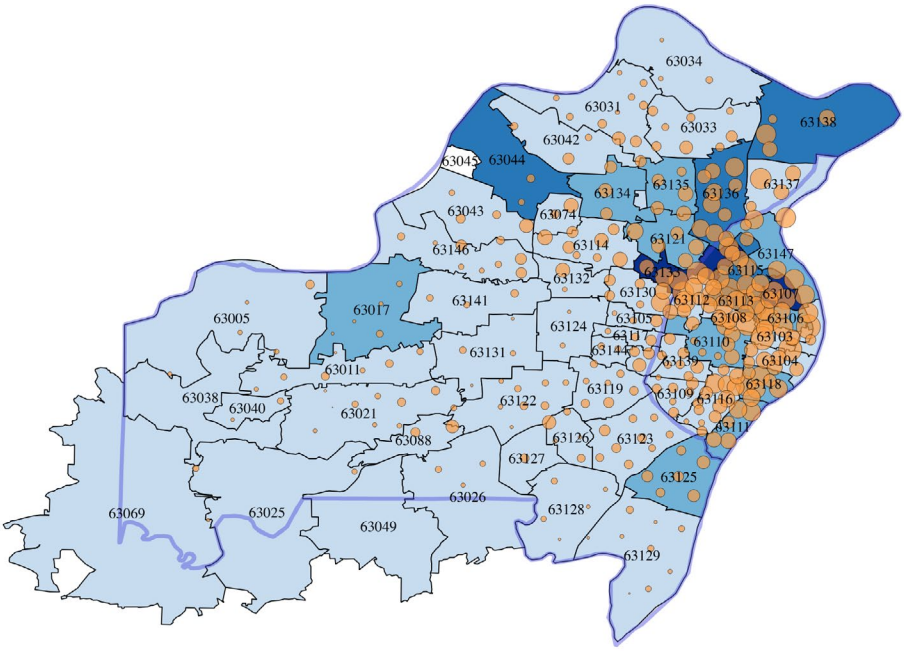
2010-2014: St. Louis City and County, MO | Rate of Infant Deaths | By Zip code

Percent Annual Income
Below Federal Poverty Level
(By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 6.0
- 6.0 - 9.0
- 9.0 - 12.0
- Greater than 12.0



MAP 33: Infant Mortality + Median Income.

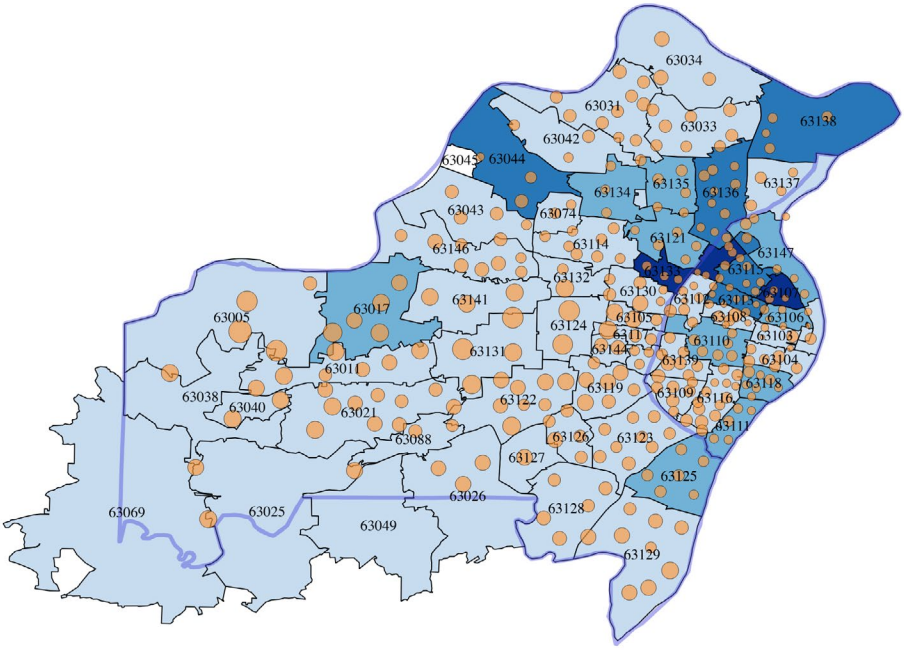
2010-2014: St. Louis City and County, MO | Rate of Infant Deaths | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 6.0
- 6.0 - 9.0
- 9.0 - 12.0
- Greater than 12.0



MAP 34: Infant Mortality + Unemployment.

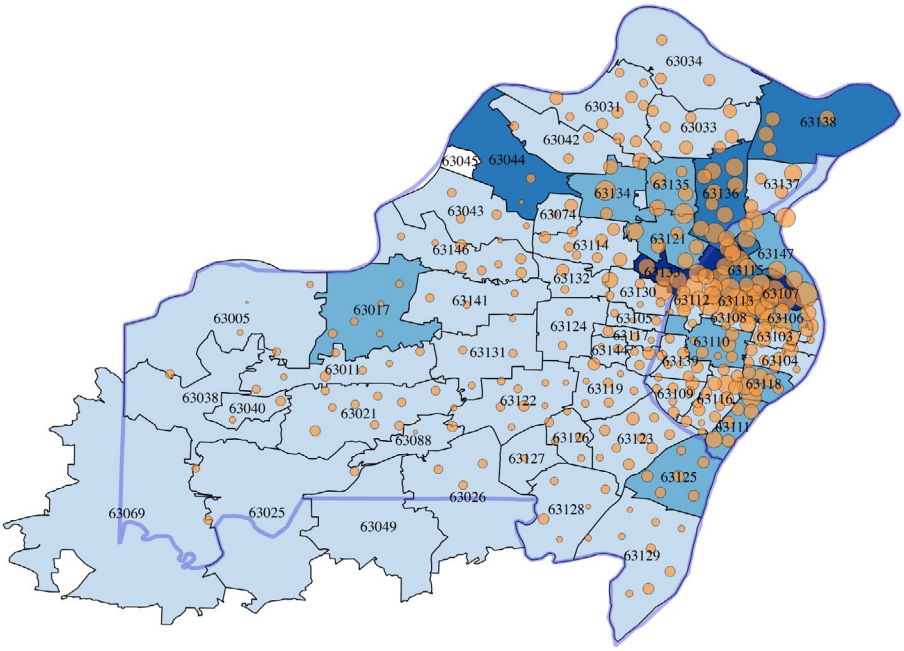
2010-2014: St. Louis City and County, MO | Rate of Infant Deaths | By Zip code

Percent Unemployed
(By Census Tract)

- Greater than 35%
- 5% - 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 6.0
- 6.0 - 9.0
- 9.0 - 12.0
- Greater than 12.0



MAP 35: Infant Mortality + Vacant Housing.

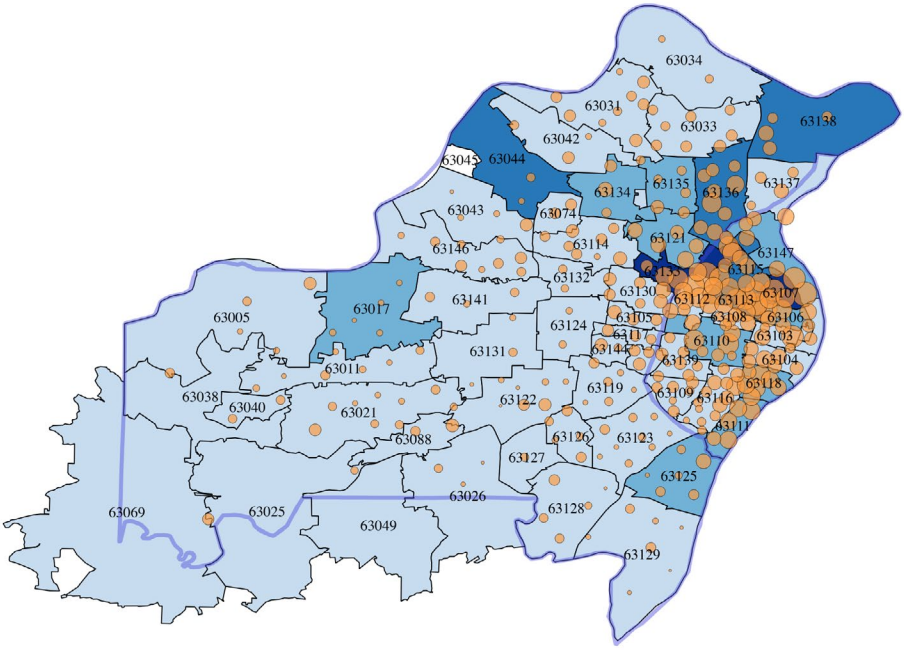
2010-2014: St. Louis City and County, MO | Rate of Infant Deaths | By Zip code

Percent Vacant Housing
Units (By Census Tract)

- Greater than 20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 6.0
- 6.0 - 9.0
- 9.0 - 12.0
- Greater than 12.0



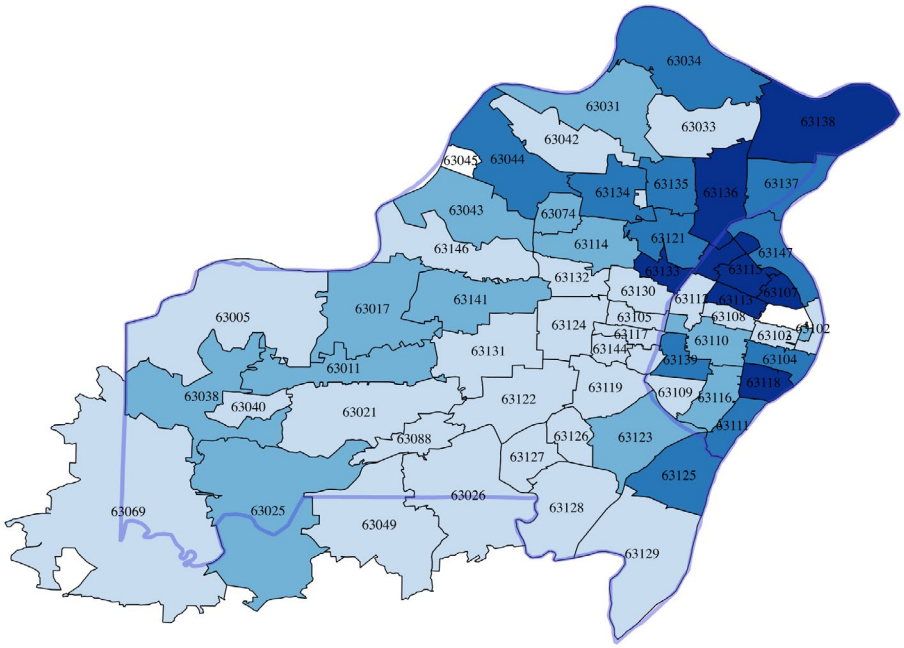
Neonatal Mortality

MAP 36: Neonatal Mortality Only.

2010-2014: St. Louis City and County, MO | Rate of Neonatal Deaths | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 4.1
- 4.1 - 6.2
- 6.2 - 8.2
- Greater than 8.2



MAP 37: Neonatal Mortality + Female-Headed Household.

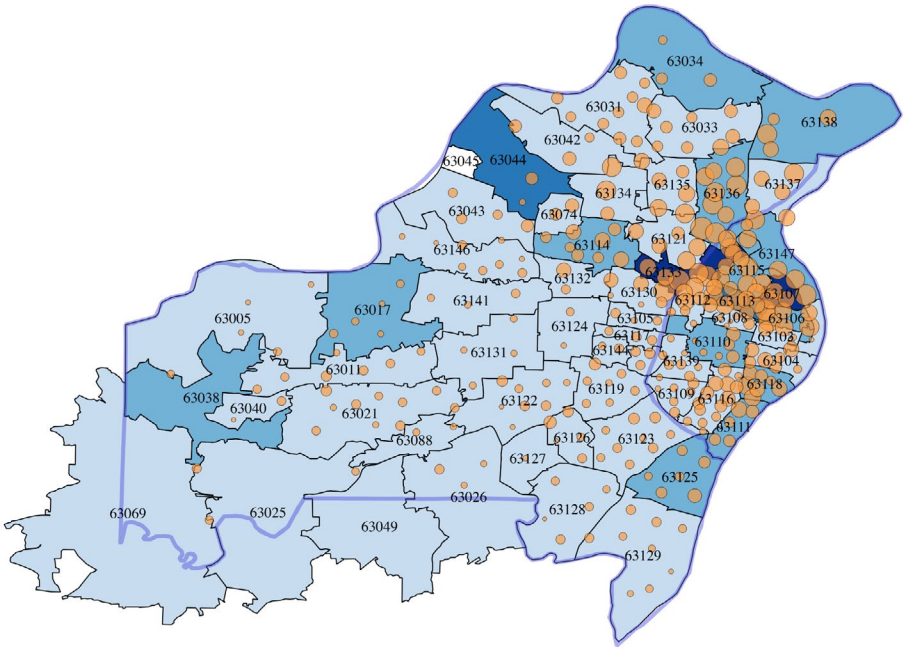
2010-2014: St. Louis City and County, MO | Rate of Neonatal Deaths | By Zip code

Female-Headed Household,
No husband present
(By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 4.1
- 4.1 - 6.2
- 6.2 - 8.2
- Greater than 8.2



MAP 38: Neonatal Mortality + High School Graduation Rates.

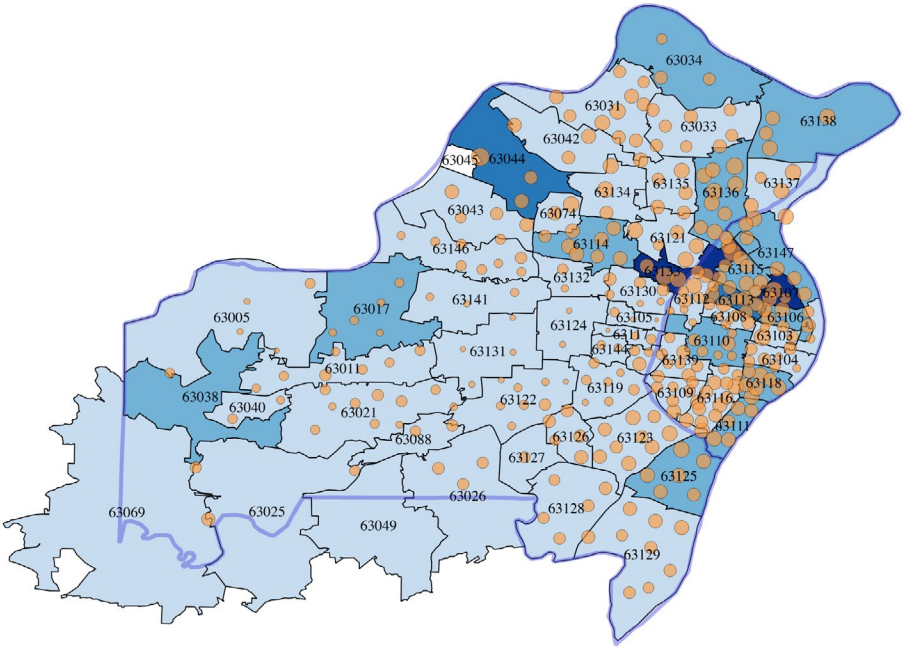
2010-2014: St. Louis City and County, MO | Rate of Neonatal Deaths | By Zip code

Percent Graduated High School
or GED Equivalent
(By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 4.1
- 4.1 - 6.2
- 6.2 - 8.2
- Greater than 8.2



MAP 39: Neonatal Mortality + Percent of Households in Poverty.

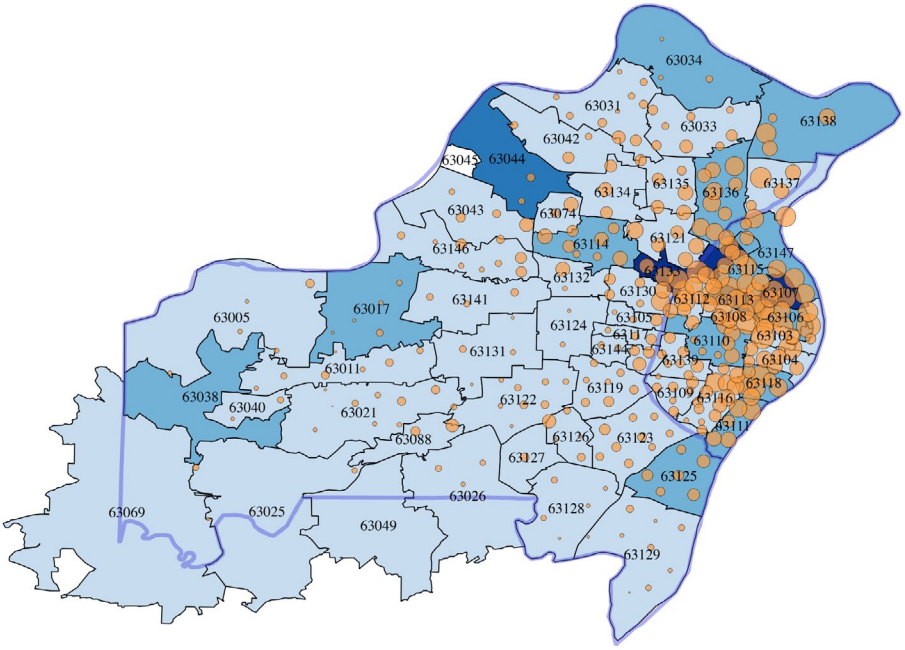
2010-2014: St. Louis City and County, MO | Rate of Neonatal Deaths | By Zip code

Percent Annual Income Below
Federal Poverty Level
(By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 4.1
- 4.1 - 6.2
- 6.2 - 8.2
- Greater than 8.2



MAP 40: Neonatal Mortality + Median Income.

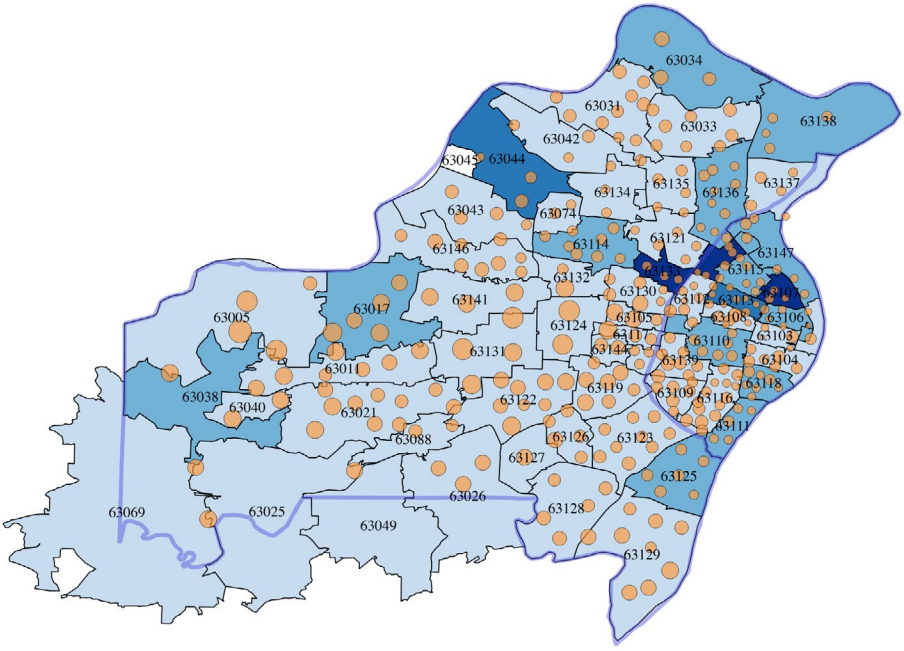
2010-2014: St. Louis City and County, MO | Rate of Neonatal Deaths | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 4.1
- 4.1 - 6.2
- 6.2 - 8.2
- Greater than 8.2



MAP 41: Neonatal Mortality + Unemployment.

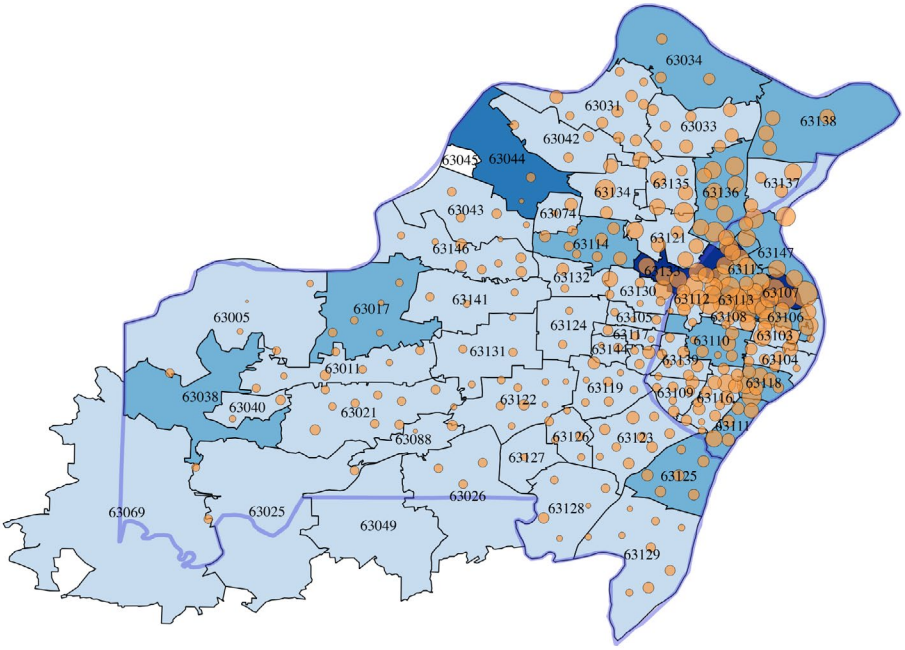
2010-2014: St. Louis City and County, MO | Rate of Neonatal Deaths | By Zip code

Percent Unemployed
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 4.1
- 4.1 - 6.2
- 6.2 - 8.2
- Greater than 8.2



MAP 42: Neonatal Mortality + Vacant Housing.

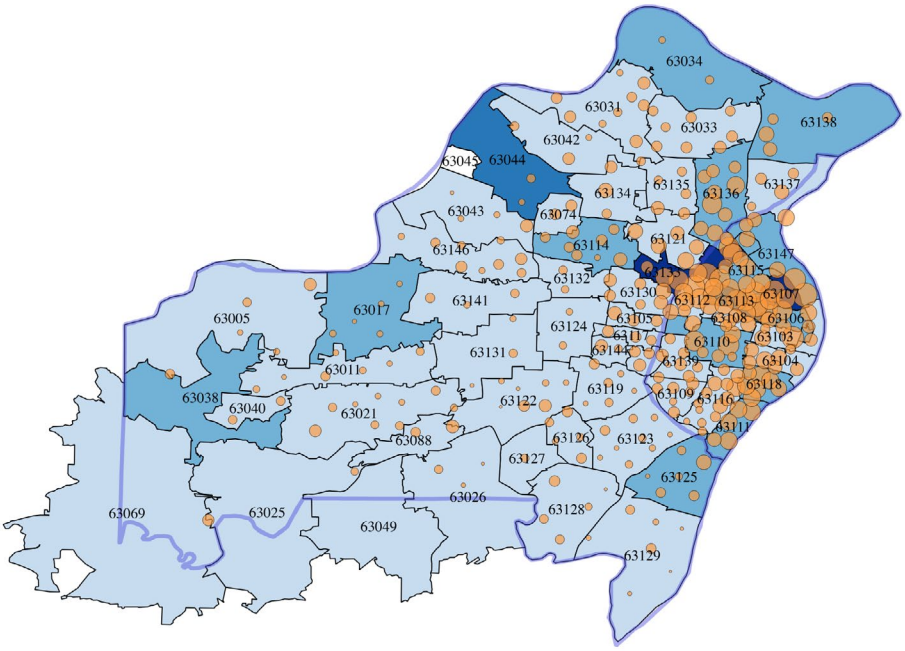
2010-2014: St. Louis City and County, MO | Rate of Neonatal Deaths | By Zip code

Percent Vacant Housing Units
(By Census Tract)

- Greater than 20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 4.1
- 4.1 - 6.2
- 6.2 - 8.2
- Greater than 8.2



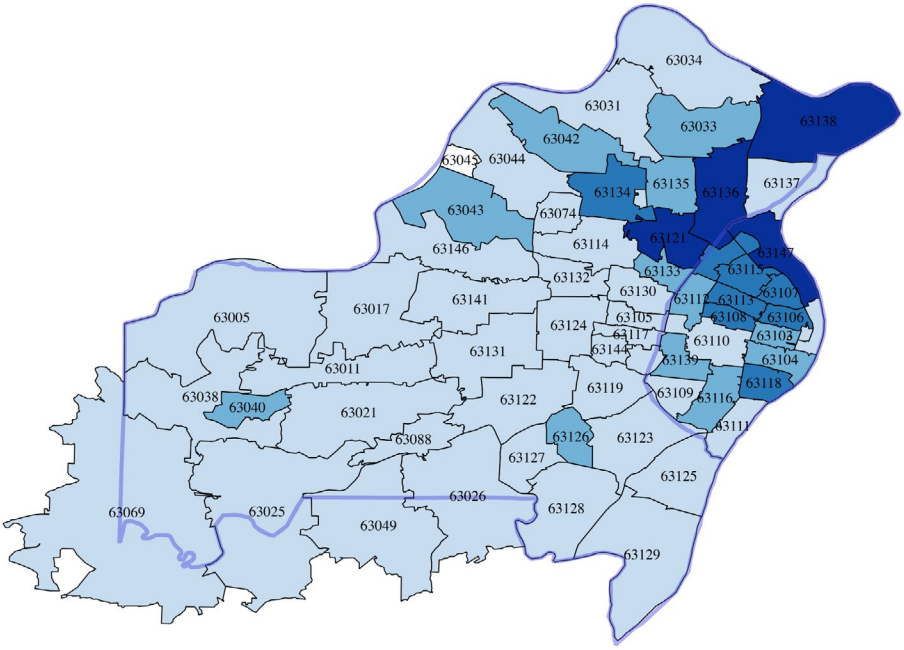
Post-Neonatal Mortality

MAP 43: Post-Neonatal Mortality Only.

2010-2014: St. Louis City and County, MO | Rate of Post-Neonatal Deaths | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- Greater than 4.0



MAP 44: Post-Neonatal Mortality + Female-Headed Household.

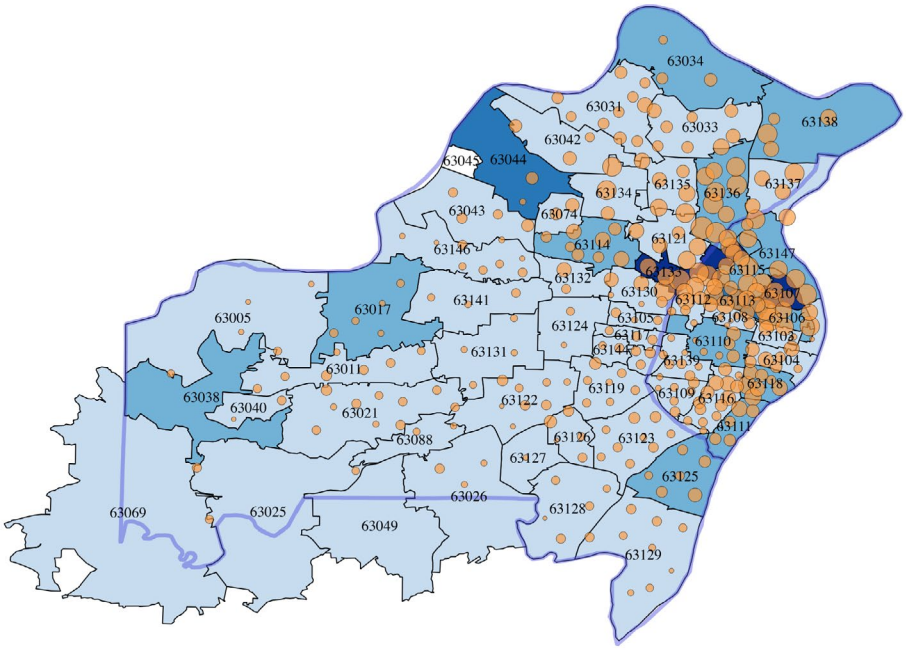
2010-2014: St. Louis City and County, MO | Rate of Post-neonatal Deaths | By Zip code

Female-Headed Household,
No husband present
(By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- Greater than 4.0



MAP 45: Post-Neonatal Mortality + High School Graduation Rates.

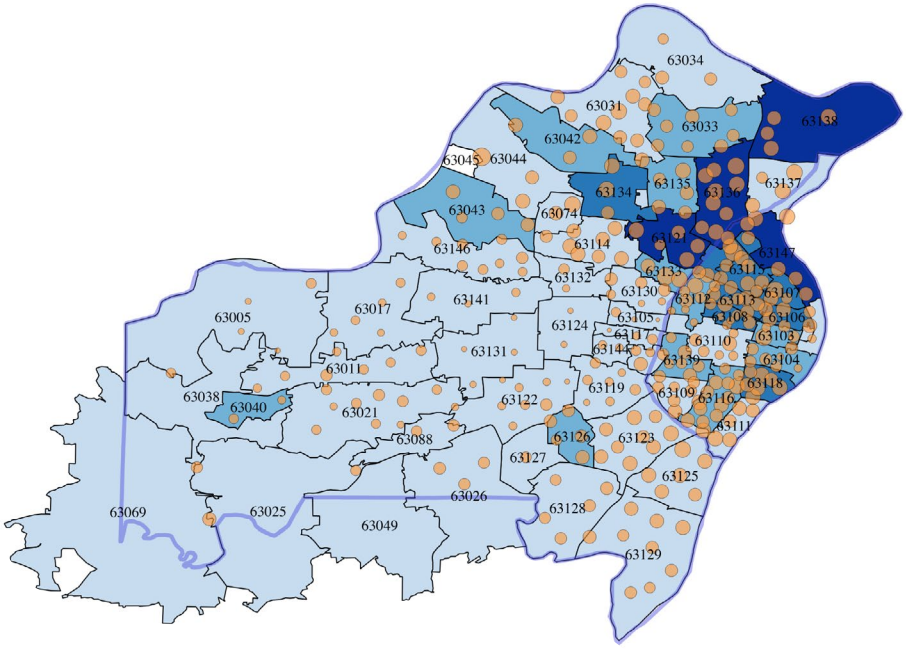
2010-2014: St. Louis City and County, MO | Rate of Post-neonatal Deaths | By Zip code

Percent Graduated High
School or GED Equivalent
(By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- Greater than 4.0



MAP 46: Post-Neonatal Mortality + Percent of Households in Poverty.

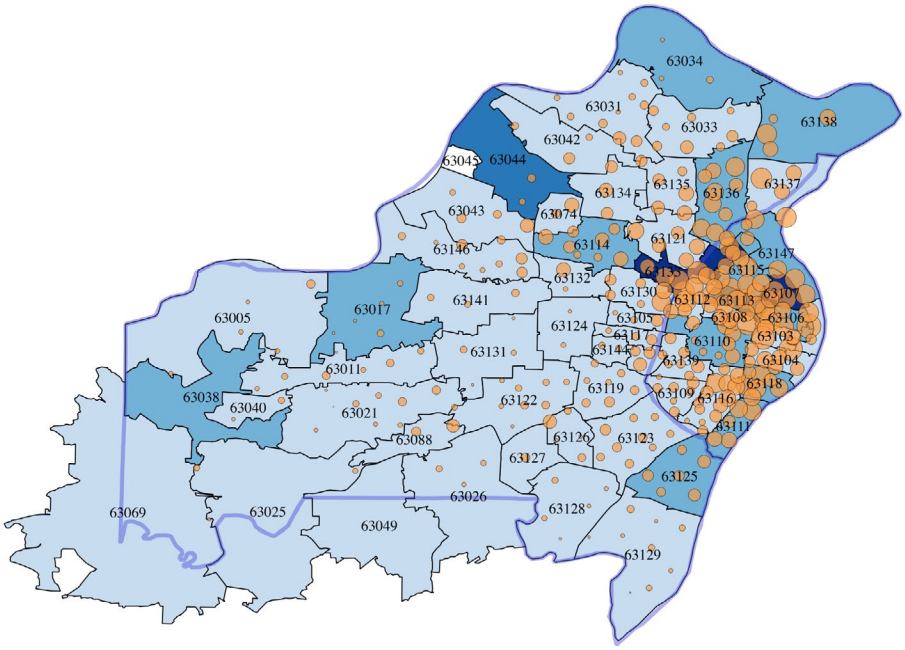
2010-2014: St. Louis City and County, MO | Rate of Post-neonatal Deaths | By Zip code

Percent Annual Income Below Federal Poverty Level (By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- Greater than 4.0



MAP 47: Post-Neonatal Mortality + Median Income.

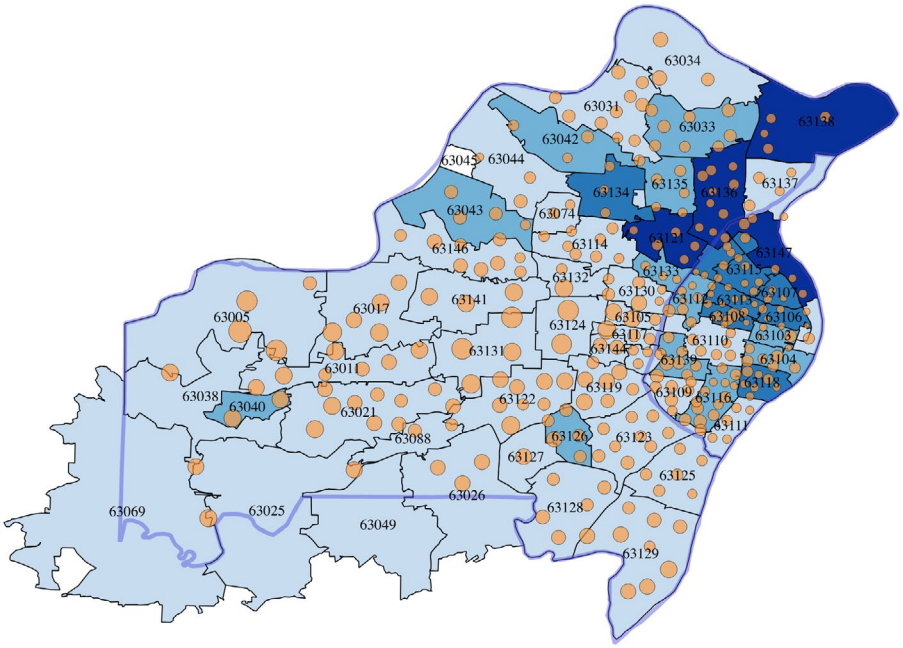
2010-2014: St. Louis City and County, MO | Rate of Post-neonatal Deaths | By Zip code

Median Household Income (By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- Greater than 4.0



MAP 48: Post-Neonatal Mortality + Unemployment.

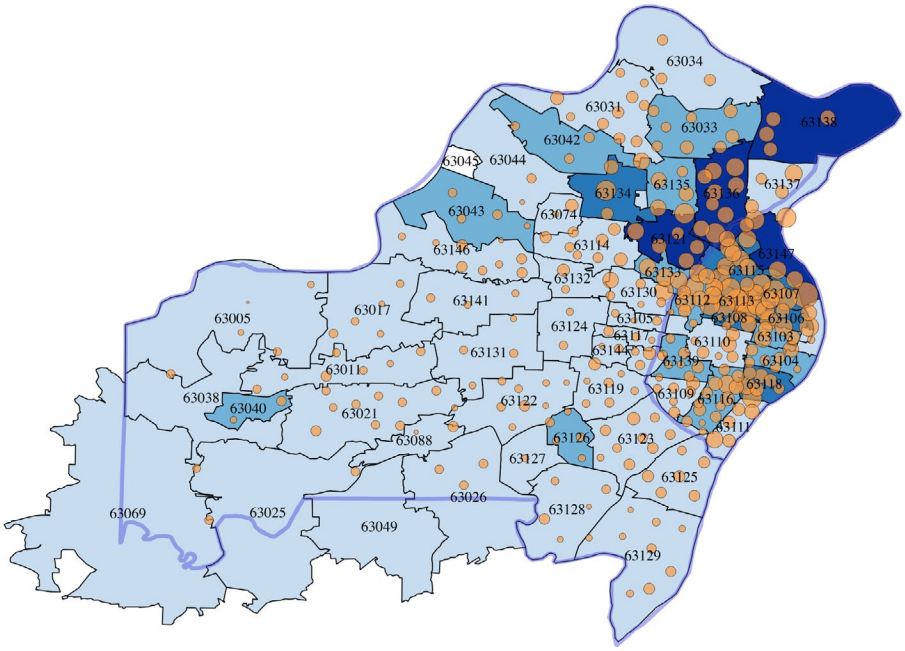
2010-2014: St. Louis City and County, MO | Rate of Post-neonatal Deaths | By Zip code

Percent Unemployed
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- Greater than 4.0



MAP 49: Post-Neonatal Mortality + Vacant Housing.

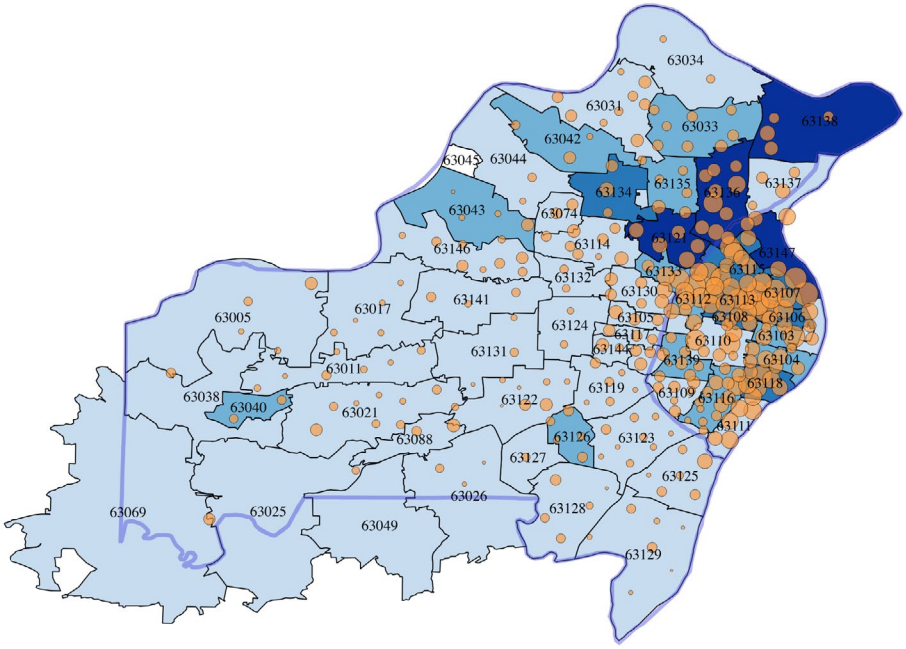
2010-2014: St. Louis City and County, MO | Rate of Post-neonatal Deaths | By Zip code

Percent Vacant Housing
Units (By Census Tract)

- Greater than 20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- Greater than 4.0



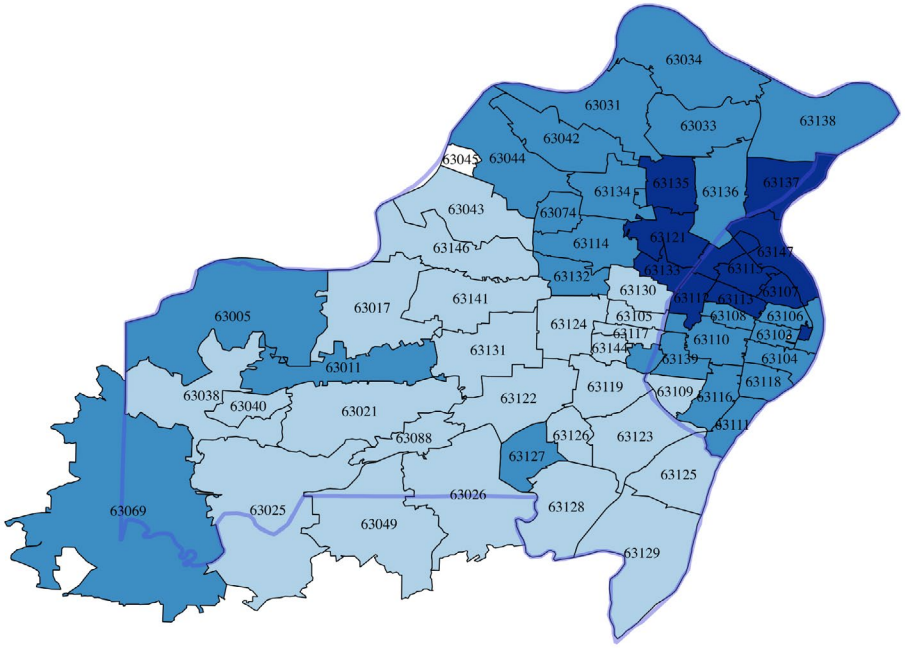
Preterm Births

MAP 50: Preterm Birth Only.

2010-2014: St. Louis City and County, MO | Rate of Preterm Live Births (<37 weeks) | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 11.4
- 11.4 - 17.1
- Greater than 17.1



MAP 51: Preterm Birth + Female-Headed Household.

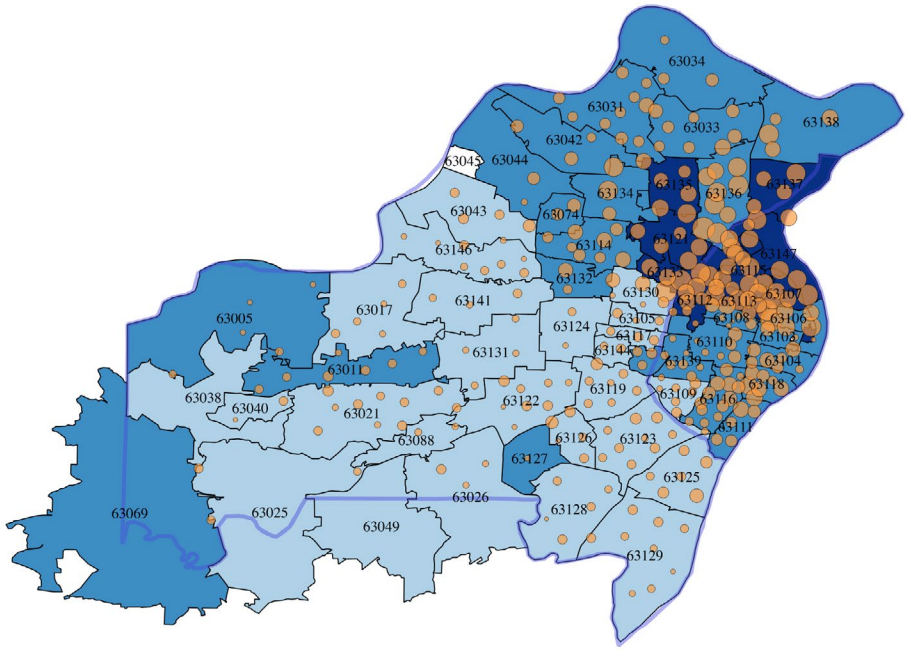
2010-2014: St. Louis City and County, MO | Rate of Preterm Live Births (<37 weeks) | By Zip code

Female-Headed Household,
No husband present
(By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 11.4
- 11.4 - 17.1
- Greater than 17.1



MAP 52: Preterm Birth + High School Graduation Rates.

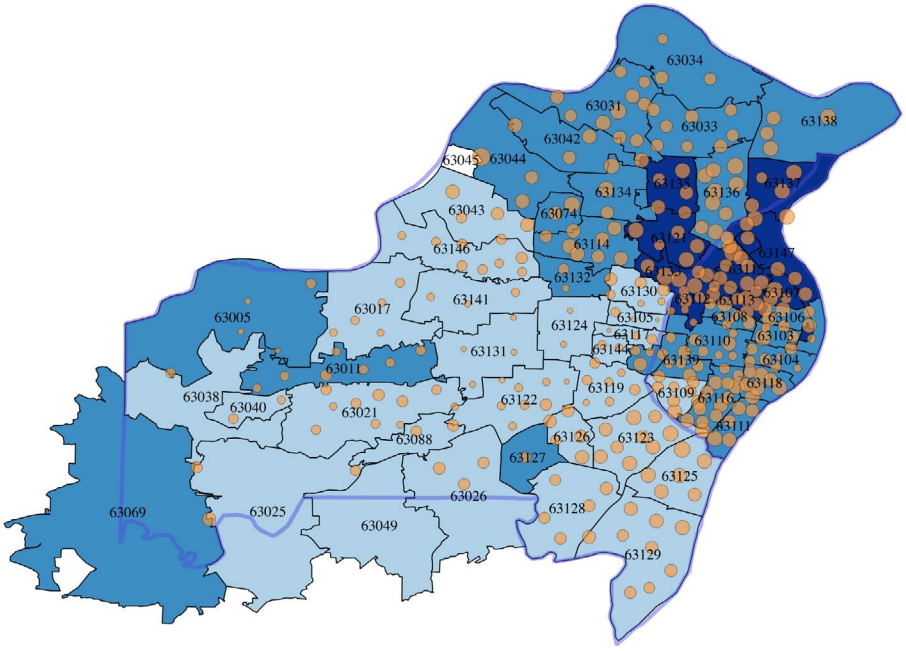
2010-2014: St. Louis City and County, MO | Rate of Preterm Live Births (<37 weeks) | By Zip code

Percent Graduated High School or GED Equivalent (By Census Tract)

- Less than 15%
- 15% - 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 11.4
- 11.4 - 17.1
- Greater than 17.1



MAP 53: Preterm Birth + Percent of Households in Poverty.

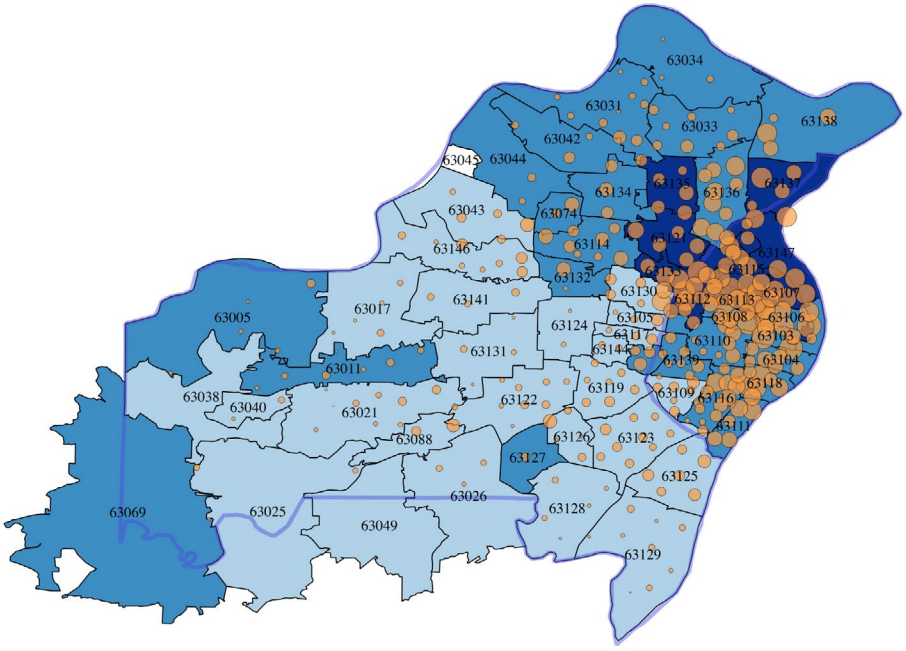
2010-2014: St. Louis City and County, MO | Rate of Preterm Live Births (<37 weeks) | By Zip code

Percent Annual Income Below Federal Poverty Level (By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 11.4
- 11.4 - 17.1
- Greater than 17.1



MAP 54: Preterm Birth + Median Income.

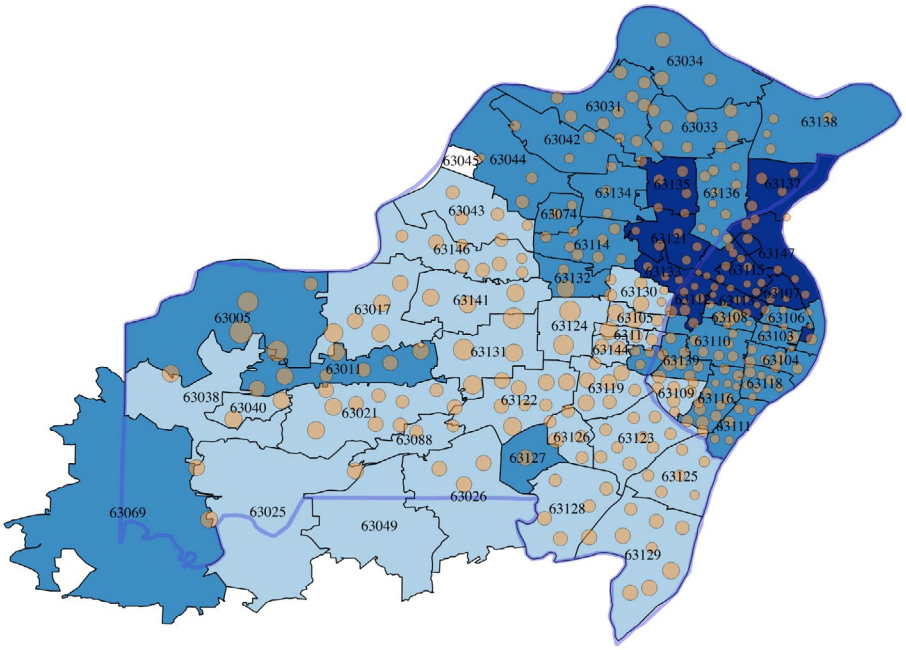
2010-2014: St. Louis City and County, MO | Rate of Preterm Live Births (<37 weeks) | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 11.4
- 11.4 - 17.1
- Greater than 17.1



MAP 55: Preterm Birth + Unemployment.

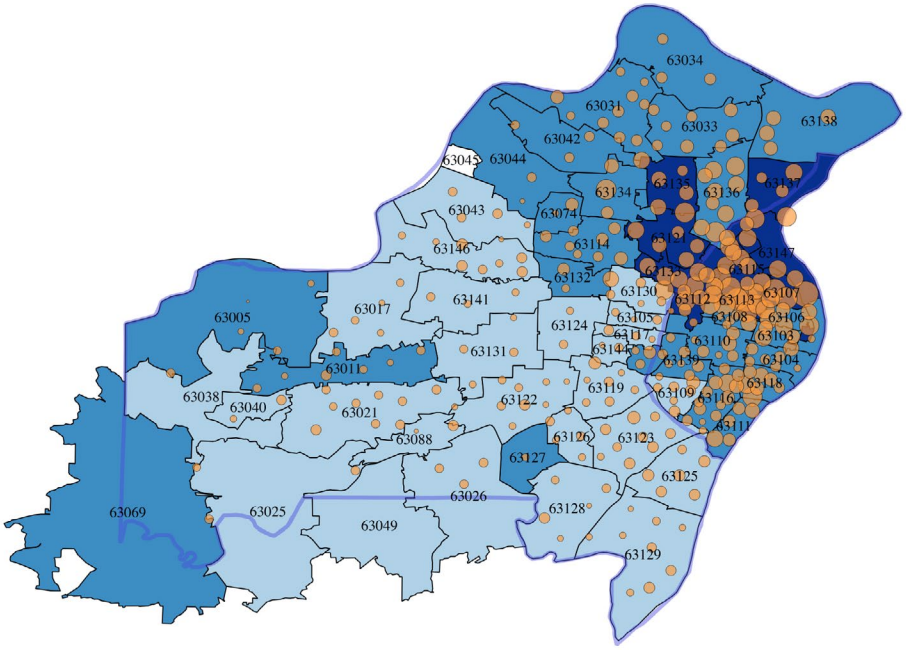
2010-2014: St. Louis City and County, MO | Rate of Preterm Live Births (<37 weeks) | By Zip code

Percent Unemployed
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 11.4
- 11.4 - 17.1
- Greater than 17.1



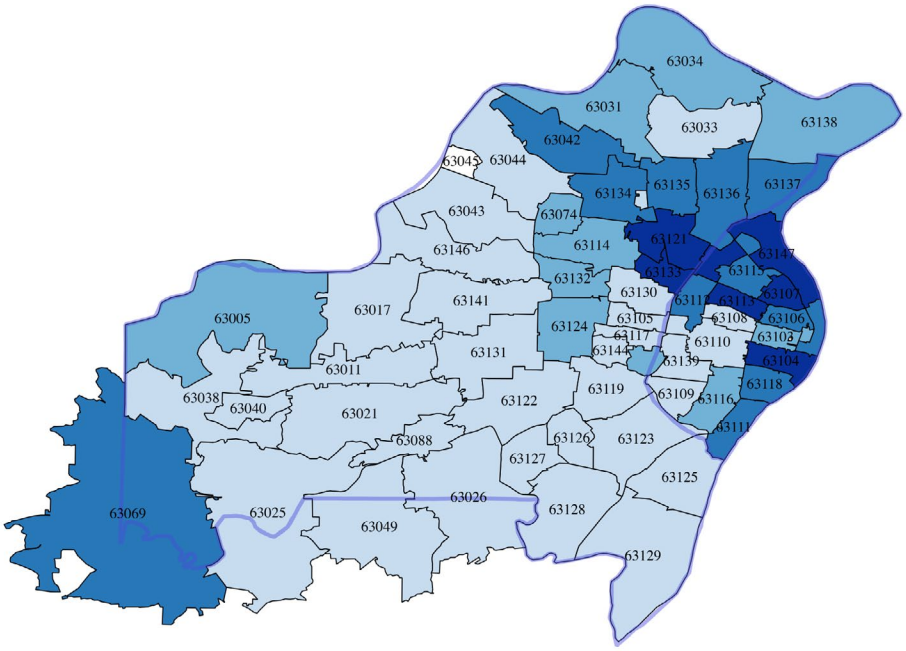
Very Preterm Births

MAP 56: Very Preterm Birth Only.

2010-2014: St. Louis City and County, MO | Rate of Very Preterm Births (<32 weeks) | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.8
- 1.8 - 2.7
- 2.7 - 3.6
- Greater than 3.6



MAP 57: Very Preterm Birth + Female-Headed Household.

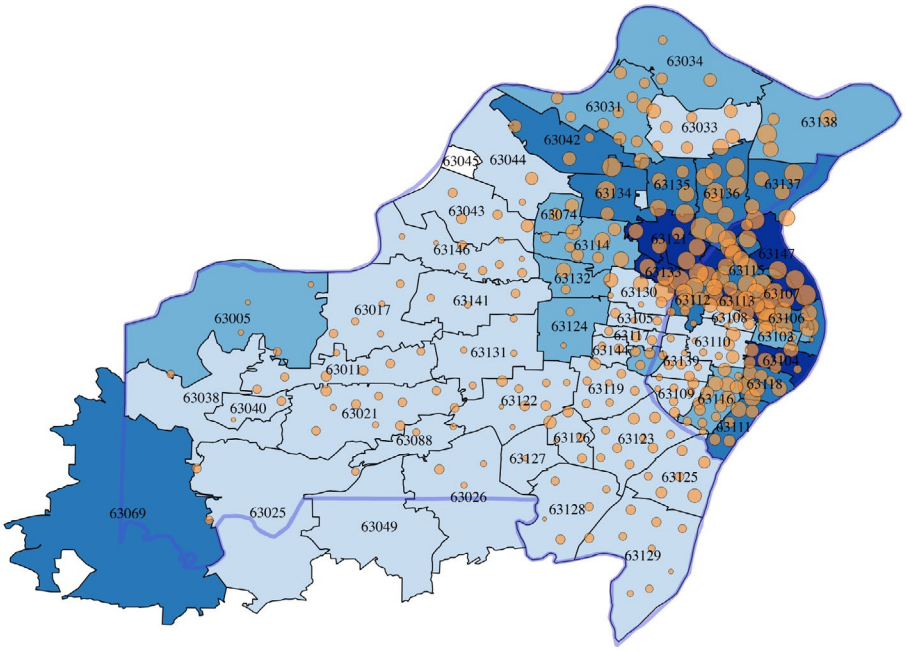
2010-2014: St. Louis City and County, MO | Rate of Very Preterm Births (<32 weeks) | By Zip code

Female-Headed Household,
No husband present
(By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.8
- 1.8 - 2.7
- 2.7 - 3.6
- Greater than 3.6



MAP 58: Very Preterm Birth + High School Graduation Rates.

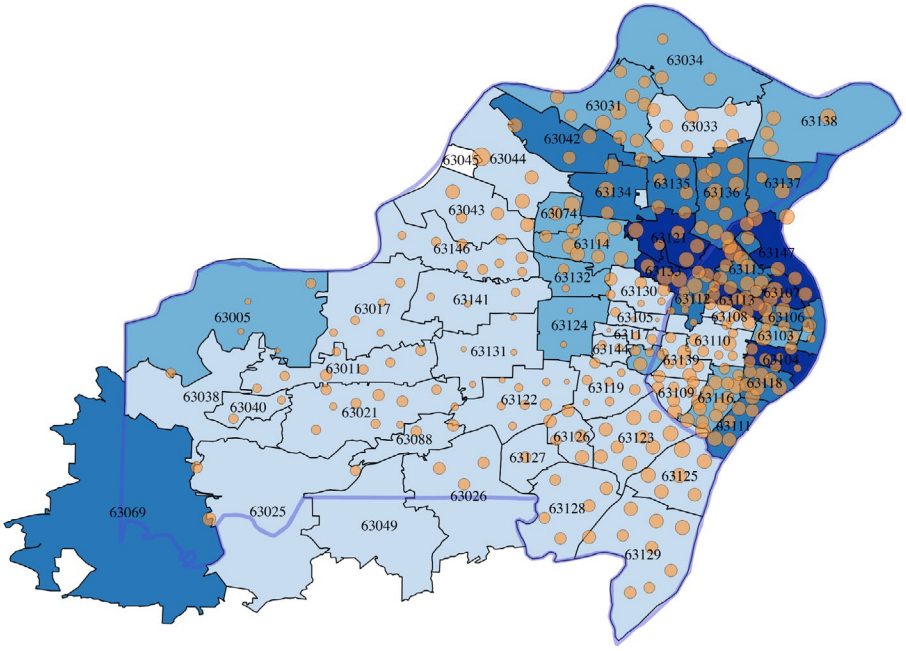
2010-2014: St. Louis City and County, MO | Rate of Very Preterm Births (<32 weeks) | By Zip code

Percent Graduated High School
or GED Equivalent
(By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.8
- 1.8 - 2.7
- 2.7 - 3.6
- Greater than 3.6



MAP 59: Very Preterm Birth + Percent of Households in Poverty.

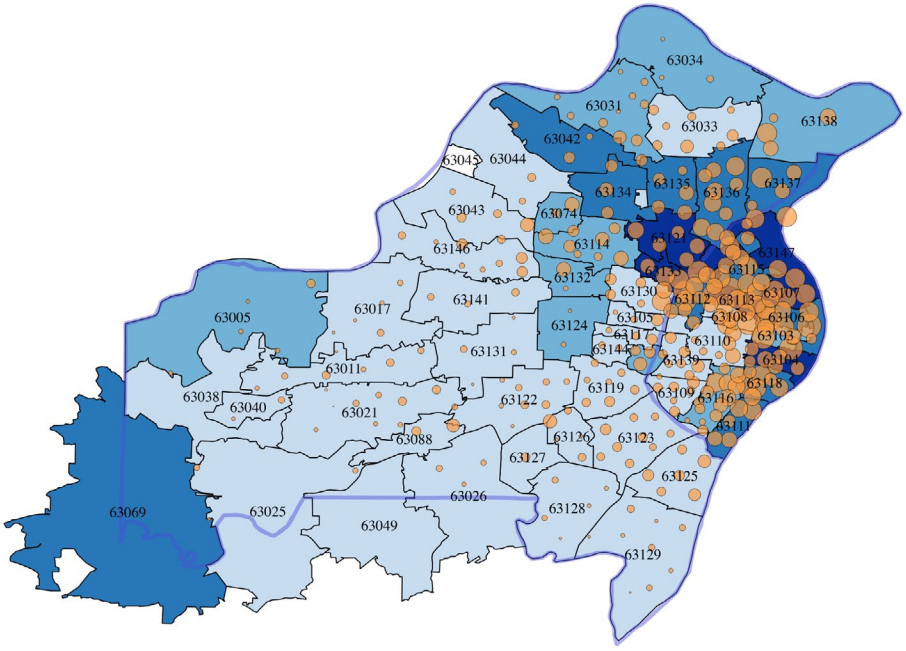
2010-2014: St. Louis City and County, MO | Rate of Very Preterm Births (<32 weeks) | By Zip code

Percent Annual Income Below
Federal Poverty Level
(By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.8
- 1.8 - 2.7
- 2.7 - 3.6
- Greater than 3.6



MAP 60: Very Preterm Birth + Median Income.

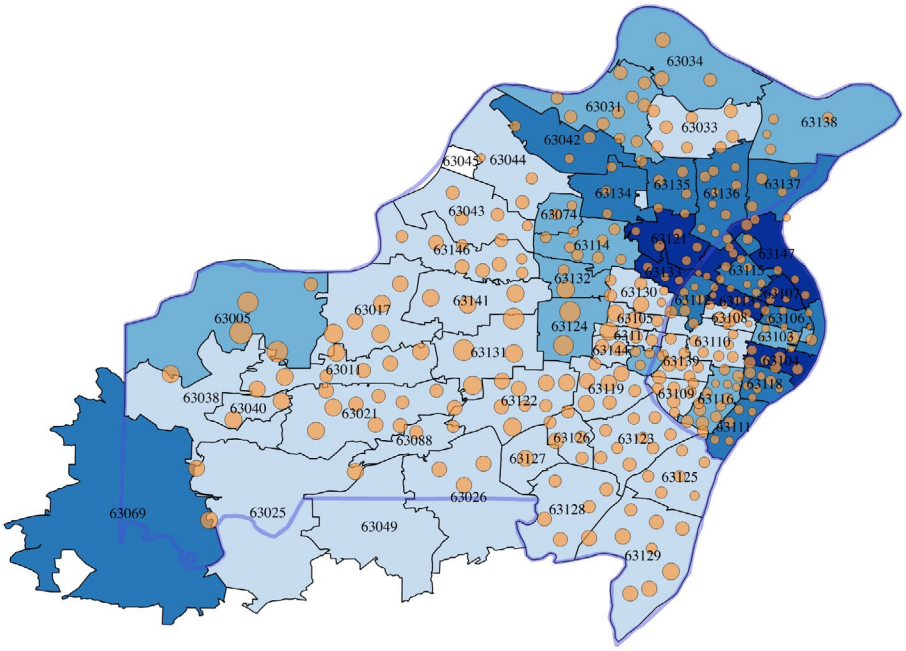
2010-2014: St. Louis City and County, MO | Rate of Very Preterm Births (<32 weeks) | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.8
- 1.8 - 2.7
- 2.7 - 3.6
- Greater than 3.6



MAP 61: Very Preterm Birth + Unemployment.

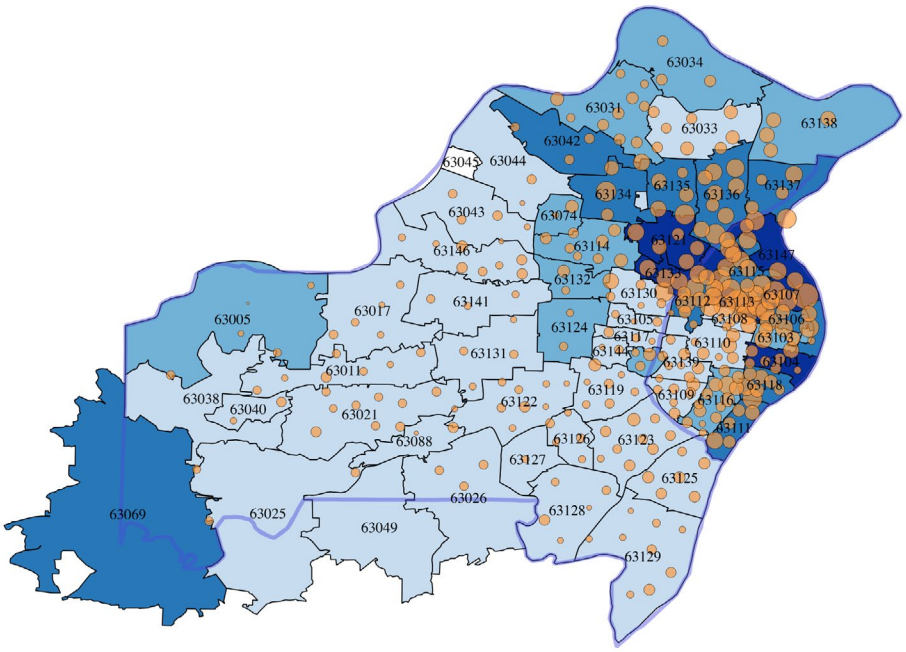
2010-2014: St. Louis City and County, MO | Rate of Very Preterm Births (<32 weeks) | By Zip code

Percent Unemployment
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.8
- 1.8 - 2.7
- 2.7 - 3.6
- Greater than 3.6



MAP 62: Very Preterm Birth + Vacant Housing.

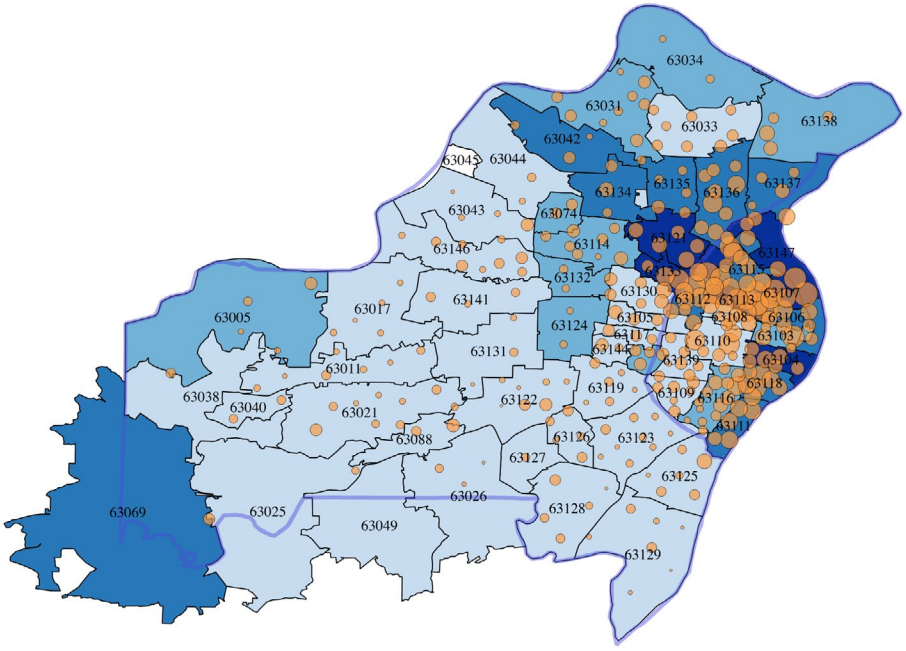
2010-2014: St. Louis City and County, MO | Rate of Very Preterm Births (<32 weeks) | By Zip code

Percent Vacant Housing Units
(By Census Tract)

- Greater than 20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.8
- 1.8 - 2.7
- 2.7 - 3.6
- Greater than 3.6



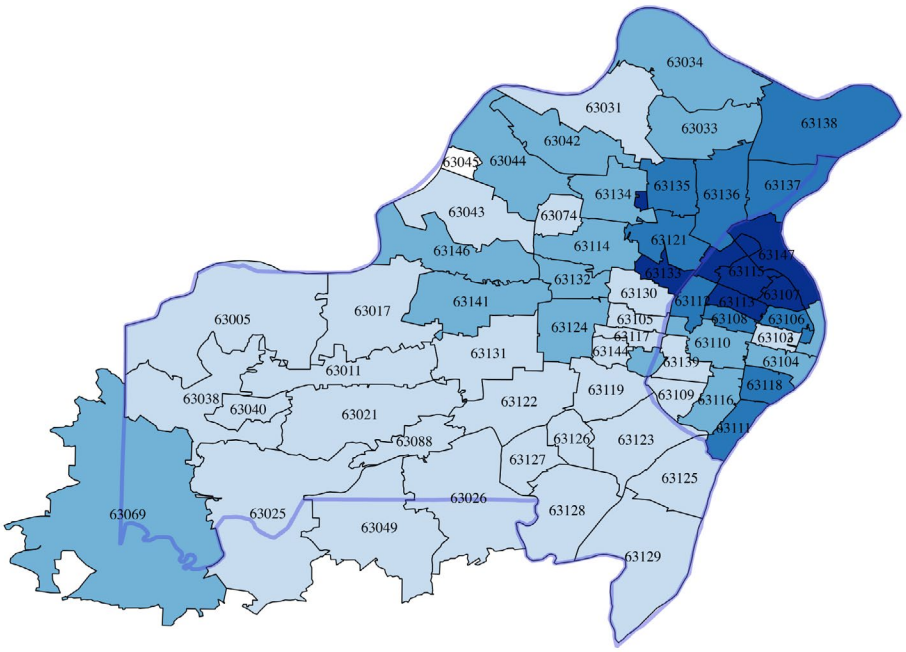
Low Birth Weight

MAP 63: Low Birth Weight Only.

2010-2014: St. Louis City and County, MO | Rate of Low Birth Weight Births (<2,500g) | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 7.8
- 7.8 - 11.7
- 11.7 - 15.6
- Greater than 15.6



MAP 64: Low Birth Weight + Female-Headed Household.

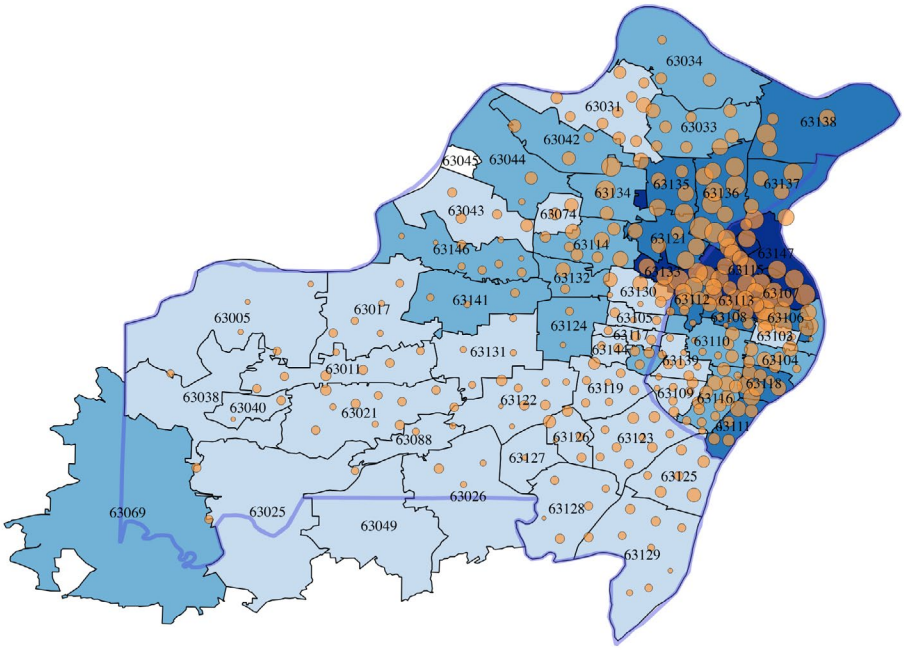
2010-2014: St. Louis City and County, MO | Rate of Low Birth Weight Births (<2,500g) | By Zip code

Female-Headed Household,
No husband present
(By Census Tract)

- Less than 10%
- 20% to 30%
- Greater than 30%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 7.8
- 7.8 - 11.7
- 11.7 - 15.6
- Greater than 15.6



MAP 65: Low Birth Weight + High School Graduation Rates.

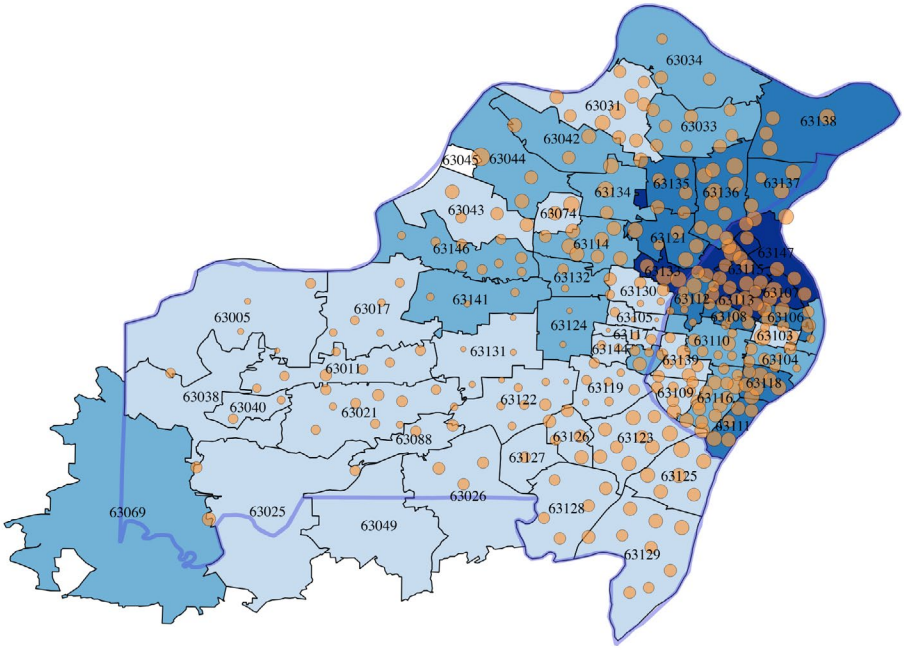
2010-2014: St. Louis City and County, MO | Rate of Low Birth Weight Births (<2,500g) | By Zip code

Percent Graduated High School
or GED Equivalent
(By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 7.8
- 7.8 - 11.7
- 11.7 - 15.6
- Greater than 15.6



MAP 66: Low Birth Weight + Percent of Households in Poverty.

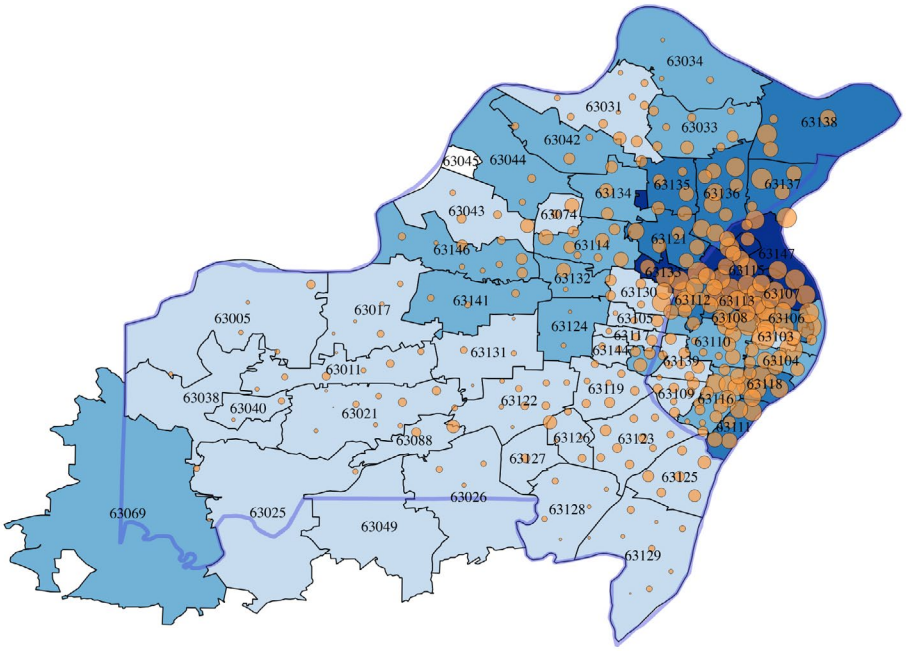
2010-2014: St. Louis City and County, MO | Rate of Low Birth Weight Births (<2,500g) | By Zip code

Percent Annual Income Below Federal Poverty Level (By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 7.8
- 7.8 - 11.7
- 11.7 - 15.6
- Greater than 15.6



MAP 67: Low Birth Weight + Median Income.

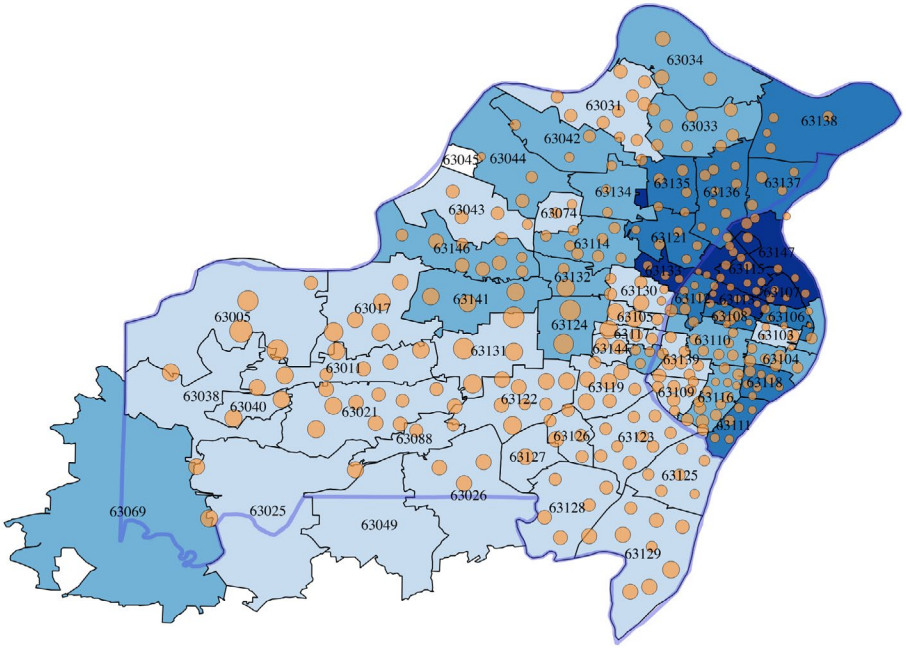
2010-2014: St. Louis City and County, MO | Rate of Low Birth Weight Births (<2,500g) | By Zip code

Median Household Income (By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 7.8
- 7.8 - 11.7
- 11.7 - 15.6
- Greater than 15.6



MAP 68: Low Birth Weight + Unemployment.

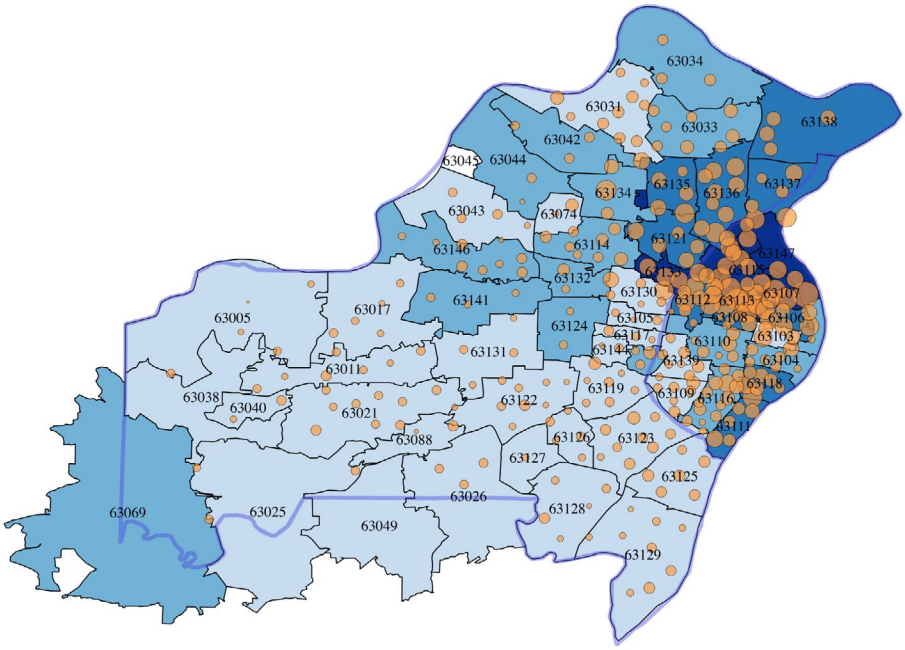
2010-2014: St. Louis City and County, MO | Rate of Low Birth Weight Births (<2,500g) | By Zip code

Percent Unemployed
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 7.8
- 7.8 - 11.7
- 11.7 - 15.6
- Greater than 15.6



MAP 69: Low Birth Weight + Vacant Housing.

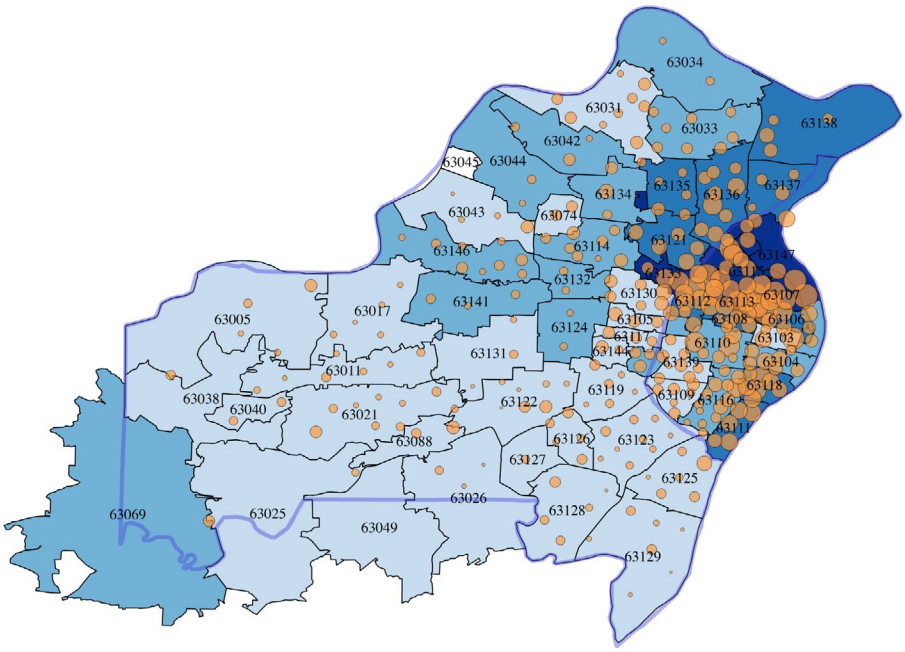
2010-2014: St. Louis City and County, MO | Rate of Low Birth Weight Births (<2,500g) | By Zip code

Percent Vacant Housing Units
(By Census Tract)

- Greater than 20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 7.8
- 7.8 - 11.7
- 11.7 - 15.6
- Greater than 15.6



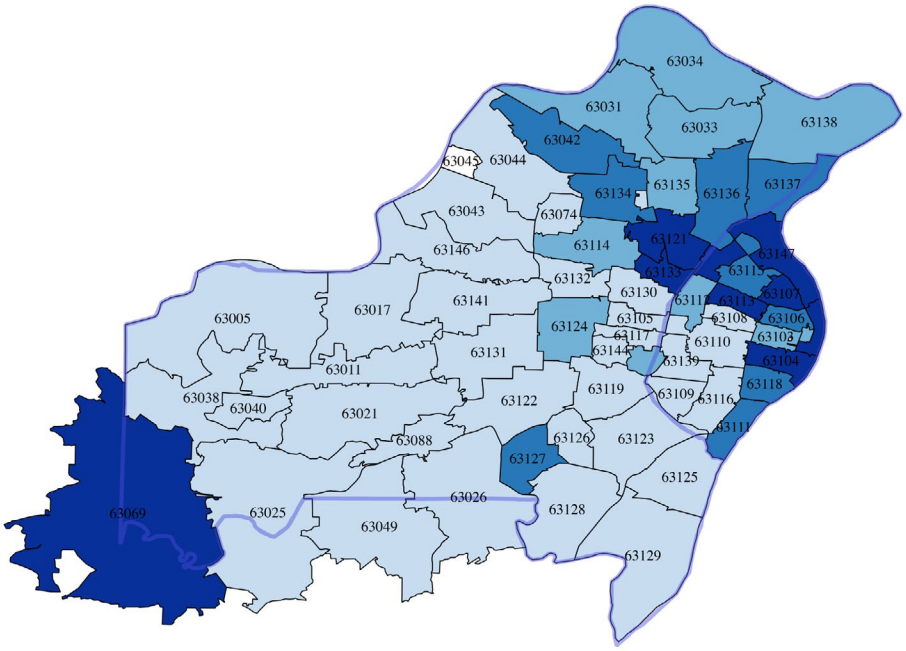
Very Low Birth Weight

MAP 70: Very Low Birth Weight Only.

2010-2014: St. Louis City and County, MO | Rate of Very Low Birth Weight Births (<1500g) | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.4
- 1.4 - 2.1
- 2.1 - 2.8
- Greater than 2.8



MAP 71: Very Low Birth Weight + Female-Headed Household.

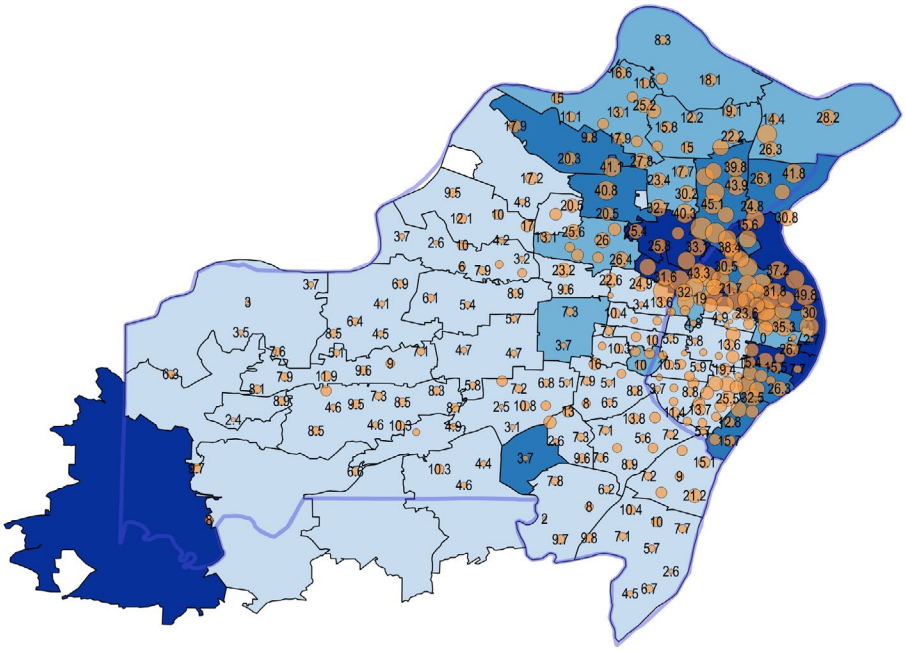
2010-2014: St. Louis City and County, MO | Rate of Very Low Birth Weight Births (<1500g) | By Zip code

Female-Headed Household, No husband present (By Census Tract)

- Greater than 30%
- 20% to 30%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.4
- 1.4 - 2.1
- 2.1 - 2.8
- Greater than 2.8



MAP 72: Very Low Birth Weight + High School Graduation Rates.

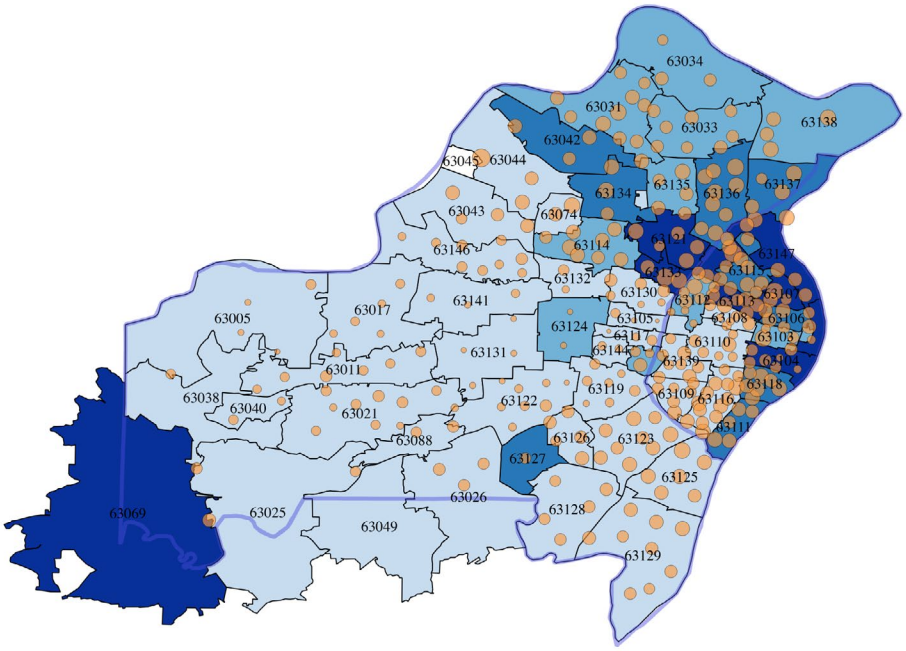
2010-2014: St. Louis City and County, MO | Rate of Very Low Birth Weight Births (<1500g) | By Zip code

Percent Graduated High School
or GED Equivalent
(By Census Tract)

- Less than 15%
- 15% to 25%
- Greater than 35%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.4
- 1.4 - 2.1
- 2.1 - 2.8
- Greater than 2.8



MAP 73: Very Low Birth Weight + Percent of Households in Poverty.

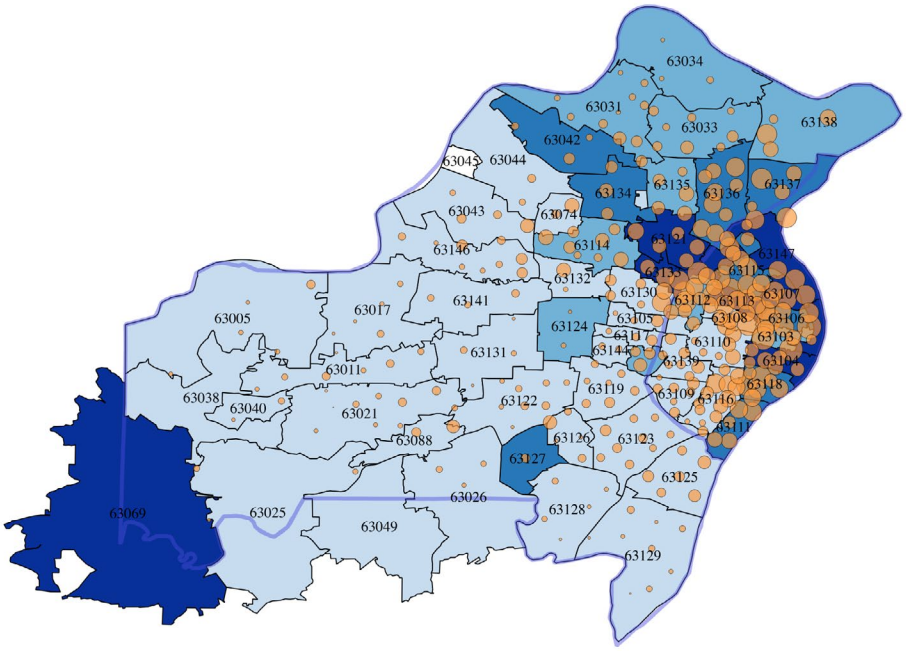
2010-2014: St. Louis City and County, MO | Rate of Very Low Birth Weight Births (<1500g) | By Zip code

Percent Annual Income Below
Federal Poverty Level
(By Census Tract)

- Greater than 35%
- 25% to 35%
- Less than 10%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.4
- 1.4 - 2.1
- 2.1 - 2.8
- Greater than 2.8



MAP 74: Very Low Birth Weight + Median Income.

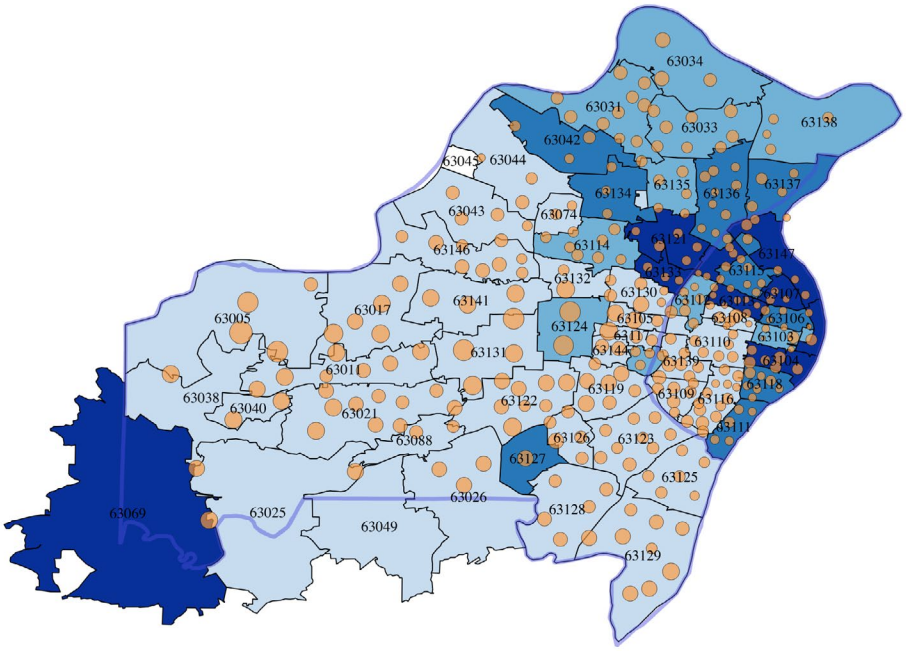
2010-2014: St. Louis City and County, MO | Rate of Very Low Birth Weight Births (<1500g) | By Zip code

Median Household Income
(By Census Tract)

- Greater than $75,000
- $50,000 to $25,000
- Less than $25,000

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.4
- 1.4 - 2.1
- 2.1 - 2.8
- Greater than 2.8



MAP 75: Very Low Birth Weight + Unemployment.

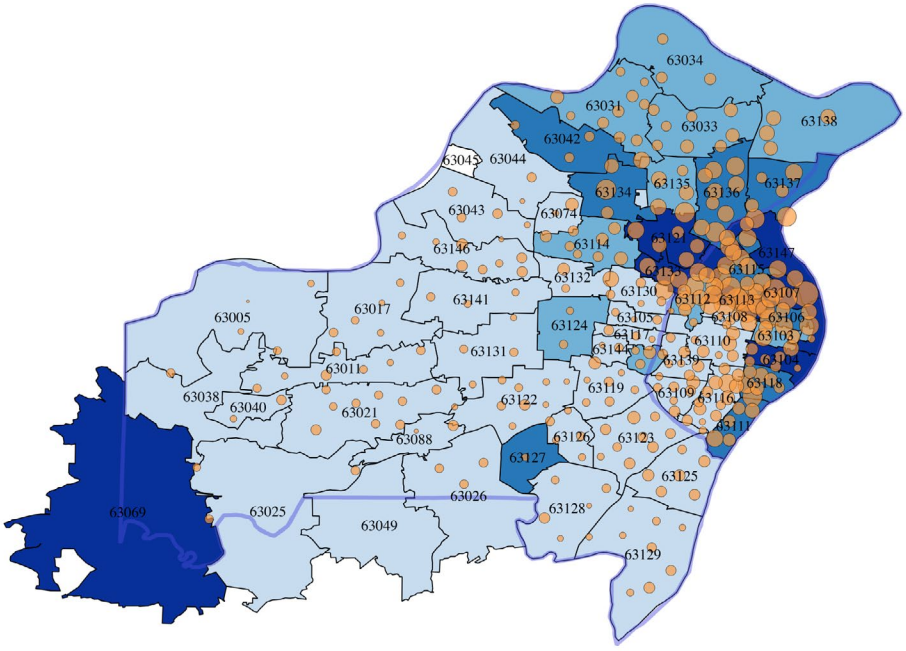
2010-2014: St. Louis City and County, MO | Rate of Very Low Birth Weight Births (<1500g) | By Zip code

Percent Unemployed
(By Census Tract)

- Greater than 35%
- 5% to 35%
- Less than 5%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.4
- 1.4 - 2.1
- 2.1 - 2.8
- Greater than 2.8



MAP 76: Very Low Birth Weight + Vacant Housing.

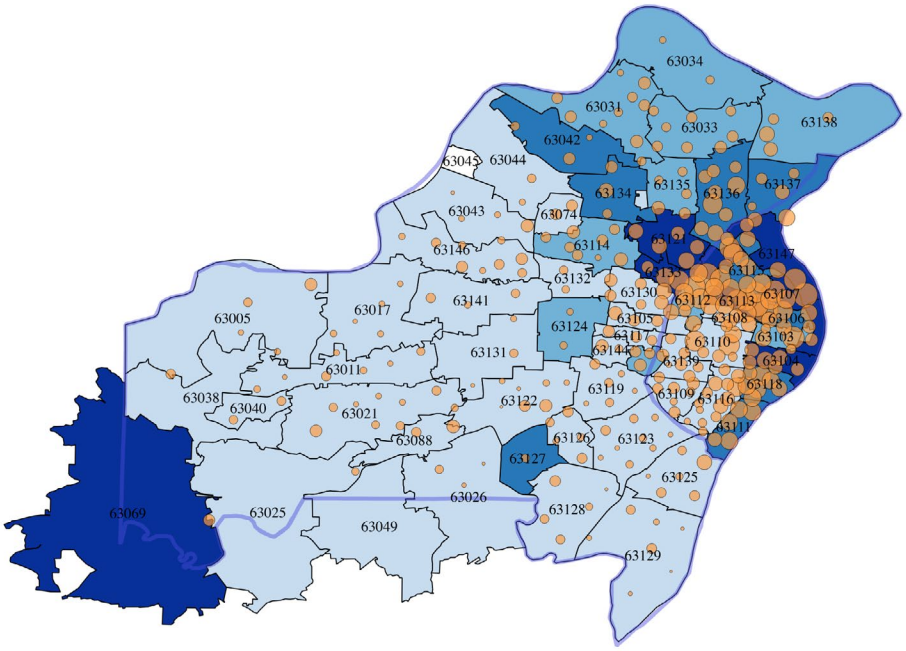
2010-2014: St. Louis City and County, MO | Rate of Very Low Birth Weight Births (<1500g) | By Zip code

Percent Vacant Housing Units
(By Census Tract)

- Greater than 20%
- 6% to 20%
- Less than 6%

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 1.4
- 1.4 - 2.1
- 2.1 - 2.8
- Greater than 2.8



Geographic Sub Analysis: Hotspot Analysis

To further evaluate the geographical distribution of infant mortality in the region, a hotspot analysis was conducted using data at the census tract level. A hotspot analysis can be used to identify statistically significant clustering of high values (hot spots) or low values (cold spots). To be clear, this technique does not present a distribution of actual values, in this case infant mortality rates, rather, it measures the extent to which census tracts with high infant mortality rates are surrounded by other census tracts with high rates. Those areas are represented in the darkest red color. This clustering of census tracts with high rates of infant mortality is statistically significant, or in other words, beyond what we might expect due to chance alone. We chose census tracts as the unit of interest of zip codes to enhance granularity yet opted not to use the smaller census blocks due to insufficient sample size in many of those blocks. It should be noted that this hotspot analysis was conducted separately for the City and County separately, to more clearly delineate clustering for each region.

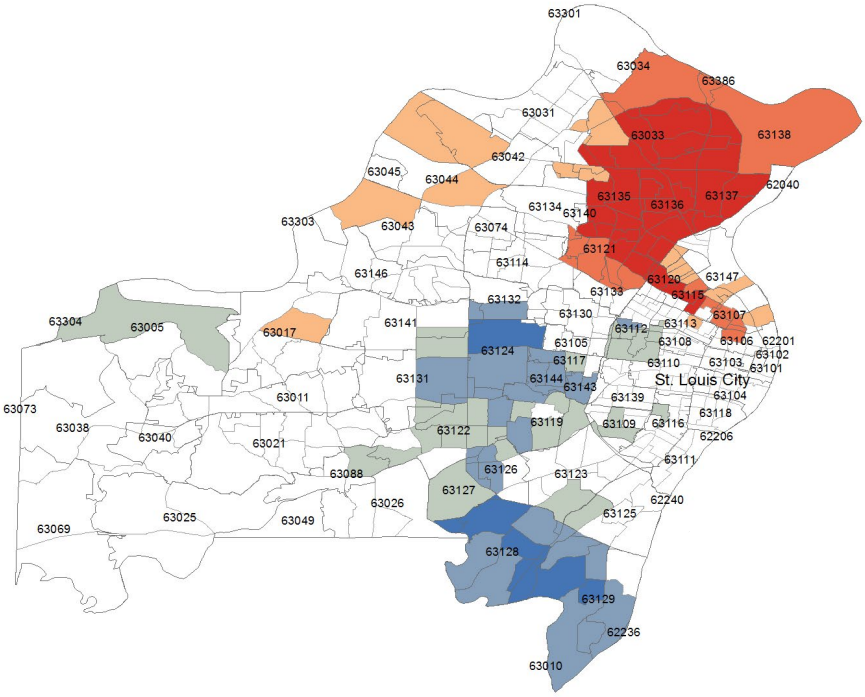
Using the zip codes in the region as an overlay, the greatest clustering for infant mortality appears in zip codes 63107, 63115 and 63120 in the City. In the County, zip codes 63120, 63033, 63135, 63136 and 63137 present the most clustering of high infant mortality rates.

MAP 77: Hotspot Analysis - Infant Death.

2010-2014: St. Louis City and County, MO | Rate of Infant Deaths per 1,000 Live Births | By Zip code

Infant Death, Clustering by Census Tract Gi_Bin

- Cold Spot - 99% Confidence
- Cold Spot - 95% Confidence
- Cold Spot - 90% Confidence
- Not Significant
- Hot Spot - 90% Confidence
- Hot Spot - 95% Confidence
- Hot Spot - 99% Confidence



6 | Policy Analysis and Recommendations

> "Would you tell me, please, which way I ought to go from here?" said Alice.
>
> "That depends a good deal on where you want to get to," said the Cat.
>
> "I don't much care where—"
>
> "Then it doesn't matter which way you go."
>
> "—so long as I get SOMEWHERE."
>
> "If you only walk long enough."
>
> – Alice and the Cheshire Cat. Alice in Wonderland

Policy Analysis

In population health, the focus of care shifts from what we can do for individual patients to how we can create health policies and health environments that incentivize the healthy choice and give all people access to what they need to make the healthy choice. We use the data to give us direction because, unlike Alice, we are trying to get SOMEWHERE SPECIFIC and not just SOMEWHERE. In order to improve population health outcomes, we need to understand how policies both help and hinder progress toward each SPECIFIC SOMEWHERE, so that we can see what policies need to be reinforced and which need to be changed or improved in order for us as a community to arrive SOMEWHERE SPECIFIC.

This section of the report assesses the policy climate in the state of Missouri around each of the three areas for improvement. Sometimes these areas will overlap, especially related to improving the health disparity.

Policy Analysis Methods

This section of the report contains an analysis of current policies and selected emerging best practices related to five identified areas of improvement based on the data analysis. The policy analysis contains background of the issue, an assessment of current policies inclusive of opportunities and threats posed by the current policy climate, a summary of the analysis, policy recommendations and examples of innovative emerging best practices for from other communities.

In conducting a national search for emerging best practices, focus was placed on currently funded initiatives in order to solicit the most cutting-edge proposals. This methodology was selected over a literature review as initiatives published in the empirical literature would be

several years old and much is changing within communities due to the implementation of the Affordable Care Act with its focus on prevention. The following agencies and funders were searched:

- CMS demonstration projects for Accountable Health Care Communities
- CityMatCH: Institute for Equity in Birth Outcomes
- Robert Wood Johnson Foundation Healthy Communities Initiatives
- Strong Start for Mothers and Newborns Initiative[49]
- Collaborative Improvement and Innovation Network to Reduce Infant Mortality (IM CoIIN)[50]

Areas of Improvement Identified for Policy Analysis

Based on the data analysis in this report, we are encouraged to see that our community efforts have yielded improvement in key areas for infant mortality. However, there are five areas where we can do better:

FIGURE 61: Making the case for focusing on equity.

AREA 1: Maternal Health Matters

- Infant mortality for Black women is threefold that of White women irrespective of place
- Excess Infant Mortality due to maternal health issues is improving, but still higher than the referent group

AREA 2: Infant Health Matters

- Excess Infant Mortality due to Infant Health is improving, but still higher than the referent group

AREA 3: Place Matters

- While the excess in Areas 1 and 2 is improving, the racial disparity in both areas remains the same and has shown no improvement over time
- Infant mortality is slightly higher in the City and County for Black women and White women
  - 9.3/1,000 and 7/1,000 respectively for Black women
  - 3.3/1,000 and 2.5/1,000 respectively for White women
- Infant mortality is highest in the City zip codes of 63107, 63113 and 63120
- Infant mortality is highest in the County zip codes of 63044, 63133 and 63136

49 https://innovation.cms.gov/initiatives/strong-start/
50 http://www.nichq.org/childrens-health/infant-health/coiin-to-reduce-infant-mortality

AREA 4: Quality of and Access to Data Matters

- Surveillance and infrastructure improvements to support community-based advocacy efforts
  - Communities need access to timely, accurate and complete data in order to track their progress toward effectiveness, accessibility and quality of population-based health services.
  - Optimally this would include access to non-fragmented, real-time data

AREA 1: Maternal Health Matters

Excess Infant Mortality due to maternal health issues is improving, but is still higher than the referent group.

Background

Maternal Health and Preconception Care: In order to continue to improve rates of infant mortality due to maternal health issues in the St. Louis community, we need to continue to target our efforts on improving the health of mothers before and in-between pregnancies. This is supported by the evidence underlying the PPOR process and is well established in the Maternal and Child Health community. Improving the health of mothers before and in-between pregnancies is known medically as Preconception Care (PCC). PCC is a set of systematic and focused screenings and interventions that identify and resolve health conditions that could affect the health of the mother and baby during or after the pregnancy. These health conditions include medically diagnosed conditions, such as high blood pressure and diabetes, and preventive measures, such as reducing the risk of birth defects by improving folic acid intake and advising mothers to discontinue tobacco, alcohol and other drug use, if they are at risk of becoming pregnant.

PCC and Access to Medical Care: In order for women of childbearing age to receive PCC, they must have access to regular comprehensive preventive physical exams and well woman care throughout their childbearing years as this is where screening and education occur. This care should begin well before women become pregnant and should continue between pregnancies. Women diagnosed with medical conditions, such as diabetes and hypertension, during these preventive visits then need access to more comprehensive medical care to treat and resolve these issues prior to becoming pregnant.

1. **Status of PCC for Women in St. Louis City and St. Louis County:** In 2010, the Maternal Child and Family Health Coalition partnered with St. Louis University and the University of Missouri St. Louis to assess the status of PCC in the City and County. In analyzing access to PCC services, the analysis showed that:

   - Access to PCC for low-income uninsured women is difficult to achieve due to lack of insurance coverage

- Inability to access PCC is disproportionately high for Black women since a larger percentage of Black women residing in the City and County rely on Medicaid for insurance and the comprehensive services provided by Medicaid begin when pregnancy is established and terminate 60 days after delivery for these women
- Low-income women on Medicaid have a higher incidence of risk factors (hypertension and diabetes) than women not on Medicaid
- Low-income women on Medicaid have a higher incidence of complications of pregnancy than women not on Medicaid
- Follow-up for problems identified during PCC services or during pregnancy becomes sporadic due to lack of insurance coverage for non-pregnant women and due to loss of Medicaid coverage for women who have been pregnant
- Due to lack of Public Health funding, we lack or have inadequate surveillance data on many of the risk assessment parameters identified in the PCC preventive service guidelines recommended by the American College of Obstetricians and Gynecologists and the Centers for Disease Control and Prevention
- Funding mechanisms for low-income, uninsured women to access PCC services do not currently exist in Missouri and the small amount of funding for Family Planning services is continually underfunded and/or under threat of budget cuts
- Funding for MCH policy and infrastructure building is also underfunded and under continuous threat of budget cuts at the state and national level. This means that we cannot build the kind of surveillance systems that we need to track progress on our goals.

Opportunities and Threats Created by Passage of the Affordable Care Act in 2010 and the 2012 Supreme Court Ruling Against the Medicaid Expansion Provisions of the Affordable Care Act: In 2010, the AC was passed and this Federal Policy changed the landscape of preconception care for women.

Provisions of the Affordable Care Act Supporting Preconception Care:

The Affordable Care Act Required:

1. **Insurers to provide preventive care for women of child-bearing age.** This meant that all women would have access to PCC services.

2. **States to expand Medicaid to all Americans under age 65 whose income is at or below 133%** of the Federal Poverty Guidelines. This meant that low-income, uninsured women would have access to medical care and screenings before, during and in between pregnancies.

Supreme Court Ruling on the ACA:

1. The Medicaid expansion provision of the law led to challenges that rose to the U.S. Supreme Court and on June 28, 2012, the court ruled that Congress may not make a state's existing Medicaid funds contingent upon compliance with Medicaid expansion.

2. In practice, this ruling makes Medicaid expansion a voluntary action by states and Missouri has opted not to voluntarily expand Medicaid for its lowest income residents. This has set up the following disparity in access to PCC for low-income, uninsured women in Missouri:

   - Insured women are guaranteed access to annual well-woman exams, comprehensive preventive physical exams and screening for health problems, such as diabetes and high blood pressure. They also have access to treatment to resolve issues diagnosed during these preventive visits through provisions of the ACA.
   - Women between 100-400% of the poverty level can receive subsidies to purchase health insurance on the health insurance exchanges set up through provisions in the ACA and many of these women are finding insurance through these subsidies. These women also have access to preconception care and services.
   - Women below 138% of poverty in Missouri are not eligible for subsidies to purchase health insurance through the exchanges, so they do not have health insurance unless they are pregnant, which is the only time that they receive Medicaid coverage. These women have no access to PCC services before or in between their pregnancies unless they have access to care through a clinic with a sliding fee scale, such as a Federally Qualified Neighborhood Health Center.

Disparity Created for Missouri Women by this Ruling:

- If you are privately insured, you can get access to PCC services because the ACA requires that your insurer provide that level of care.
- If you are low income (between 100-400% of poverty), you are eligible for subsidies to help you purchase health insurance through the health insurance exchanges, so you can get access to PCC services.
- If you are a woman who is Medicaid eligible, you are not eligible to receive any subsidies to assist you in purchasing health insurance on the exchanges. This means that you do not have access to any comprehensive preventive care unless you are pregnant when Medicaid will cover your medical care. Your access to care before and in between your pregnancies is reliant on your ability to find that care on a sliding fee scale within your community.

Services Currently Available to Medicaid Eligible, Non-Pregnant Women in Missouri: Some limited services are available to low-income, Medicaid eligible women before and in between pregnancies. This care consists of contraceptive services and screening and

treatment of STIs. These services are currently supported through a program supported by a 1115 waiver from CMS (Centers for Medicare and Medicaid Services) in Missouri. These services are not comprehensive and do not include many of the PCC risk assessments recommended by the American College of Obstetricians and Gynecologists (ACOG) and the Centers for Disease Control and Prevention (CDC). As part of the 2010 Preconception Care Assessment, an analysis of PCC services was conducted to identify gaps in PCC for Medicaid eligible women in the state of Missouri. The table below shows the results of the 2011 analysis and the results of a reanalysis in 2016. As you can see, women are still receiving the same level of services in 2016 that they were in 2011. Medicaid eligible women still do not have access to the array of PCC services and screening that they would have if they had access to insurance.

TABLE 17: Access to Selected Recommended PCC Services.
2011 and 2016

	Missouri Medicaid for Pregnant Women (& 90 days post-partum)	Uninsured Women's Health Services	Title X	Missouri Medicaid for Pregnant Women (& 90 days post-partum)	Uninsured Women's Health Services	Title X
Service	**2011**			**2016**		
Contraception	Yes	Yes	Yes	Yes	Yes	Yes
Substance Abuse	Yes	No	No	Yes	No	No
Mental Health	Yes	No	No	Yes	No	No
Immunizations	Yes	No	No	Yes	No	No
Lab Tests	Yes	Pap & STI only	Pap & STI only	Yes	Pap & STI only	Pap & STI only
Genetic Screening	Yes	No	No	Yes	No	No
Weight & Nutrition	Yes	No	No	Yes	No	No
Regular Comprehensive Physical Exam	Yes	No	No	Yes	No	No
Interventions for identified risks and problems	Yes	No	No	Yes	No	No

Policy Threats to Currently Funded Programs in Missouri

1. **Uninsured Women's Health Services**

    a. The Missouri Legislature is currently in the process of dissolving the 1115 waiver that funds the Uninsured Women's Health Services Program. This waiver provides a financial 90/10 match from the Federal Center for Medicare and Medicaid Services (CMS) for services provided to uninsured, Medicaid eligible women in Missouri. The program serves low-income women through local community-based providers who are reimbursed for their services. Because of the Federal funding, providers are subject to rules and guidelines of CMS and Missouri cannot give preference to any specific providers of care nor can they exclude specific providers unless the provider has medical sanctions or violations. This assures that care is provided by medical professionals that meet quality guidelines.

    b. If the Legislature is successful in dissolving this 1115 demonstration waiver, they have made plans to fund the program exclusively from General Revenue funds from the State of Missouri, however this funding is capped at $9 million.

    c. Unintended consequences of dissolving the 1115 waiver and funding the program through the General Revenue budget of the State:

        i. The program would become vulnerable to budget cuts when revenue is low. This is a frequent problem in Missouri and there is significant risk that the program could face budget cuts.

        ii. The program is capped at $9 million, so it could never grow beyond that budget. This is concerning in that outreach efforts to serve more women would be limited due to the budget cap. Long-Acting Reversible Contraception (LARC), which are the most effective methods for reducing unintended pregnancies, are becoming more common as they are quickly being shown to be a best practice. These methods are expensive (some costing as much as $1,000 per device) and if more revenue is expended on these more effective and reliable methods, less women will have the potential of being served.

        iii. Missouri's program would no longer be under oversight from CMS. CMS oversight currently assures quality of care delivered by providers and assures that the providers meet specific quality guidelines before they can be considered for reimbursement. If this oversight from CMS is removed, it opens questions about how program providers will be selected, governed and monitored. It also brings to light questions about how quality assurance and patient safety will be assured since this is part of the advantage of CMS oversight.

2. **Overburdening of Title X**

   a. Title X funding in Missouri supports Family Planning services by providing money to providers for Family Planning services for low-income women.

   b. The program is small and does assist many community-based providers, clinics and Federally Qualified Health Centers to provide needed services to women, but this program would not be able to absorb women from the Uninsured Women's Health Services in Missouri if those funds were cut.

Summary of Maternal Health Policy

- Current Missouri policy only allows Medicaid eligible, low-income women access to health insurance and a complete array of comprehensive health services when they are pregnant. Women lose these benefits 90 days after delivery of their infants.
- After pregnancy, Medicaid eligible, low-income women do have access to limited services, which consist of contraceptives and screening and treatment for STIs through Uninsured Women's Health Services.
- The Uninsured Women's Health Services funding is in the process of being defunded by the Missouri State legislature and replaced with a program that will fund services out of the General Revenue funds, but this funding will be capped at $9 million. This change in funding creates instability for the program because it becomes vulnerable to budget cuts when revenues are down.
- Any health problems diagnosed during pregnancy are considered the responsibility of the woman and she must find her own access to treatment for conditions, such as diabetes, hypertension or other chronic health problems, before her Medicaid is discontinued after delivery.
- The current Missouri policy creates a disparity of access to PCC services between women with access to insurance and those without access to insurance.
- The disparity in access is disproportionately high for Black women because more low-income, Medicaid eligible women in St. Louis are Black.
- The disparity in access to PCC services could be resolved for low-income women if Missouri would expand Medicaid, which would allow them to have access to health insurance before, during and after pregnancy.

Policy Recommendations

1. **Expand Medicaid to low-income, Medicaid eligible women in Missouri, which would:**

   - Promote comprehensive whole person care across the reproductive lifespan. This would enable all women in our state access to the same routine preventive screening services for PCC and comprehensive medical follow-up as women who are insured through their employers or through the Health Exchanges.

- Allow women to receive care for diagnosed medical conditions, such as pre-pregnancy hypertension, which results in 3.1 increased odds for very low birth weight infants in the City according to our analysis.
- Abolish the need for the Uninsured Women's Health Services that the state is proposing to fund through General Revenue after it dissolves the 1115 waiver with the CMS.
- Create a long-term sustainable solution for a persistent barrier to care that numerous programmatic, grant-funded initiatives have been unable to ameliorate.

2. **Support other community-based organizations that work to eliminate and reduce smoking and tobacco use, especially programs targeting low-income women of color.**

   - In this analysis, the smoking prevalence in Black women was higher than for White women in St. Louis City.

3. **Support and Expand Case Management Models that address the social, as well as physical, determinants of health as these have been shown to be successful in improving birth outcomes.**

   - Many successful case management models exist in our own community; however, the scope is small, which limits the reach of the programs and the funding is inadequate for long-term sustainability and expansion.

Promising Best Practices

1. **Improving Care and Achieving the Triple Aim Across the Continuum of Care in a State that has Expanded Medicaid**

   The Triple Aim is defined by the Institute for Healthcare Improvement as, "Applying integrated approaches to simultaneously improve care, improve population health, and reduce costs per capita."[51] There is a growing consensus that improvements in population health lie in a community's ability to concurrently deliver high-quality care, at optimized costs, and improve the health of the population.

Project: One Key Question

- **Funding Source:** Oregon Foundation for Reproductive Health (project design) with funding from the Ms. Foundation
- **Jurisdiction:** Oregon
- **Goal or Purpose of the Program:** Improved Preconception Health and Infant Mortality Reduction

51 http://www.ihi.org/Topics/TripleAim/Pages/Overview.aspx

- **Specific Innovation:** Provider Incentives and Training to Reproductive and Maternal Health in Medicaid Eligible Women
    i. In 2015, Oregon added "Effective contraception among women at risk for unintended pregnancy (ECU)" as an incentivized metric for Coordinated Care Organizations through its Metrics and Scoring Committee. Oregon became the first in the nation to adopt a preventive approach for reproductive health ensuring that women are receiving proactive care.

- **Program Structure:**

    i. **Managed Through Oregon's Coordinated Care Organization (CCO),** which is a network of health care providers who have agreed to work together in their local communities for people who receive health care coverage under the Oregon Health Plan (Medicaid).
    ii. **CCO Incentive Metrics:** This metric does not provide financial incentives to women to encourage contraceptive use OR to individual health care providers. The metric is part of a package of metrics that promote what is known as the Triple Aim (high quality of care, improved population health and lower costs). Each CCO must establish a system to distribute and use the incentive payments they receive. CCOs receive quality pool funds if they meet 12 of the 17 incentive metrics (which must include the electronic health record adoption measure) and if at least 60% of their members are enrolled in Patient-Centered Primary Care Homes.
    iii. **How CCOs Meet the ECU Metric:** CCOs meet the benchmark, which is set at 50% of women in the denominator, or if they meet the improvement target (a 3 percentage-point improvement over their 2014 baseline). Therefore, if at least 50% of a CCO's eligible members use one of the most effective or moderately effective contraceptive methods OR if the CCO increases the number of their eligible members who use one of the most effective or moderately effective contraceptive methods by 3 percentage-points over their baseline, the CCO will be considered to have met the ECU metric.

- **How the program works:**

    i. **One Key Question:** Providers ask women "Would you like to become pregnant in the next year?" starts a conversation about preventive reproductive health.

        1. "Yes," provider advises her to take folic acid and give information on health conditions, medications, substances and behaviors that may adversely affect pregnancy. Her history will be reviewed for immunizations and medications.
        2. "No," and she is at risk for pregnancy, can be assessed for whether she is issuing contraception and whether she is satisfied with her method. Provider offers contraception counseling with emphasis on the most effective methods.

3. "Unsure," provider recommends folic acid and other preconception or contraception services.

ii. **CHOICE Training for Most Effective Methods:** Providers are educated in how/where to obtain resources from CCOs. Provider training uses the CHOICE contraceptive counseling project, which includes a training program, materials used during the counseling session, and protocols for testing and ongoing quality assurance. CHOICE contraceptive counseling uses a tier-based approach, presenting all methods in order of most to least effective. (http://www.larcfirst.com/protocol.html)

- **Is the program connected with Case Management Models?** Yes, the program is associated with the CCO "Timeliness to Prenatal Care" metric. This metric is designed to measure enrollment of pregnant patients in the first trimester (i.e., first three months), which is a nationally accepted way to assess timely initiation of care for pregnant women. Currently, Oregon CCOs are:

  i. Identifying which of their PCP offer prenatal care and which do not. If assigning women to a PCP that does not offer prenatal care, they send an accompanying list of contracted prenatal care providers in the area.
  iii. CCOs or clinics also reach out to women enrolled in Medicaid (with pregnancy as their eligibility category). CCOs provide welcome calls to newly enrolled women, or newly pregnant women, to inquire about their need for pregnancy-related services, and to inform them of clinics or providers in the area that are accepting clients.
  iv. Ensuring that clinicians are endorsing initiation of prenatal care before 13 weeks.
  v. If the woman is a no-show, schedulers are encouraged to fast track her into a clinic via an outreach worker or case manager.

- **Program Highlights:**

  i. Through expanded Medicaid, these two initiatives can manage the population of Medicaid enrolled women across the continuum of care and throughout their various life stages. This means that women can be screened prior to pregnancy for health issues, such as smoking, drug and alcohol abuse, and medical conditions, such as hypertension. Problems can be identified and treatment can be initiated prior to pregnancy.
  ii. Women do not experience gaps in prenatal care while applying for Medicaid for Pregnant Women.
  iii. Early entry into prenatal care becomes less problematic because women do not have to prove eligibility prior to receiving care.

2. **Development of a Comprehensive Population Approach to Maternal Health and Care for Medicaid Beneficiaries.**

   Project: Designing a Population Approach to Maternal Health and Care (i)

   a. **Funding Source:** Institute for Healthcare Innovation
   b. **Jurisdiction:** The project is being developed by the Institute for Healthcare Innovation, which is a privately funded organization with a mission to, "Improve health and healthcare worldwide."(ii)
   c. **Goal:** To develop a population approach to maternal health for Medicaid beneficiaries that will decrease disparities in outcomes and reduce preterm birth.
   d. **Specific Innovation:** Up to this time, no state or region has developed an integrated population health approach for pregnant women on Medicaid. An integrated prevention-based strategy for Medicaid beneficiaries is an important step in improving outcomes and reducing overall costs since poor birth outcomes are more prevalent in the Medicaid population and half of all births each year in the U.S. are financed by Medicaid. (iii)
   e. **Program Progress to Date:**

      i. Ground work: In 2015, the Institute for Health Care Innovation initiated work utilizing the following methodology:

         1. National scan for best practice models
         2. Evaluation of evidence-based strategies for interventions to reduce preterm births
         3. Interviews with experts in 15 states to assess state and regional approaches to perinatal care
         4. Convening a design meeting that assembled payers, providers, community-based organizations, researchers, national policy experts, and patients to vet and develop a model for change to improve birth outcomes for Medicaid beneficiaries

Present status: The model of care that emerged from the work carries a vision of "women who are supported across the reproductive life span; connected and served by integrated resources to overcome barriers to health and well-being; and reliably receive evidence-based, population-specific care." The model proposes integration of four evidence-based intervention strategies within a community to achieve the vision. These interventions include:

1. **The Pregnancy Medical Home Model:** This model is a part of the Center for Medicare and Medicaid Innovation Strong Start for Mothers and Newborns Initiative. The model modifies the methodology of the patient-centered medical home to meet the specific needs of delivering care to pregnant women, particularly integrating clinical needs and social determinants of health. This model functions as a service delivery model to assure quality care by ensuring that risk factors are evaluated and the best clinical evidence is reliably delivered to all women. Adoption of the pregnancy medical home model is pivotal to a population-focused model of perinatal care, but further research is needed to improve our understanding about how best to implement the model in different payer and provider contexts, particularly in resource-poor settings with a focus on reducing disparities.

2. **Peer Support Including Group Prenatal Care:** "Group prenatal care has emerged as an intervention with relatively strong evidence supporting both improved perinatal outcomes overall and reduced racial and ethnic disparities in birth outcomes. A recent review found significant support for group prenatal care as an intervention leading to reductions in preterm birth and a 2012 study found group prenatal care improved adverse birth outcomes among Black women. Testing for this intervention would focus on increased access to peer support systems in socially disadvantaged communities and would test ways to engage pregnant and postpartum women."

3. **Pregnancy Intention and Access to Effective Contraception:** Unintended pregnancies account for half of all births in the U.S. Use of long-acting reversible contraception (LARC) has shown substantial results in reducing unplanned pregnancy and associated adverse birth outcomes, including preterm birth. However, reproductive life course planning and the use LARCs remain underutilized in the U.S. among family planning providers and patients. Ways to improve culturally competent approaches to improving LARC access and acceptance and evaluating the impact on improving disparities in perinatal outcomes are important considerations for population effectiveness.

4. **Integrating Substance Abuse Treatment with Perinatal Care:** In the past decade, substance abuse has become a significant and persistent problem in many communities throughout the U.S. The incidence of neonatal abstinence syndrome rose 300% between 2000 and 2009. Integrated models merging substance abuse management programs into prenatal care has revealed some encouraging results. However, more research is needed to identify the key elements of integrating substance abuse treatment with perinatal care, and focus on reducing racial and ethnic health disparities.

Next Steps: The Institute for Healthcare Innovation is testing these four care models with a small number of organizations and communities serving populations of Medicaid beneficiaries. The goal is to develop a refined and validated population health model that may be ready to be expand to other communities in the near future.

a. **Program Highlights:**

   i. The model consists of evidence-based approaches to care, which have been shown to be successful in a variety of settings.

   ii. The model is comprehensive and supports women across life stages and across the spectrum of care, which provides a more holistic approach than we currently experience with Medicaid populations.

   iii. The model integrates substance abuse treatment into perinatal care, which provides more seamless services for women and infants at highest need.

   iv. However, the model is in early stages of testing and the effectiveness of integrating these individual, evidence-based approaches into a continuum of care is unknown.

AREA 2: Infant Health Matters

Excess Infant Mortality due to Infant Health is improving, but still higher than the referent group.

The PPOR analysis also established that we are improving, but still have excess infant mortality attributable to Infant Health. Most of the excess deaths are due to Sudden Unexpected Infant Death (SUID), which is a term that has recently been adopted to better describe the death of an infant less than one year of age that occurs suddenly and unexpectedly, and whose cause of death is not immediately obvious before an investigation is conducted.

Background

Recent Changes in Sudden Infant Death Terminology and Reporting:

Not all sudden and unexpected infant deaths are attributable to Sudden Infant Death Syndrome (SIDS). When an infant dies suddenly and unexpectedly it can be attributed to a number of different causes. This can be confusing for parents, as well as health professionals and researchers.

In an attempt to bring clarity to the issue, the Centers for Disease Control and Prevention (CDC), suggested that a broad term be adopted that would encompass all sudden infant deaths. The term SUID (Sudden Unexpected Infant Death) was adopted and now includes:

- Sudden Infant Death Syndrome (SIDS)
- Accidental Suffocation and Strangulation in Bed (ASSB)
- Unknown Cause

According to the CDC, in 2014, 3,490 infants in the U.S. died suddenly and unexpectedly.

In order to assure more accurate reporting, the CDC worked with a host of stakeholders, including federal agencies, professional organizations, researchers and parents who have experienced the death of an infant to develop and disseminate the Sudden Unexpected Infant Death Investigation (SUIDI) reporting form for state and local use in infant death scene investigations. The reporting form and comprehensive training curriculum can be found at http://www.cdc.gov/sids/suidrf.htm. In order to disseminate the SUIDI reporting forms, the CDC held Train-the-Trainer Academies in five regions around the country between 2006 and 2008. St. Louis hosted a Train-the-Trainer Academy in 2006.[52] As early as 2007, the Missouri Child Fatality Review Program Report indicated that, "Of the 127 sudden, unexpected infant deaths in Missouri in 2007, a scene investigation was completed in 122 cases (96%)."[53] An SUID Case Registry was initiated by the CDC in 2010 through a cooperative agreement with five states. In 2012, an additional nine states were awarded cooperative agreements to continue or begin work with the Registry. Missouri is not currently one of the states within these cooperative agreements.

Preventing SIDS and Accidental Suffocation and Strangulation in Bed:

According to the SIDS Institute,[54] "most sleep-related deaths are caused from a combination of infant vulnerability and asphyxiating conditions and can be seen as existing on a continuum of highly vulnerable infant/safe environment to normal infant/highly asphyxiating environment."

To reduce the risk of a sleep-related death, six overarching approaches are promoted by the SIDS Institute, the CDC, the American Academy of Pediatrics and numerous other groups. All of these groups have developed policies and educational materials for providers and parents that encourage the following:[55]

1. **Keeping the Infant's Airway Free:** Avoiding prone (stomach) sleep, bed sharing and cluttered sleep surfaces.
2. **Avoiding activities that decrease the baby's ability to wake itself:** Avoiding prone sleep, bed sharing, over-heating, and sedation. Avoid risks of infections.
3. **Avoiding activities that decrease the parent's ability to wake themselves.** Avoiding situations leading to exhaustion, as well as alcohol and drug sedation.
4. **Reduce smoking in pregnant women and cigarette smoke exposure in infants after birth.**
5. **Promote and encourage breastfeeding.**
6. **Improved understanding of SIDS and factors that increase risk for SIDS:** We need to continue to provide funding for medical research to improve our comprehension of medical factors that may contribute to SIDS, such as genetic abnormalities, brain abnormalities, prematurity and other pregnancy-related medical risks.

52 http://www.cdc.gov/sids/suidabout.htm
53 https://www.childdeathreview.org/wp-content/uploads/State-Docs/MO_2007AnnualReport.pdf, p. 14
54 http://sids.org/what-is-sidssuid/sids-accidental-suffocation/
55 http://sids.org/what-is-sidssuid/sids-accidental-suffocation/

What We Know About SUID Cases in Missouri

The 2014 annual report of the Missouri Child Fatality Review Program stated that:

Thirteen SUID cases were diagnosed as SIDS. Of the 13 infants:

- **Six** were found to be on a sleep surface not designed for infants
- **Four** were sleeping on their side or stomach
- **Two** were sleeping on an adult bed
- **One** was sleeping alone, on its back in a standard crib – the safest sleep position

Seventy-five infants less than one year of age died due to unintentional suffocation. Of these children:

- Forty-seven were sharing a sleep surface with one or more individuals
- Forty-four were sleeping in an adult bed
- One was sleeping on the floor with her mother
- One was sleeping on an air mattress
- One was sleeping on a sofa
- Twenty-seven infants died due to soft bedding
- Ten children died in their cribs due to soft bedding and/or bumper pads
- Five were placed face down in a bassinet on soft bedding
- Three were placed in a pack-n-play with either soft bedding or swaddled
- Five were placed on adult beds with either pillows or comforters
- Two were face down on futons
- One was on a waterbed

Summary of SUID Policy:

1. The Medical Examiners Offices in St. Louis City and St. Louis County follow current CDC recommendations for SUID reporting and all sudden and unexplained infant deaths are subject to a death scene investigation.

2. Despite communitywide adoption of, and support for, education to reduce the risk of SUID through safe sleep practices, most of the SUID deaths reviewed by Child Fatality Review Panels in Missouri in 2014 were found to have one or more of these risk factors. Only one of the SIDS deaths was found to be in a safe sleep position. Of the 75 infants found to have died from unintentional suffocation, 47 were sharing a sleep surface and 27 were on sleep surfaces with soft bedding.

Policy Recommendations

1. **Through collaborative efforts, identify families most at risk for unsafe sleep practices and develop targeted interventions to reduce risk in those groups.** Work with local SIDS resources, researchers, nurse home visitation programs, medical care providers and Child Fatality Review Panels to identify families at high risk for unsafe sleep practices and develop interventions that will reduce risk in those families.

2. **Support other community-based organizations that work to eliminate and reduce smoking and tobacco use, especially programs targeting low-income women of color.**

3. **Support other community-based organizations that work to promote breast feeding.**

Promising Best Practices

1. **Training Frist Responders to Proactively Reduce Sleep-Related Infant Deaths**

   Project: DOSE (Direct On-Scene Education) (iv)

   a. **Funding Source:** None
   b. **Jurisdiction:** Developed in Florida and now operating in Fire, EMS and Police Departments in five states.
   c. **Goal:** Reducing the number of Sudden Unexplained Infant Deaths through in-home assessment of infant sleep space and education of families about sleep hazards identified.
   d. **Specific Innovation:** Utilizes first responders who are in the home responding to an emergent or non-emergent call to assess infant sleep areas if there are children less than one year of age in the home. The program utilizes first responders who are in the home for other reasons to do a quick check on infant sleep environments and educate caregivers about any hazards found.
   e. **Program Structure:** Out of concern for the growing number of sleep-related deaths reported in Broward County, Fla., Lieutenant James Carroll, in conjunction with Jennifer Combs of Healthy Mothers, Healthy Babies Coalition of Broward Inc., in 2012 created the DOSE (Direct On-Scene Education) program for first responders. When responding to an emergency or non-emergency call from a household with a pregnant woman or infant, and after attending to the patient, first responders are trained to do four things:

      i. Look for possible unsafe sleep conditions
      ii. Remove any hazards in the crib, such as blankets, pillows, bumpers and stuffed animals
      iii. Talk to families about safe sleep habits
      iv. Offer a safe sleep kit with educational information about safe sleep habits

f. **Evaluation:** The program was implemented in 2012 in Broward County Florida where in 2011 there were seven infants died from accidental suffocation and strangulation in bed (ASSB). In 2012 and 2013 only three infants died each year from ASSB. In 2014, only one infant death was attributed to ASSB in Broward County. (v)

g. **Program Highlights:**
   i. The program is a Train-the-Trainer model and the training sessions are brief, so they can be done quickly and inexpensively.
   ii. The program can be used with geo-mapping to assure that first responders in the highest risk areas are targeted.
   iii. First responders are in homes in situations where families have requested help for what they perceive is an emergent situation and might be more open to health education and prevention efforts.

AREA 3: Equity Matters

Equity

- Infant mortality for Black women is threefold that of White women irrespective of place.
- While the excess death in Maternal Health (AREA 1) and Infant Health (AREA 2) is improving, the racial disparity in both areas remains the same and has shown no improvement over time.

Background

Like place, Equity is also greatly affected by the distribution of social determinants of health. An unequal distribution of social determinants of health can cause poor health outcomes when one experiences things like persistent poverty, unstable housing and limited educational opportunity. When unequal distribution of social determinants of health are caused by inequity, then systemic, avoidable and unjust social and economic policies and practices that create barriers to opportunity, disparities are created. Many disparities are reflected in health outcomes for specific segments of the population, such as gender, race or ethnicity, education, income, and disability.

Despite overall improvements in population health over time, many disparities have persisted and, in some cases, widened. (vii) This is true of infant mortality in our community, which has improved over time for all population groups, but the disparity in rates of infant mortality for Black infants and White infants has not changed over time. Disproportionate exposure to toxic stress created by inequity is suggested to be one of the reasons that babies born to Black women are three times as likely to die as babies born to White women in our community. (viii) Best practices indicate that cross-sector collaboration is necessary to address the causes of this stress and improve outcomes. (ix)

Infant Mortality and Equity in St. Louis

The rate of infant mortality between Black women and White women in St. Louis City and County is threefold. Rates for both races have improved over time, but the disparity remains constant over time indicating that we are providing interventions that reduce the rates, but we have failed to find interventions, policies and strategies that are able to improve the disparity.

In St. Louis, infant mortality is 9.3/1,000 and 7/1,000 respectively for Black women and 3.3/1,000 and 2.5/1,000 respectively for White women.

Complex Problems Require Complex Solutions

Service interventions alone are insufficient to confront the complex root causes of health inequity and health disparities. A paradigm shift is needed to create transformative health improvements, produce population-based change, or revamp the social climate and generate the momentum needed to address the scope of problems that perpetuate environments where health disparities have continued to thrive. (x)

Policy Recommendations:

Invest in community-driven, broad-based, long-term, capacity building initiatives that can address an array of complex and comorbid health and social problems concurrently.

Promising Best Practices

1. **A Transformational Process Model for Improving Intergenerational Health**

   Project: Self-Healing Communities (SHCM)[56]

   a. **Funding Source:** Robert Wood Johnson Foundation
   b. **Jurisdiction:** Washington
   c. **Goal:** Build the capacity of communities to heal themselves through engagement and empowerment.
   d. **Specific Innovation:** In the early 1990's, Washington state constructed a program to concurrently address issues like domestic violence, school dropouts, youth substance abuse, and other issues that affect families and children. The innovation in this model is not the issues addressed, but that typically these issues had been addressed separately, and the team in Washington decided to address them collectively through a very different model of community change.
   e. **Program Structure:** The process is comprised of four stages of community engagement: leadership expansion, focus, learning and results. The process affords increasing opportunity for community members to overcome or lower stress and hardship by establishing and enlarging nourishing social and cultural networks and practices. The rhythm of the process allows time for emergence

56 http://www.rwjf.org/en/culture-of-health/2016/07/to_heal_a_community.html

of new perspectives, development of new leaders, and for changes to policies, services, and the everyday interactions of community members. The process is significant because success in each phase invites the next, creating a self-reinforcing cycle that mirrors the emerging understanding of healthy living systems.

f. **Evaluation:** Between 1994 and 2012, Washington state supported use of the model in 42 communities. Community capacity was assessed using an index containing indicators of effective use of the four process phases of the model. Communities using the SHCM for eight or more years reduced the rates of the following major social problems:

   i. Infant mortality
   ii. Child abuse and neglect
   iii. Family violence
   iv. Youth violence
   v. Youth substance abuse
   vi. Dropping out of school
   vii. Teen pregnancy
   viii. Youth suicide

   Communities with consistently high index scores improved five or more separate problem rates concurrently.

   Per year, avoided caseload costs in child welfare, juvenile justice and public medical costs associated with births to teen mothers were calculated to be over $601 million, an average of $120 million per year, for a public investment of $3.4 million per year.

g. **Program Highlights**

   The program uses community capacity building instead of a service program model to address complex issues with root causes in the social determinants of health.

   i. The program creates capacity and resiliency in its community members making it self-sustaining.
      a. The program addresses multiple problems collectively through capacity building rather than programmatic focus.

AREA 4: Place Matters

Place

- Infant mortality is slightly higher in St. Louis City and St. Louis County for Black women and White women.
  - 9.3/1,000 and 7/1,000 respectively for Black women
  - 3.3/1,000 and 2.5/1,000 respectively for White women
- Infant mortality is highest in the St. Louis City zip codes of 63107, 63113 and 63120.
- Infant mortality is highest in the St. Louis County zip codes of 63044, 63133 and 63136.

Background

Places are affected by the distribution of social determinants of health. Social determinants of health are interrelated social and economic factors that influence health. Specifically, social determinants of health are conditions in the environments in which we are born, live, learn, work, play, worship, and age that influence a wide range of health, functioning, and quality-of-life outcomes and risks.

This cause and effect relationship is well documented in the scientific literature and is a long-standing and persistent issue. Many disparities are reflected in health outcomes for specific segments of the population, such as living in various geographic localities.

Infant Mortality and Place in St. Louis

Our community has a persistently high disparity in infant mortality between Black women and White women irrespective of place. The rate of infant mortality between Black women and White women in St. Louis City and County is threefold. Rates for both races have improved over time but the disparity remains constant over time indicating that we are providing interventions that reduce the rates but we have failed to find interventions, policies and strategies that are able to improve the disparity.

Infant mortality is slightly higher in the City and County for Black women and White women. Infant mortality is 9.3/1,000 and 7/1,000 respectively for Black women and 3.3/1,000 and 2.5/1,000 respectively for White women. Infant mortality varies by zip code in the City and County. Infant mortality is highest in the St. Louis City zip codes of 63107, 63113 and 63120. Infant mortality is highest in the St. Louis County zip codes of 63044, 63133 and 63136.

Complex Problems Require Complex Solutions

Direct-service interventions and programs are needed within communities.

Communities will not be structurally changed into more vibrant places by traditional incremental strategies, such as reorganizing decision-making groups, revamping programs, improving service locations, or improving evaluation methods and technology. The structural

change needed to transform communities must involve non-traditional ways of thinking that create changes in interpersonal and inter-organizational relationships. Community members must be engaged in the public process. The changes and the processes must inspire innovation, establish and nurture peer support, ease the daily stress burden of parents, and promote change in all the systems that serve them, so that communities can protect and nurture themselves and the next generation.

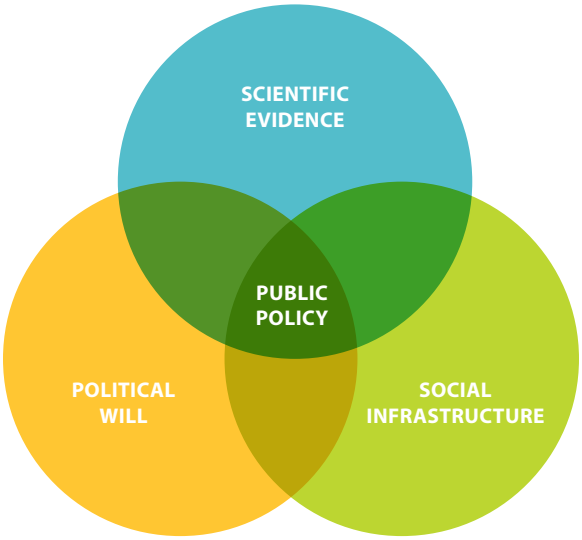
AREA 5: Quality of and Access to Data Matters

- Surveillance and Infrastructure Improvements to Support Community-Based Advocacy Efforts.
- Communities need access to timely, accurate and complete data in order to track their progress toward effectiveness, accessibility and quality of population-based health services.
- Optimally this would include access to non-fragmented, real-time data.

Background

The data needed to conduct this analysis is not readily accessible to communities and must be specifically requested from the State in order to conduct the analysis and create maps. Data requests can be delayed by processes, such as IRB, which can take months. Data is not available in real time and the most current data is several years old. Furthermore, understaffing and frequent turnover at the state department of health reduces the training and efficiency of the public health work force to address the need for accurate and timely data. This lack of availability of real-time data means that communities must make decisions about future actions based on retrospective data.

FIGURE 62: The role of data in impacting outcomes.



Policy Recommendations

1. Improve the data request system and work with the State to expedite processes, such as IRB.
2. Work with the State to move toward real-time data availability.

Final Thought

Data, data everywhere not a thought to think. We need data to support our interventions, however, we also need the infrastructure and the political will to change public policy. The three components have a synergistic effect to create an environment for healthy mothers and babies.[57]

57 Centers for Disease Control and Prevention. Available path: (https://www.cdc.gov/pcd/issues/2008/oct/08_0033.htm.

7 | References

- Alexander G., Kogan M, & Himes, J. (1999). 1994-1996 US singleton birth weight percentiles for gestational age by race, Hispanic origin, and gender. Maternal and Child Health Journal, 3, 225.
- American College of Obstetrics and Gynecology. (2013). Hypertension in pregnancy: Report of the American College of Obstetricians and Gynecologists. Obstetrics and Gynecology, 122, 1122-1131. Retrieved on 8/27/2016 at http://www.tsop.org.tw/db/CFile/File/8-1.pdf.
- American College of Obstetricians and Gynecologists. (2013, reaffirmed 2015). Weight gain during pregnancy. Committee Opinion, 548, 1. Retrieved on 8/27/2016 at http://www.acog.org/Resources-And-Publications/Committee-Opinions/Committee-on-Obstetric-Practice/Weight-Gain-During-Pregnancy.
- Centers for Disease Control and Prevention. (2016). STDs during Pregnancy- CDC Fact Sheet. Retrieved on 8/7/2016 at http://www.cdc.gov/std/pregnancy/std-pregnancy-april-2016.pdf.
- Flick L., & Leet T. (2007). Monitoring infant mortality in St. Louis City and County: Update for 2000-2004. Final report submitted to the St. Louis Maternal Child and Family Health Coalition, August 30, 2007.
- Lo J., Mission J., & Caughey A. (2013). Hypertensive disease of pregnancy ad maternal mortality. Current Opinion in Obstetrics and Gynecology, 25, 124-132.
- Kemm, J. (2015). Health Promotion: Ideology, Discipline, and Specialism. Published by Oxford University Press, United Kingdom.
- Kotelchuck M. (1994). An evaluation of the Kessner adequacy of prenatal care index and a proposed adequacy of prenatal care utilization index. American Journal of Public Health, 84, 1414-1419.
- Kramer M., Demissie K., yang H., Platt R., Sauve R., & Liston R. (2000). The contribution of mild and moderate preterm birth to infant mortality. Fetal and Infant Health Study Group of the Canadian Perinatal Surveillance System. Journal of the American Medical Association, 28, 843-849.
- MacDorman M., & Mathews T. (2011). Infant mortality statistics from the 2007 period inked birth/infant death data set. National Vital Statistics Reports, 58, 1-321.
- MacDorman M., Hoyert D., Mathews T.J., (April 2013) Recent Declines in Infant Mortality in the United States, 2005–2011. National Center for Health Statistics, 120, 1-8. Retrieved from http://www.cdc.gov/nchs/data/databriefs/db120.pdf.
- Markowitz B., Cook R., Flick L., & Leet T. (2005). Socioeconomic factors and adolescent pregnancy outcomes: Distinctions between neonatal and post-neonatal deaths. BMC Public Health, 5, 79.
- Mathews T., & MacDorman M. (2013). Infant mortality statistics from the 2010 period

linked birth/infant death data set. National Vital Statistics Reports, 62, 1-27. Retrieved on 8/27/2016 at

- National Institute of Diabetes and Digestive and Kidney Disorders. (2013). What I Need to Know about Gestational Diabetes. NIH Publication No 13-5129. Retrieved on 8/27/2016 at http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62_08.pdfhttps://www.niddk.nih.gov/health-information/diabetes/types/gestational
- Pongou R. (2013). Why is infant mortality higher in boys than in girls? A new hypothesis based on preconception environment and evidence from a large sample of twins. Demography, 50, 421-444.
- Rich-Edwards J., & Grizzard T. (2005). Psychosocial stress and neuroendocrine mechanism in preterm delivery. American Journal of Obstetrics and Gynecology, 192, S30-35.
- Richmond JB, Kotelchuck M. Political influences: rethinking national health policy. In: McGuire C, Foley R, Gorr A, Richards R, eds. Handbook of health professionals education. San Francisco (CA): Jossey-Bass Publishers; 1993. p. 386-404.

i http://www.ihi.org/communities/blogs/_layouts/ihi/community/blog/itemview.aspx?ID=218&List=7d1126ec-8f63-4a3b-9926-c44ea3036813.

ii http://www.ihi.org/about/Pages/IHIVisionandValues.aspx.

iii http://kff.org/medicaid/state-indicator/births-financed-by-medicaid/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D.

iv http://jcarrolldose.wixsite.com/dosetm/states-running-dose.

v http://www.nichq.org/blog/2015/may/first-responders-safe-sleep-education.

vi Gopal Singh and Mohammad Siahpush, "Widening Socioeconomic Inequalities in US Life Expectancy 1980-2000," International Journal of Epidemiology 35 (May 2006):969-979, doi:10.1093/ije/dyl083.

vii Paula Braverman et al., "Socioeconomic Disparities in Health in the United States: What the Patterns Tell Us," American Journal of Public Health 100(1) (April 2010):186-196.

viii U.S. Department of Health and Human Services, The Power to Reduce Health Disparities: Voices from Reach Communities, (Atlanta, GA: Centers for Disease Control and Prevention, 2007), https://stacks.cdc.gov/view/cdc/12109/.

ix Porter, L. Martin, K., Anda, R. "Self-Healing Communities: A Transformational Process Model for Improving Intergenerational Health, (Robert Wood Johnson Foundation, 2016), http://www.rwjf.org/content/dam/farm/reports/reports/2016/rwjf430225.

x Porter, L. Martin, K., Anda, R. "Self-Healing Communities: A Transformational Process Model for Improving Intergenerational Health, (Robert Wood Johnson Foundation, 2016), http://www.rwjf.org/content/dam/farm/reports/reports/2016/rwjf430225

8 | Appendices

Appendix A

Table A shows the prevalence of selected risk factors overall and the percent missing for each variable. Missing cases were included in subsequent chi-square and logistic regression analyses so as not to lose sample size and to be representative of the sample, but results in the unknown subgroups are not shown. Note, variables were chosen based on theoretical basis and on the fact that they were available across all three datasets (live births and the two fetal death datasets). Participation in government programs is 'yes' if the mother participated in WIC, Food Stamps or Medicaid. A combination variable was created for analysis as the three are highly correlated and represent a proxy for socioeconomic status.

TABLE A: Prevalence of risk and preventive factors for Birth weight distribution among all live births/ fetal deaths.
2010-2014: St. Louis City and County, MO | (n=81,733)

		Overall (n=81,733)
Risk/Preventive Factors	**n (%)**	**n missing (%)**
Maternal residence county	**0 (0.0)**	
St. Louis County	57926 (70.9)	
St. Louis City	23807 (29.1)	
Maternal Race	**684 (0.8)**	
White, non-Hispanic	42113 (51.5)	
Black, non-Hispanic	31065 (38.0)	
Other, non-Hispanic	4604 (5.6)	
Hispanic	3267 (4.0)	
Maternal Age	**13 (0.02)**	
< 20	6088 (7.5)	
20 - 34	63413 (77.6)	
> 34	12219 (14.9)	
Maternal Education < High school graduate	10194 (12.5)	368 (0.5)
Married (yes)	44884 (54.9)	265 (0.3)
Participate in government program (yes)	41707 (51.0)	4331 (5.3)
Kotelchuck Index: Inadequate PNC	9724 (11.9)	8598 (10.5)
Parity (previous live births)	**844 (1.0)**	
Nulliparous	33463 (40.9)	

TABLE A (CONTINUED): Prevalence of risk and preventive factors for Birth weight distribution among all live births/fetal deaths.
2010-2014: St. Louis City and County, MO | (n=81,733)

		Overall (n=81,733)
Risk/Preventive Factors	**n (%)**	**n missing (%)**
Primiparous	24433 (29.9)	
Multiparous	22993 (28.1)	
Smoking during pregnancy (yes)	8728 (10.7)	848 (1.0)
Insulin dependent diabetes (yes)	589 (0.7)	2 (<0.01)
Other diabetes (yes)	4093 (5.0)	3 (<0.01)
Pre-pregnancy hypertension (yes)	1418 (1.7)	2 (<0.01)
Gestational hypertension (yes)	5166 (6.3)	2 (<0.01)
Hypertension eclampsia (yes)	637 (0.8)	2 (<0.01)

CALCULATION TABLES FOR TABLE 3 (FROM PAGE 23): Number of deaths broken out.

Overall (denominator = 81,733; total deaths = 612)			
	Fetal	Neonatal	Postneonatal
500-1,499	235		
1,500+	133	125	119

2010 (denominator = 16,370; toal deaths = 115			
	Fetal	Neonatal	Postneonatal
500-1,499	48		
1,500+	29	24	14

2011 (denominator = 16,740; total deaths = 128)			
	Fetal	Neonatal	Postneonatal
500-1,499	40		
1,500+	25	32	28

2012 (denominator = 16,092; total deaths = 124)			
	Fetal	Neonatal	Postneonatal
500-1,499	50		
1,500+	26	19	29

2013 (denominator = 16,160; total deaths = 111)			
	Fetal	Neonatal	Postneonatal
500-1,499	46		
1,500+	24	21	20

2014 (denominator = 16,371; total deaths = 134)			
	Fetal	Neonatal	Postneonatal
500-1,499	48		
1,500+	29	24	14

St. Louis County (denominator = 57,926; total deaths = 374)			
	Fetal	Neonatal	Postneonatal
500-1,499	149		
1,500+	81	78	66

St. Louis City (denominator = 23,807; total deaths = 238)			
	Fetal	Neonatal	Postneonatal
500-1,499	86		
1,500+	52	47	53

CALCULATION TABLES FOR TABLE 3 (CONTINUED): Number of deaths broken out.

White non-Hispanic (denominator = 42,113; total deaths = 188)			
	Fetal	Neonatal	Postneonatal
500-1,499	53		
1,500+	50	52	33

Black non-Hispanic (denominator = 31,065; total deaths = 372)			
	Fetal	Neonatal	Postneonatal
500-1,499	162		
1,500+	73	59	78

Appendix B: Breakdown of excess mortality by time, place and race/ethnicity.

Excess Deaths

*note, for figures, percent calculation used the absolute value of the number of excess deaths for calculation

*calculation table = number of excess deaths (used to create figures). The total column is what is listed in Table B, however, the denominator is the calculation from the sum of the absolute values of excess deaths in each category.

TABLE B: Number of excess deaths.

	mh/p	mc	nc	ih	total (sum in table B)	Total of absolute values (denominator for figures)
All	55.187	10.401	35.094	45.440	146.122	146.1219
2010	11.986	4.445	5.993	-0.733	21.691	23.157
2011	3.102	2.826	13.286	12.648	31.862	31.86185
2012	14.850	1.894	1.321	14.768	32.833	32.83318
2013	10.584	-0.243	3.266	5.527	19.133	19.61969
2014	14.984	1.444	10.992	13.266	40.685	40.6853
St. Louis County	21.563	-5.889	14.281	13.867	43.822	55.5998
St. Louis City	33.625	16.290	20.812	31.574	102.300	102.3001
White, non-Hispanic	-39.649	-13.170	5.676	-4.902	-52.044	63.3955
Black, non-Hispanic	93.657	26.403	24.829	50.042	194.930	194.9295

Appendix C: Investigation of disparities in excess death by each PPOR category.

* To investigate if there were any disparities in excess deaths for Maternal Health/Prematurity period by race and county, a chi-square analysis was conducted on the 2x2 Tables below. Results are shown below each table and indicate that Black and St. Louis City residents would be of particular importance in understanding the cause of excess deaths for Maternal Health/Prematurity. These 2x2 tables are looking at Maternal Health/Prematurity deaths.

TABLE C: Number of maternal Health/Prematurity deaths.

MH/P category	Excess Deaths	Remaining Deaths	Total Deaths
BLACK	94 (58.0%)	68	162
WHITE	0 (0.0%)	53	53
Chi-square = 52.3, df = 1, p<.0001			
STL CITY	34 (39.5%)	52	86
STL COUNTY	22 (14.8%)	127	149
Chi-square = 17.1, df = 1, p=<.0001			

* To investigate if there were any disparities in excess deaths for the Infant heath (IH) period by race and county, a chi-square analysis was conducted on the 2x2 Tables below. Results are shown below each table and indicate that the Black and St. Louis City target populations would be of particular interest in examination to uncover the cause of excess deaths for IH. These 2x2 tables are looking at IH.

TABLE D: Number of Infant Health deaths.

IH category	Excess Deaths	Remaining Deaths	Total Deaths
BLACK	50 (64.1%)	28	78
WHITE	0 (0.0%)	33	33
Chi-square = 35.9, df = 1, p<.0001			
STL CITY	32 (60.4%)	21	53
STL COUNTY	14 (21.2%)	52	66
Chi-square = 17.4, df = 1, p=<.0008			

Appendix D: Variables in Infant Heath Analysis

TABLE E: Definitions for outcomes and risk factors.

Outcome	Definition (Birth cohort specific in Year, Y)
Fetal Mortality	Rate of fetuses ≥ 24 weeks gestation dying in utero for all live births and fetal deaths in Year, Y
Perinatal Mortality	Rate of fetuses ≥ 28 weeks gestation dying in utero and infants dying in first 6 days of life for all live births and fetal deaths in Year, Y
Infant Mortality	Rate of infants dying before their first birthday for all live births in Year, Y
Neonatal Mortality	Rate of infants dying during the first 27 days of life for all live births in Year, Y
Post-Neonatal Mortality	Rate of infants dying > 27 days of life and before first birthday for all live births in Year, Y
Infant Mortality – Perinatal Conditions	Rate of infants dying from perinatal conditions before first birthday for all live births in Year, Y
Infant Mortality – Congenital Anomalies	Rate of infants dying from congenital anomalies before first birthday for all live births in Year, Y
Infant Mortality – SIDS	Rate of infants dying from SIDS before first birthday for all live births in Year, Y
Infant Mortality – All Other Causes	Rate of infants dying from all other causes before first birthday for all live births in Year, Y
Low Birth Weight (LBW)	Rate of infants weighing < 2,500 grams among all live births in Year, Y
Moderately Low Birth Weight (MLBW)	Rate of infants weighing 1,500 – 2,499 grams among all live births in Year, Y
Very Low Birth Weight (VLBW)	Rate of infants weighing < 1,500 grams among all live births in Year, Y
Preterm Delivery	Rate of infants < 37 weeks gestation among all live births in Year, Y
Preterm Delivery 32-36 Weeks	Rate of infants 32-36 weeks gestation among all live births in Year, Y
Preterm Delivery < 32 Weeks	Rate of infants < 32 weeks gestation among all live births in Year, Y
Small for Gestational Age (SGA)	Rate of infants born < 10th percentile on weight for gestational age distribution in weeks among all live births in Year, Y. Based on tables by race published by Alexander et al. (1999).[58]

58 Alexander GR, Kogan MD and Himes JH: 1994–1996 U.S. singleton birth weight percentiles for gestational age by race, Hispanic origin, and gender. Maternal Child Health J 1999, 3(4):225

Risk Factor	Definition (Birth cohort specific in Year, Y) – For all live births only
Maternal Age < 18 Years	Percentage of mothers < 18 years of age
Maternal Age ≥ 35 Years	Percentage of mothers ≥ 35 years of age
Maternal Education < 13 Years	Percentage of mothers with less than 13 years of education (i.e. < high school graduate)
No Paternal Information on Birth Certificate	Percentage of birth certificates with no paternal information listed
Maternal Participation in Government Programs	Percentage of mothers participating in one of three government programs (Medicaid, WIC, Food Stamps)
Maternal Cigarette Use	Percentage of mothers who smoked during pregnancy
Inadequate Prenatal Care Utilization	Percentage of mothers with inadequate prenatal care based on Kotelchuck Index
Adequate Plus Prenatal Care Utilization	Percentage of mothers with adequate plus prenatal care based on Kotelchuck Index. These are assumed to be medically complicated pregnancies requiring more frequent care.
No Prenatal Care	Percentage of mothers with no prenatal care visits
Gestational Hypertension	Percentage of mothers diagnosed with gestational hypertension
Hypertension Eclampsia	Percentage of mothers diagnosed with hypertension eclampsia
Gestational Diabetes	Percentage of mothers diagnosed with gestational diabetes
Any Sexually Transmitted Infection	Percentage of mothers with any STI present and/or treated during pregnancy (gonorrhea, syphilis, chlamydia, hepatitis b or c, HIV)
Inadequate Gestational Weight Gain	Percentage of mothers with inadequate weight gain based on gestational age and pre-pregnancy BMI. Using IOM guidelines, inadequate weight gain is present if a mother does not meet the minimum weight gain given gestational age and BMI.
Multiple Gestations	Percentage of mothers with multiple gestations (plurality > 1)
Parity is 5+	Percentage of mothers with parity (i.e. previous live births) of ≥ 5
Male Infant	Percentage of male infants

Appendix E: Death

TABLE F: Total sample sizes (number removed at each step, % removed).*

	Unrestricted	Remove missing birth weight or gestational age	Remove improbable birth weight and gestational age combinations	Remove birth weight less than 500 grams	Remove gestational age less than 24 weeks (fetal death only)
Fetal Deaths - Overall	**466**	**397 (-69, -14.8%)**	**392 (-5, -1.3%)**	**241 (-151, -38.5%)**	**218 (-23, -9.5%)**
Year					
2010	95	78 (-17, -17.9%)	78 (-0, -0.0%)	48 (-30, -38.5%)	43 (-5, -10.4%)
2011	100	82 (-18, -18.0%)	82 (-0, -0.0%)	46 (-36, -43.9%)	41 (-5, -10.9%)
2012	93	83 (-10, -10.8%)	83 (0, -0.0%)	56 (-27, -32.5%)	47 (-9, -16.1%)
2013	104	87 (-17, -16.4%)	83 (-4, -4.6%)	45 (-38, -45.8%)	43 (-2, -4.4%)
2014	74	67 (-7)	66 (-1, -1.5%)	45 (-38, -45.8%)	44 (-2, -4.4%)
Race					
White	154	123 (-31, -20.1%)	123 (-0, -0.0%)	79 (-44, -22.2%)	76 (-3, -3.8%)
Black	269	239 (-30, -11.2%)	236 (-3, -1.3%)	143 (-93, -39.4%)	125 (-18, -12.6%)
Hispanic	12	8 (-4, -33.3%)	8 (-0, -0.0%)	3 (-5, -62.5%)	3 (-0, -0.0%)
Other	19	18 (-1, -5.3%)	16 (-2, -11.1%)	9 (-7, -43.8%)	8 (-1, -11.1%)
Unknown	12	9 (-3, -25.0%)	9 (-0, -0.0%)	7 (-2, -22.2%)	6 (-1, -14.3%)
County					
St. Louis County	315	262 (-53, -16.8%)	261 (-1, -0.4%)	157 (-104, -39.8%)	141 (-16, -10.2%)
Stl City	151	135 (-16, -10.6%)	131 (-4, -3.0%)	84 (-47, -35.9%)	77 (-7, -8.3%)
Infant Deaths - Overall	**605**	**566 (-39, -6.4%)**	**562 (-4, 0.7%)**	**394 (-168, -29.9%)**	**n/a**
YEAR					
2010	112	102 (-10, -8.9%)	102 (-0, -0.0%)	72 (-30, -29.4%)	n/a
2011	146	133 (-13, -8.9%)	132 (-1, -0.8%)	87 (-45, -34.1%)	n/a
2012	114	107 (-7, -6.1%)	106 (-1, -0.9%)	77 (-29, -27.4%)	n/a
2013	106	103 (-3, -2.8%)	101 (-2, -1.9%)	68 (-33, -32.7%)	n/a
2014	127	121 (-6, -4.7%)	121 (-0, -0.0%)	90 (-31, -25.6%)	n/a
RACE					
White	156	135 (-21, 13.5%)-	134 (-1, -0.7%)	112 (-22, -16.4%)-	n/a
Black	397	385 (-12, -3.0%)	382 (-3, -0.8%)	247 (-135, -35.3%)	n/a
Hispanic	24	21 (-3, -12.5%)	21 (-0, -0.0%)	15 (-6, -28.6%)	n/a
Other	20	17 (-3, -15.0%)	17 (-0, -0.0%)	16 (-1, -5.9%)	n/a
Unknown	8	8 (-0, -0.0%)	8 (-0, -0.0%)	4 (-4, -50.0%)	n/a

TABLE F (CONTINUED): Total sample sizes (number removed at each step, % removed).*

	Unrestricted	Remove missing birth weight or gestational age	Remove improbable birth weight and gestational age combinations	Remove birth weight less than 500 grams	Remove gestational age less than 24 weeks
County					
Stl County	370	339 (-31, -8.4%)	337 (-2, -0.6%)	233 (-104, -30.9%)	n/a
Stl City	235	227(-8, -3.4%))	225 (-2, -0.9%)	161 (-64, -28.4%)	n/a

*NOTE – in MICA, infant deaths are 612 for time frame. However, this dataset is based on a birth cohort, so the infant deaths won't be exact, but remain similar to MICA. Also, number removed and percent removed are in parentheses.

Appendix F: Maps of Unrestricted Data

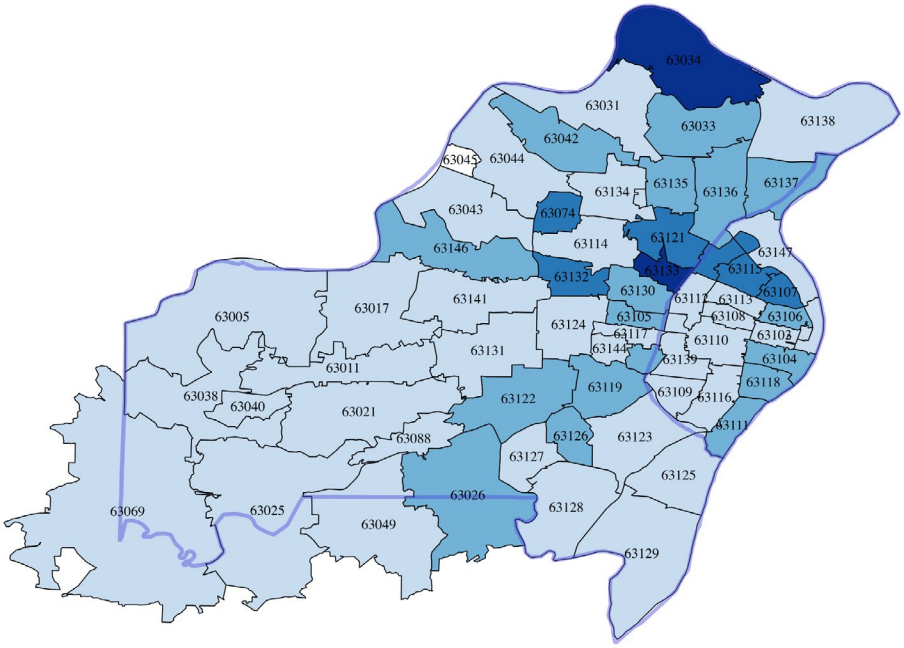
MAP 78: Fetal Death - Unrestricted Data.

2010-2014: St. Louis City and County, MO | Rate of Fetal Deaths* | By Zip code

Rate per 1,000 Live Births & Fetal Deaths

- Insufficient Data
- Less than 5.6
- 5.6 - 8.4
- 8.4 - 11.2
- Greater than 11.2

*This map was produced using an unrestricted data file. See Methods section for more details



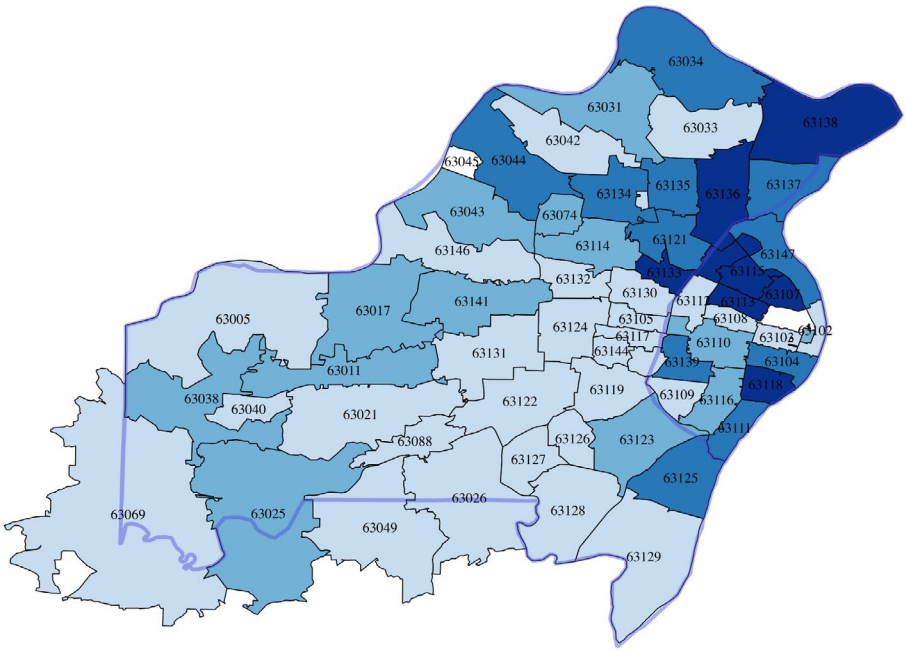
MAP 79: Neonatal Death - Unrestricted Data.

2010-2014: St. Louis City and County, MO | Rate of Neonatal Deaths* | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 4.1
- 4.1 - 6.2
- 6.2 - 8.2
- Greater than 8.2

*This map was produced using an unrestricted data file. See Methods section for more details



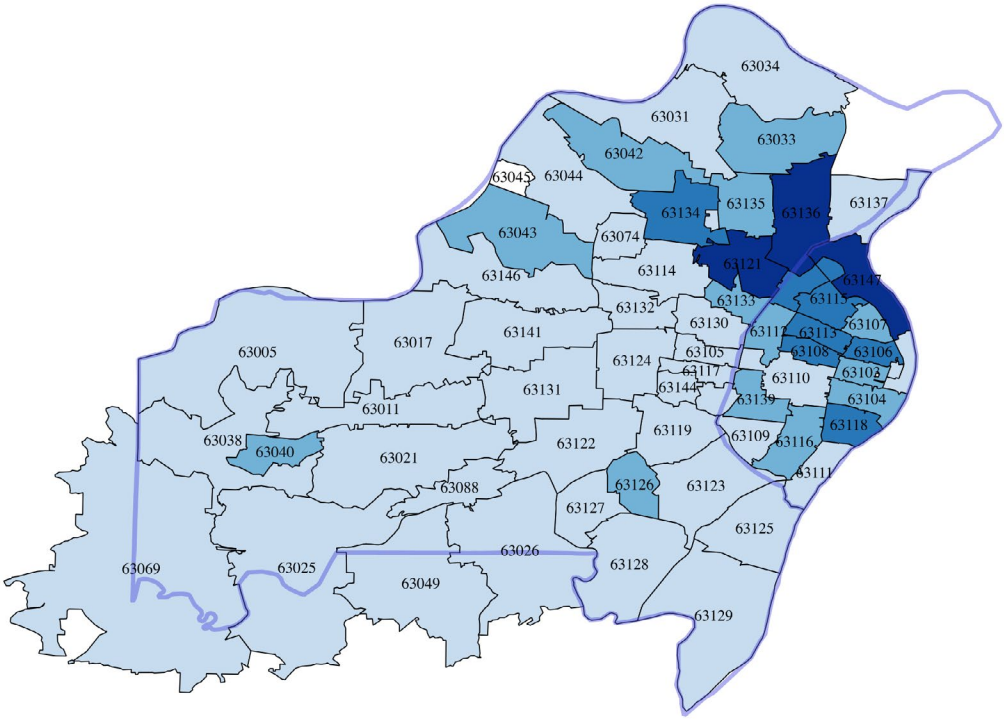
MAP 80: Post-Neonatal Deaths - Unrestricted Data.

2010-2014: St. Louis City and County, MO | Rate of Post-neonatal Deaths* | By Zip code

Rate Per 1,000 Live Births

- Insufficient Data
- Less than 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- Greater than 4.0

*This map was produced using an unrestricted data file. See Methods section for more details



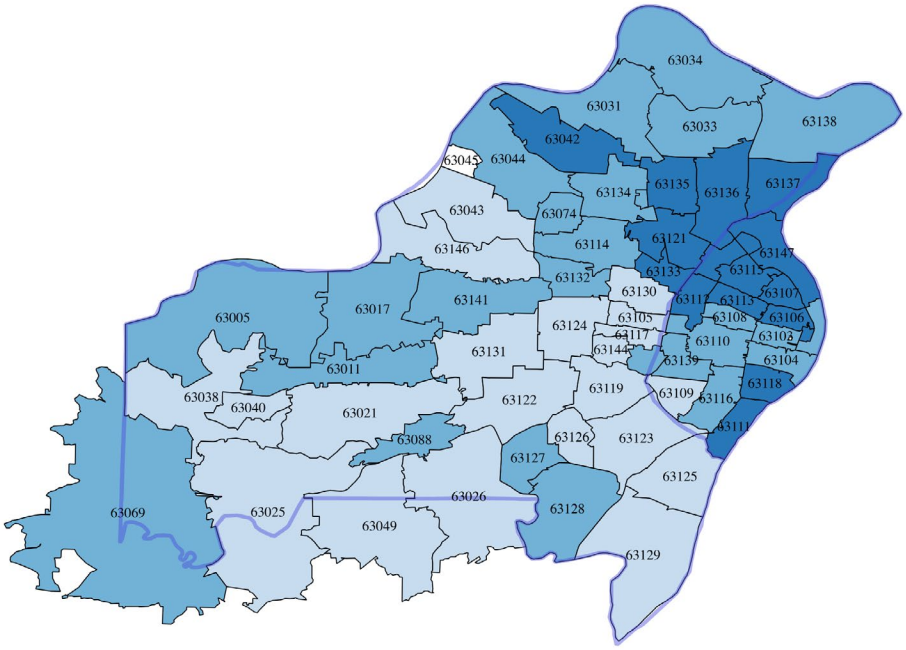
MAP 81: Preterm Birth - Unrestricted Data.

2010-2014: St. Louis City and County, MO | Rate of Preterm Live Births (<37 weeks)* | By Zip code

Rate Per 100 Live Births

- Insufficient Data
- Less than 11.4
- 11.4 - 17.1
- 17.1 - 22.8
- Greater than 22.8

*This map was produced using an unrestricted data file. See Methods section for more details



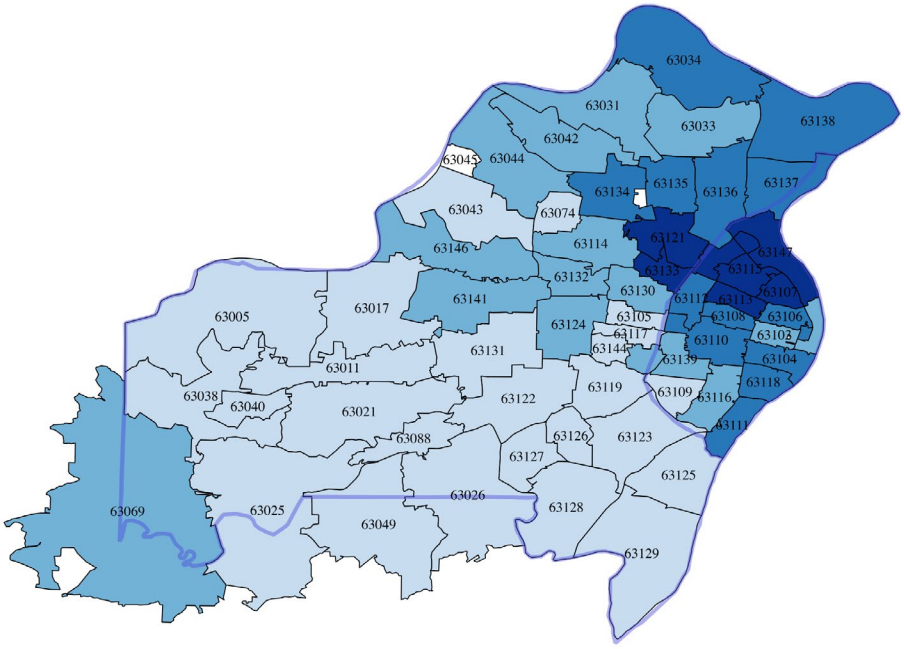
MAP 82: Low Birth Weight - Unrestricted Data.

2010-2014: St. Louis City and County, MO | Rate of Low Birth Weight Births (<2,500g)* | By Zip code

Rate Per 100 Live Births

- Insufficient Data
- Less than 7.8
- 7.8 - 11.7
- 11.7 - 15.6
- Greater than 15.6

*This map was produced using an unrestricted data file. See Methods section for more details



MAP 83: Very Low Birth Weight - Unrestricted Data.

2010-2014: St. Louis City and County, MO | Rate of Very Low Birth Weight Births (<1500g)* | By Zip code

Rate Per 100 Live Births

- Insufficient Data
- Less than 1.4
- 1.4 - 2.1
- 2.1 - 2.8
- Greater than 2.8

*This map was produced using an unrestricted data file. See Methods section for more details