

Appendix A: Data on Factors Associated with Infant Mortality in African American Infants and Infants in Rural Communities in Maryland

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[Author note: I need to finish captioning figures and tables to update these tables]

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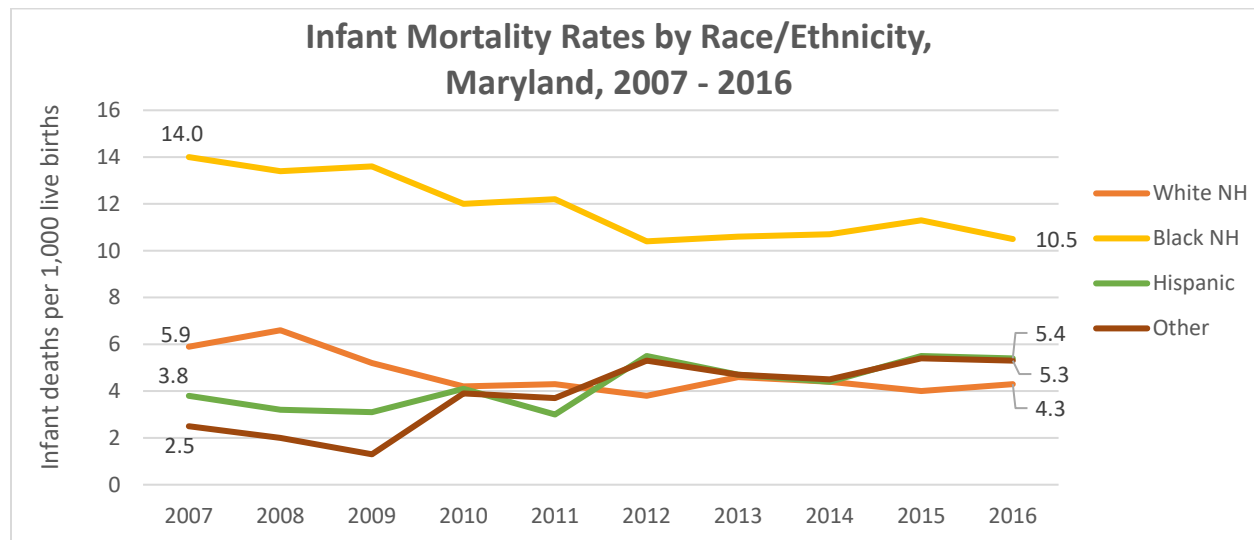
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Introduction

Chapter 83 of the State Laws of Maryland, 2018, requires that the Maryland Health Care Commission (MHCC) “examine factors, beyond the known factors of low birth weight, teen pregnancy, poor nutrition, and lack of prenatal care, affecting the mortality of African American infants and infants in rural areas in the ...State”.

The study of Black Infant Mortality rates, specifically, is justified by the scale of the disparities in outcomes for Black infants, compared to other racial and ethnic groups. Figure 1 show infant mortality rates for the past decade for Black Non-Hispanic infants (the top line), White Non-Hispanic Infants, Hispanic Infants, and other races and ethnicities in Maryland. Black Non-Hispanic infants consistently experience an infant mortality rate that is more than two times larger than the infant mortality rate for white infants. While there are currently small disparities in outcomes between Hispanic infants, other races/ethnicities, and White Non-Hispanic Infants, historically the outcomes between these groups is similar.

Figure 1: Infant Mortality Rates by Race/Ethnicity, Maryland, 2007 - 2016

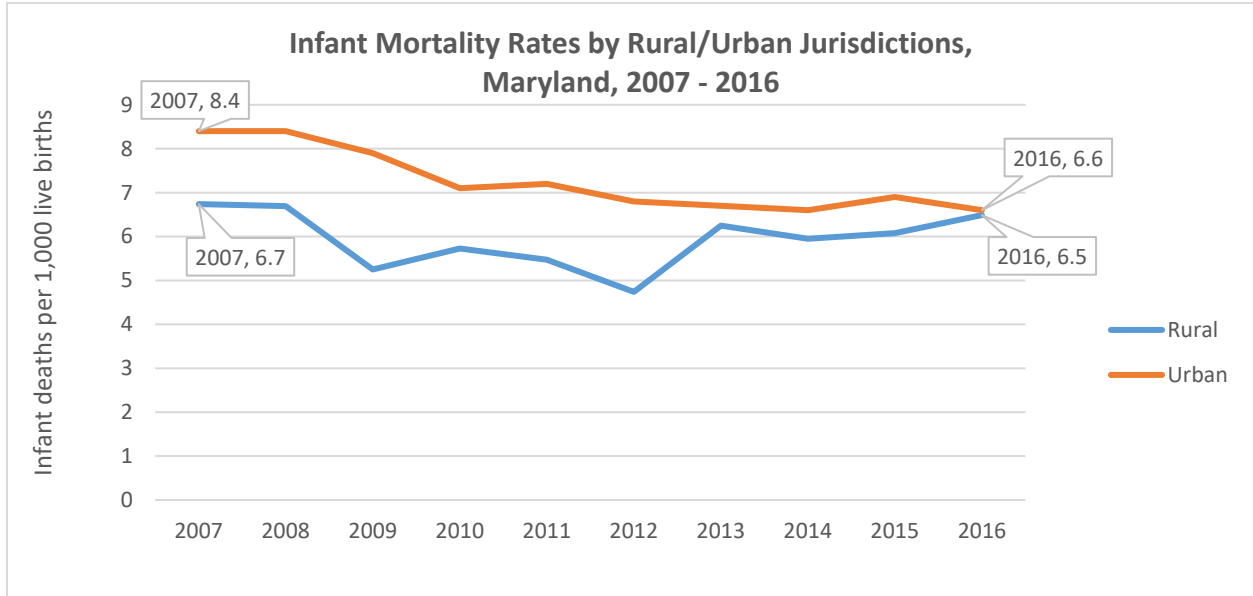


[Author note: I will update with 2017 data]

Rural infants are also a topic of concern (see Figure 2). Historically, the infant mortality rate in rural jurisdictions in Maryland has been lower than the rate in urban areas. Over the past decade, the infant mortality rate in urban jurisdictions has showed improvement. Rural jurisdictions also showed improvement in the period between 2007 and 2012, but that trend has reversed over the past 5 years. If these trends in rural and urban areas continue, the outcomes for rural infants will soon be worse than the outcomes for urban infants.

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Figure 2: Infant Mortality Rates by Rural/Urban Jurisdictions,

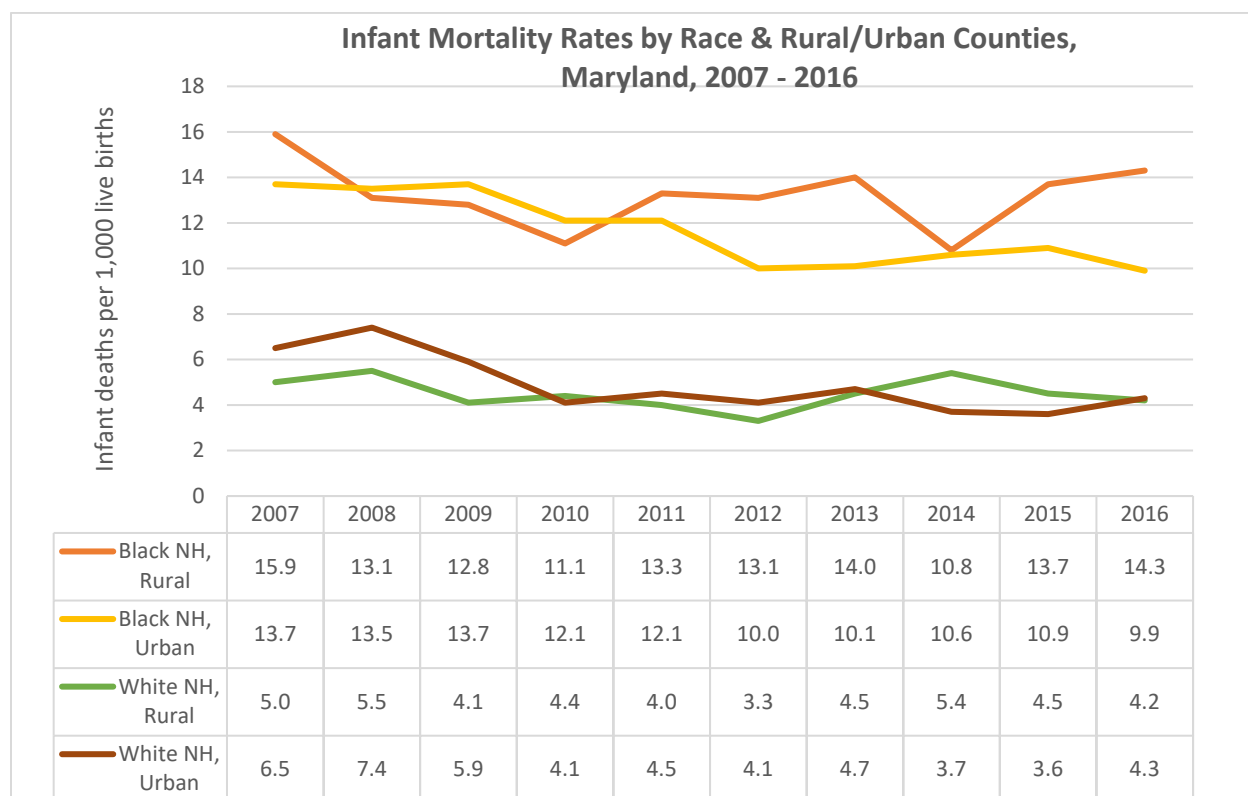


[Author note: I will update with 2017 data]

Race is an important factor in this data story (see Figure 3). The infant mortality rate for White Non-Hispanic infants in rural and urban jurisdictions in Maryland are similar. And the disparities between White Non-Hispanic and Black Non-Hispanic infants exist in both rural and urban areas. However, Black-Non-Hispanic infants in urban areas experienced a decline in infant mortality rates and have maintained a lower rate over the past five years, while Black Non-Hispanic infants in rural communities have not experienced the same trend, particularly over the past five years. As of 2016, the difference in outcomes for Black Non-Hispanic infants in urban communities and those in rural communities was statistically significant. Approximately 52 percent of the population in Maryland’s urban jurisdictions is Black, while only about 20 percent of the populations in rural jurisdictions is Black, so these populations have different levels of impact on the overall infant mortality rates shown in Figure 2.

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Figure 3: Infant Mortality Rates by Race & Rural/Urban Counties, Maryland, 2007 - 2016



[Author note: I will update with 2017 data]

MHCC collaborated closely with the Office of Minority Health and Health Disparities, the Maternal and Child Health Bureau, the Vital Statistics Administration (VSA), as well as members of the Study workgroup and the subgroup on data analysis in identifying potential factors to study and conducting data analysis on State vital records data. The results of that analysis is included in this appendix.

Data Source and other Resources

Unless specified, the data in this appendix is from Maryland Vital Statistics (i.e. birth certificates and death certificates). Birth data is available through 2017.¹ Most of the data in this report is from a data set that links birth data from 2012-2016 with death data from 2012-2017 (hereafter referred to as the Linked Birth-Infant Death Cohort, 2012-2016 Births). The Vital Statistics Administration annually reports on births (in much greater detail than is included in this report) and infant mortality. Those reports are available here: <https://health.maryland.gov/vsa/Pages/reports.aspx>.

Data from the Pregnancy Risk Assessment Monitoring System (PRAMS) was not used for this analysis because it is reported to the State at the State-level and reweighting the data to allow for the geographical analysis to understand impact on rural communities would require significant (and

¹ Summary 2018 birth data may be released before this report is released, but was not available at the time analysis was completed.

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unavailable) staff resources. PRAMS is a joint research project between the state departments of health and the Centers for Disease Control and Prevention.

Selection of Factors for Study

The factors selected for study in this report were selected through a multi-prong process. The 2011 epidemiologic report “Maryland Infant Mortality Epidemiology Work Group Findings from Data Analysis and Overall Recommendations” as well as a 2018 [PPOR analysis from the Maternal and Child Health Bureau](#) was used to create base list of possible factors for study. Additional possible factors were added and prioritized by workgroup members and as a result of the literature review on risk factors, which is discussed in Appendix C. Finally, State and contractor staff reviewed the list in the context of available data and staff resources available for data analysis. A number of factors that were identified as potentially impacting infant mortality (such as stress, experience of bias, and non-marital social supports) were excluded from analysis based on lack of data to support the analysis.

The factors included in this analysis are maternal education level, smoking during pregnancy, maternal marital status, insurance source, utilization of prenatal care, chronic hypertension, gestational hypertension, gestational diabetes, breast feeding (prior to hospital discharge at birth), inter-pregnancy interval, and pre-pregnancy BMI.

Other Methodology Issues

Geographic Level of Analysis

Data in this study was analyzed at the State and County level. County level data was combined for generate rural and Urban geographic categories. Sub-county level data (e.g. zip code or census tract) could be useful for targeting interventions. The analysis of sub-county level data is not included in this document, in part because the relatively rarity of infant mortality makes analysis at a sub-county level (e.g. zip code or census tract) less meaningful, as the analysis would require combining more years of data to obtain adequate cell sized for analysis (both to ensure privacy and to minimize the influence of chance on the analytic results). This would mask the impact of trends over time, an important focus of this report.

Definition of Rural

For purposes of this report, analysts used the State definition of “rural”. The following counties constitute rural Maryland: Allegany, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Garrett, Harford, Kent, Queen Anne’s, Somerset, St. Mary’s, Talbot, Washington, Wicomico and Worcester.

The Urban jurisdictions are: Montgomery, Prince George’s, Howard, Anne Arundel, Baltimore, and Baltimore City.

Race and Ethnicity

This appendix includes analysis of data on Black Non-Hispanic Infants. These infants are compared with White Non-Hispanic Infants to provide information on disparities in outcomes between these two populations. Maryland’s diverse population includes infants of many races and ethnicities. Outcomes for infants of Hispanic, Native American, Asian, Pacific Islander, and other racial and ethnic barriers are not included in this study due to its focus on “African American” infants.

Discussion of Findings related to Infant Mortality

Approximately 281,000 Black Non-Hispanic or White Non-Hispanic infants were born in Maryland between 2012 and 2016. These infants are the cohort for the remainder of the data discussed in this study. Infants identified as belonging to other race and ethnic groups are excluded.

	Rural		Urban	
	Births	Deaths	Births	Deaths
Black Non-Hispanic	16,231	193	101,839	1023
White Non-Hispanic	67,057	308	95,764	366

Approximately 1,900 of those infants died in their first year of life. The majority of these deaths (54 percent) are African American infants living in urban counties, even though African American infants are only 36 percent of total births in the studied cohort. Rural African American infants are similarly overrepresented in the mortality data, compared to the birth data (6% of births, 10% of deaths)

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Figure 4: Infant Deaths for Non-Hispanic Black and White Infants by Geography, Maryland, 2012-2016

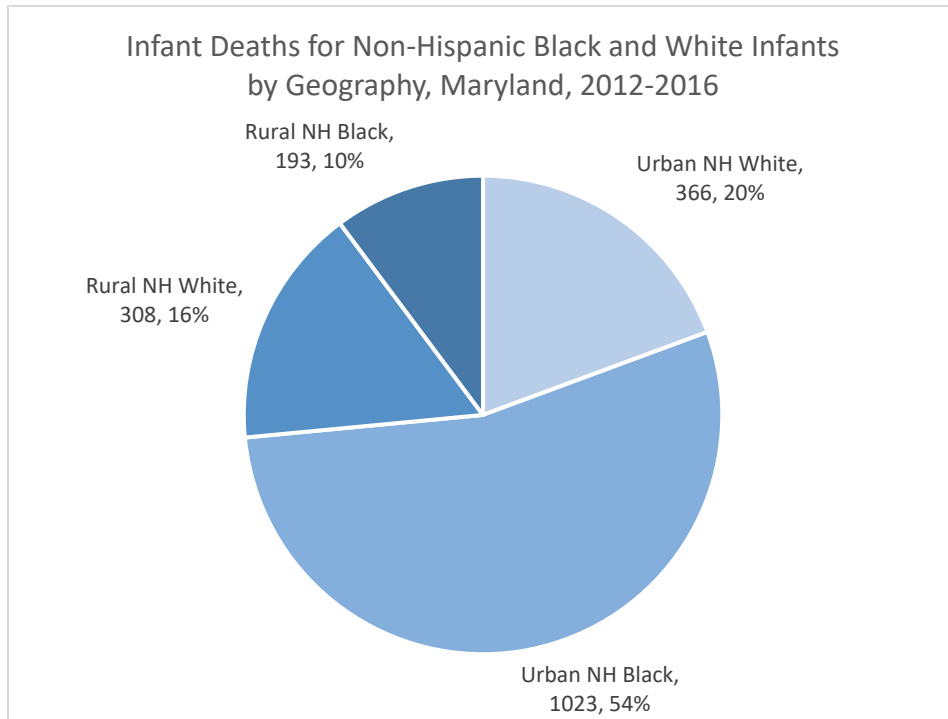
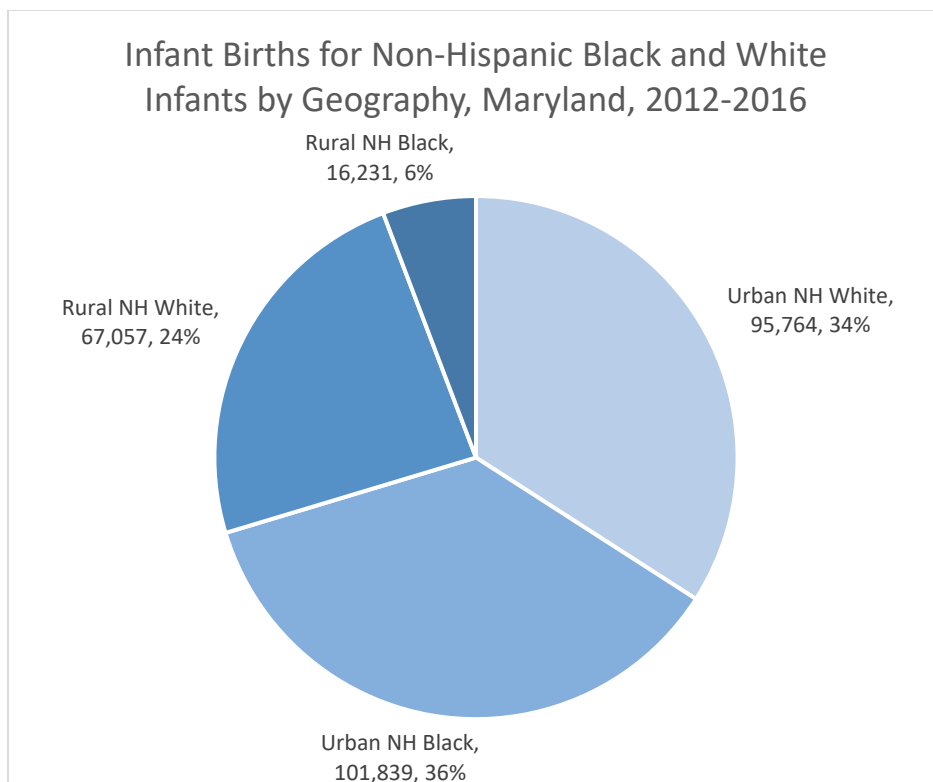
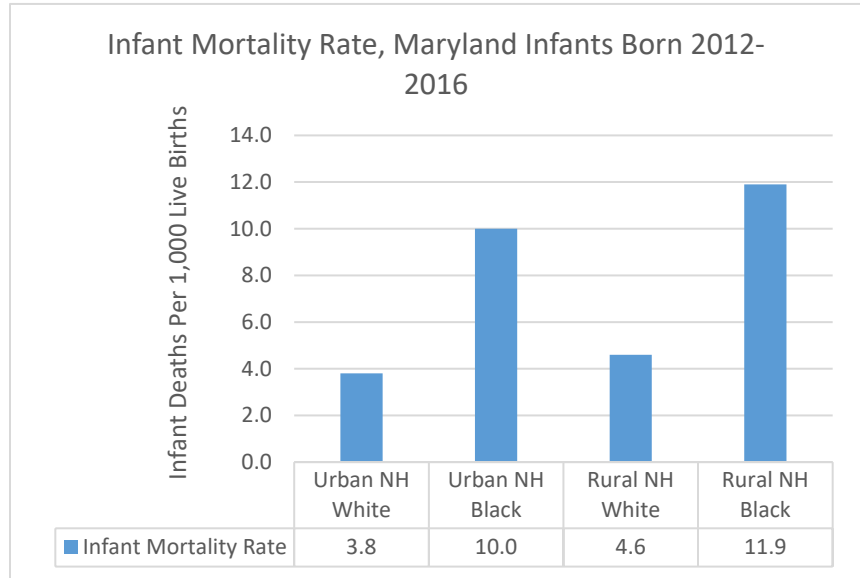


Figure 5: Infant Births for Non-Hispanic Black and White Infants by Geography, Maryland, 2012-2016



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This disparity is clearly reflected in the infant mortality rate. White Non-Hispanic Infants have a much lower infant mortality rate than Black Non-Hispanic Infants in both geographic categories. And urban infants of a specified race have a lower infant mortality rate than their peers in rural areas. The disparities in outcomes between White and Black infants are large for both geographic areas, but more pronounced in rural areas.

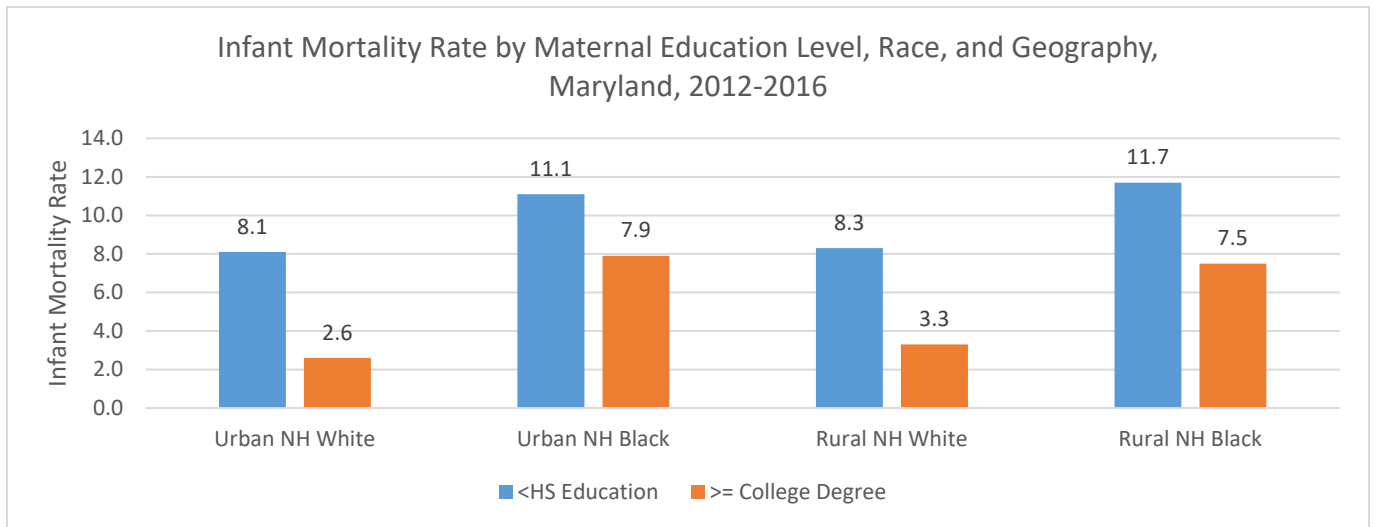


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Education

In general, mothers with higher levels of education experience lower rates of infant loss. Higher levels of education are highly protective against infant mortality for White women, with slightly more benefit for urban White women than rural white women. Higher levels of education are less protective for Black women.

Relative Risk of Infant Mortality, += College Education compared to < High School Graduate, Infant Mortality, Maryland, 2012-2016		
	Rural	Urban
Black Non-Hispanic	0.64	0.71
White Non-Hispanic	0.40	0.32



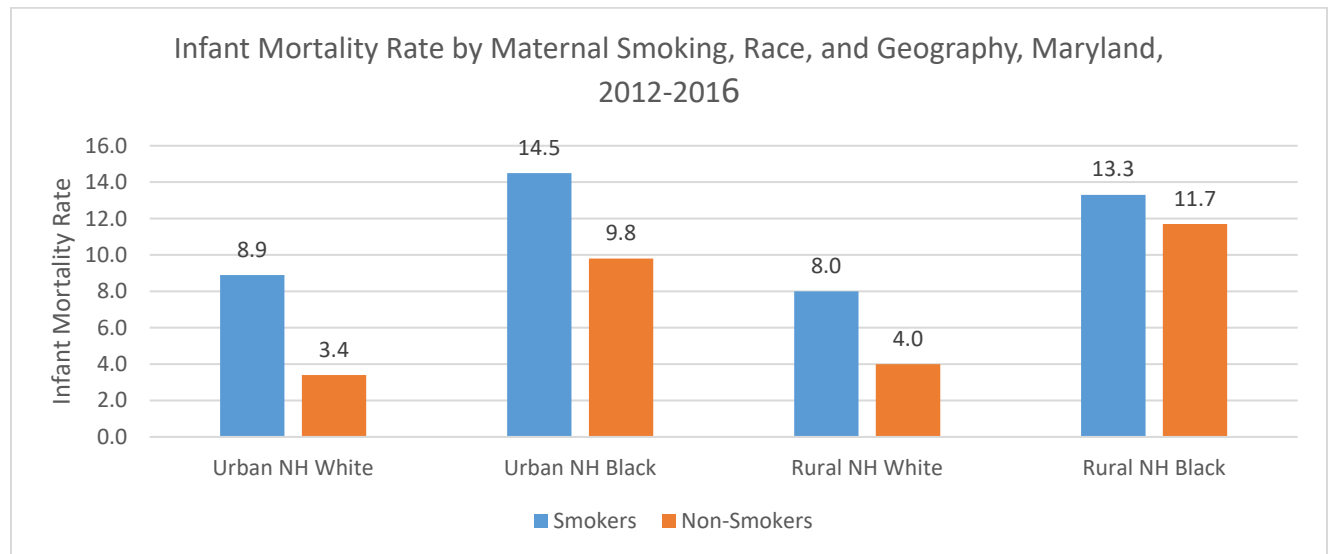
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Smoking

Smoking during pregnancy is a risk factor for infant mortality. For White infants, maternal smoking during pregnancy doubles the risk of infant mortality. Smoking has less of an impact on outcomes for Black women.

Smoking is more common among White Non-Hispanic women than Black Non-Hispanic women. In this cohort, 10 percent of White Non-Hispanic mothers reported smoking during pregnancy, compared with 6 percent of Black Non-Hispanic mothers. Smoking is also more common in rural areas in the State. Twelve percent of mothers from rural communities reported smoking during pregnancy, compare to 5 percent of mothers from non-rural jurisdictions.

Relative Risk of Infant Mortality, Non-Smoking v. Smoking during pregnancy , Infant Mortality, Maryland, 2012-2016		
	Rural	Urban
Black Non-Hispanic	0.88	0.68
White Non-Hispanic	0.50	0.38

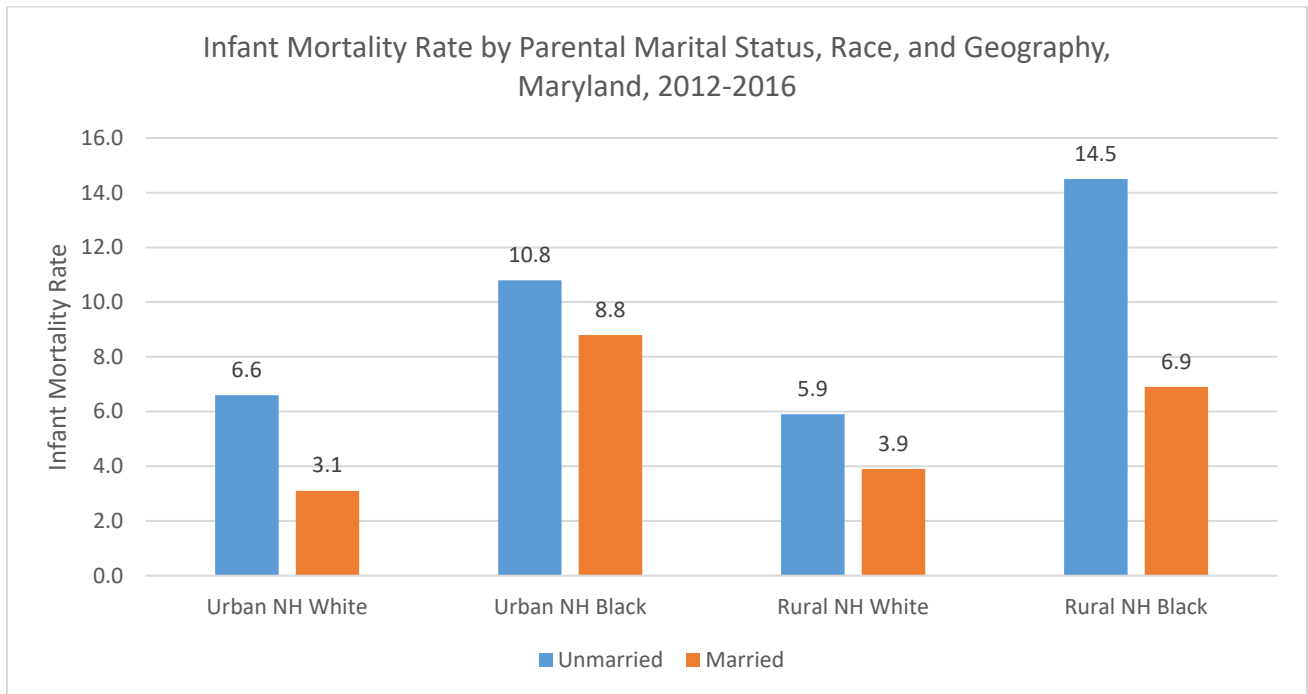


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Parental Marital Status

Parental marital status was examined as the best available, but imperfect, proxy for social supports available in the vital statistics data. Being married is more protective of infant mortality for Black rural women and White Urban Women than it is for Black urban or White rural women. This data suggests targeting interventions designed to increase social supports on these populations, although all women studied benefit.

	Rural	Urban
Black Non-Hispanic	0.48	0.81
White Non-Hispanic	0.66	0.47

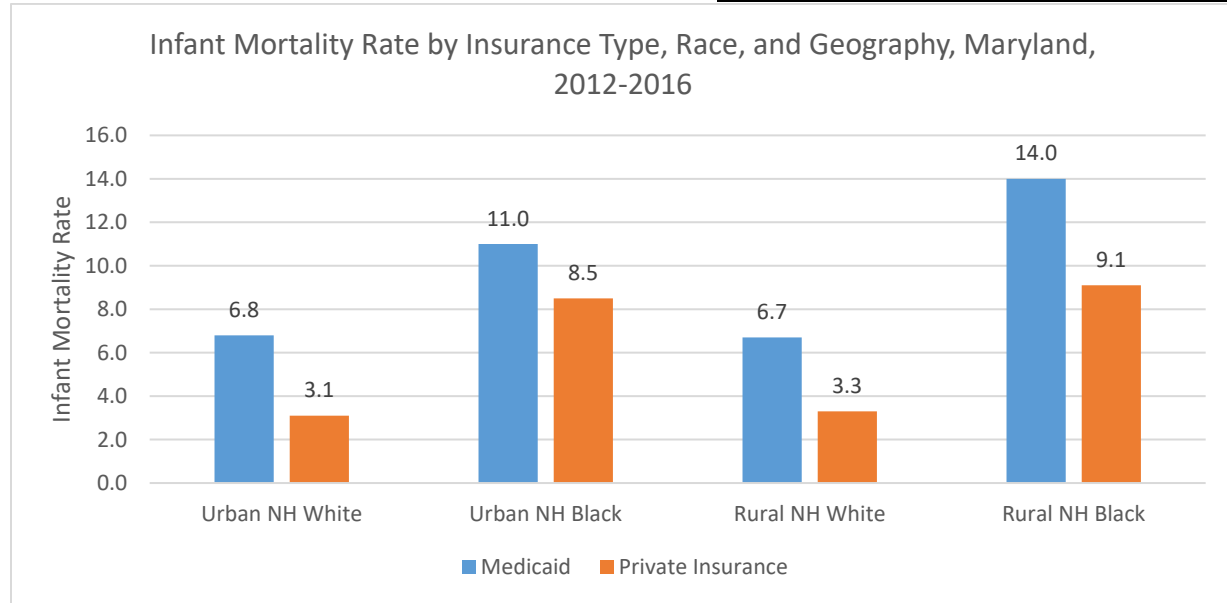


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Insurance Source

Infant mortality rate is higher for births financed through Medicaid than births financed through private insurance. Medicaid coverage during pregnancy is a proxy measure for identifying individuals with limited incomes. The data does show that having private insurance (compared to Medicaid) is more protective for white women than for black women.

Relative Risk of Infant Mortality, Private Insurance v. Medicaid, Infant Mortality, Maryland, 2012-2016		
	Rural	Urban
Black Non-Hispanic	0.65	0.77
White Non-Hispanic	0.49	0.46

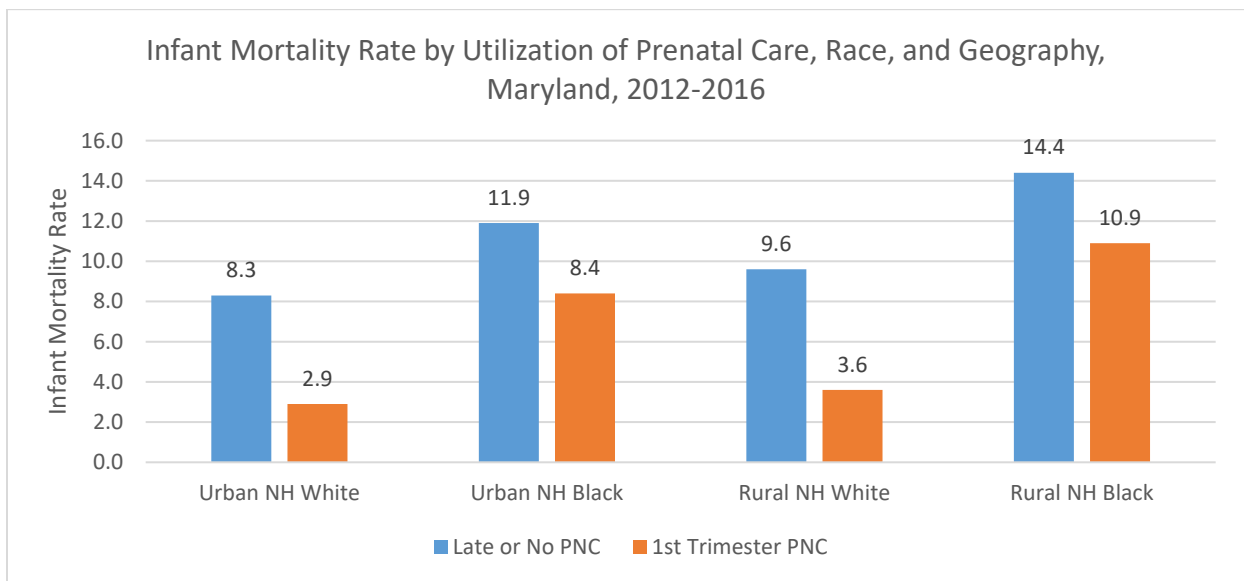


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Utilization of Prenatal Care

Pregnant women are encouraged to seek prenatal care early, ideally in the first trimester, and continue prenatal care throughout the pregnancy. White women who start prenatal care in the first trimester, as opposed to White women who start prenatal care in the 3rd trimester or receive no prenatal care reduce the chance of infant mortality by 60 percent. For Black women, the impact of early prenatal care on improving outcomes is important, but less impactful.

Relative Risk of Infant Mortality, Early PNC v. Late or No PNC, Infant Mortality, Maryland, 2012-2016		
	Rural	Urban
Black Non-Hispanic	0.76	0.71
White Non-Hispanic	0.38	0.35

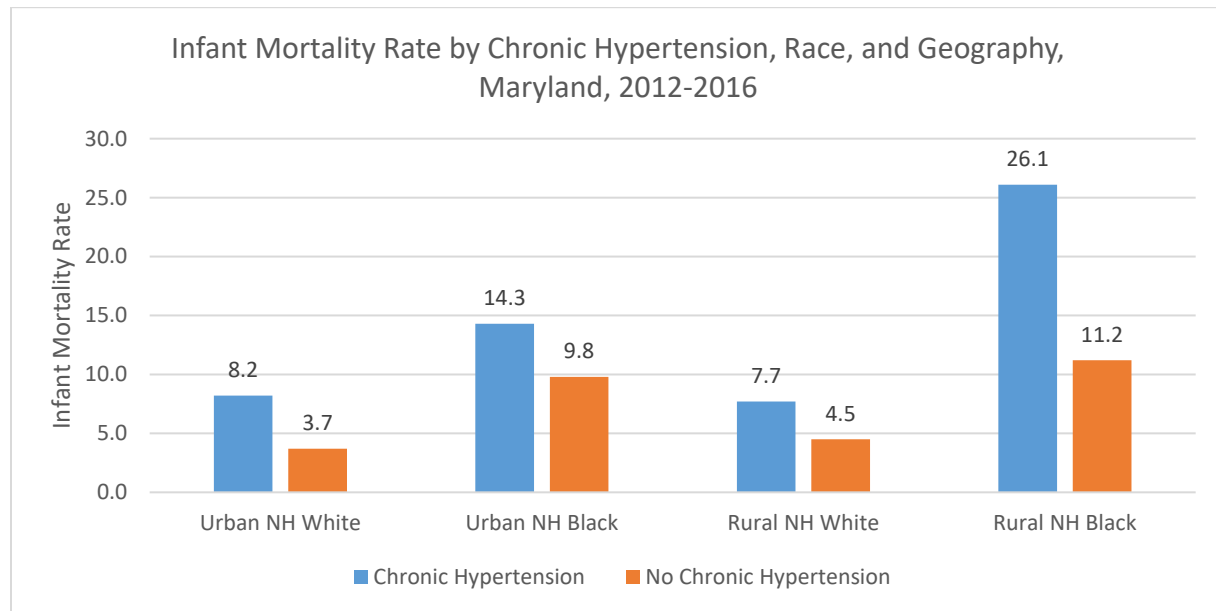


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Chronic Hypertension

On area of interest to the workgroup was preconception health, a topic that was also covered in the 2011 study. Chronic hypertension is hypertension that is unrelated to pregnancy. Women with chronic hypertension have a higher risk of experiencing infant mortality than similar women without hypertension. The impact of chronic hypertension is particularly severe for rural Black women: this population has an infant mortality rate of 26.1 per 1,000 live births.

	Rural	Urban
Black Non-Hispanic	0.43	0.69
White Non-Hispanic	0.58	0.45

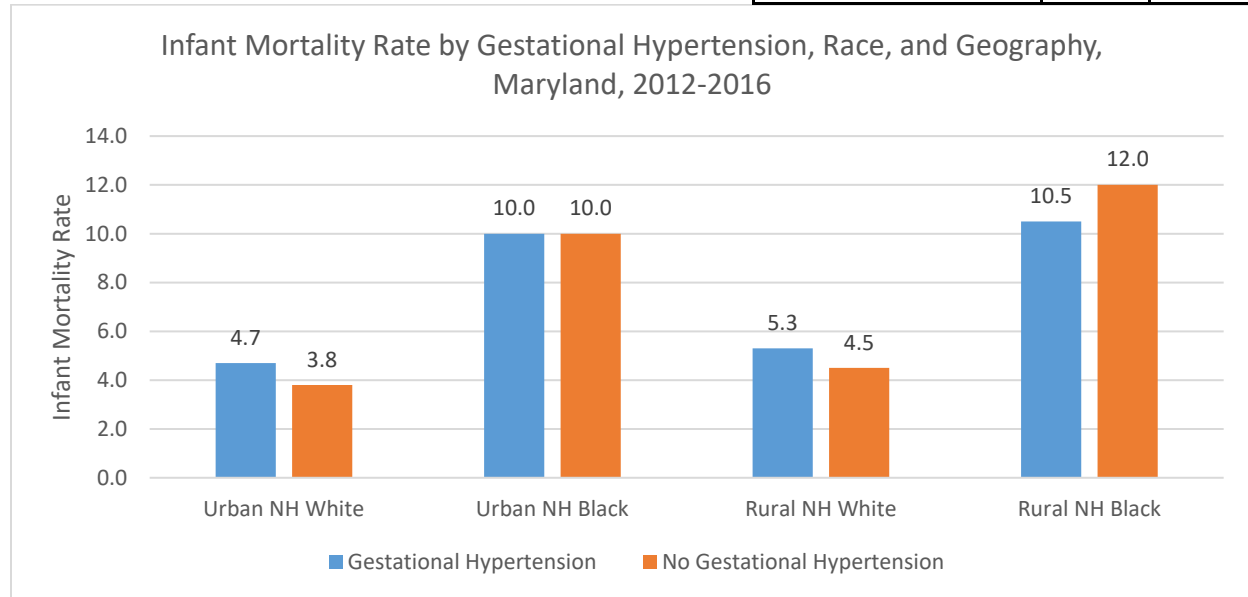


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Gestational Hypertension

Gestational hypertension is hypertension that develops during pregnancy. According to this data, gestational hypertension is a risk for infant mortality for White women, but the risk is relatively small compared to other factors examined in this study. For Black urban women, gestational hypertension does not appear to be a risk for infant mortality.

	Rural	Urban
Black Non-Hispanic	1.14	1.00
White Non-Hispanic	0.85	0.81

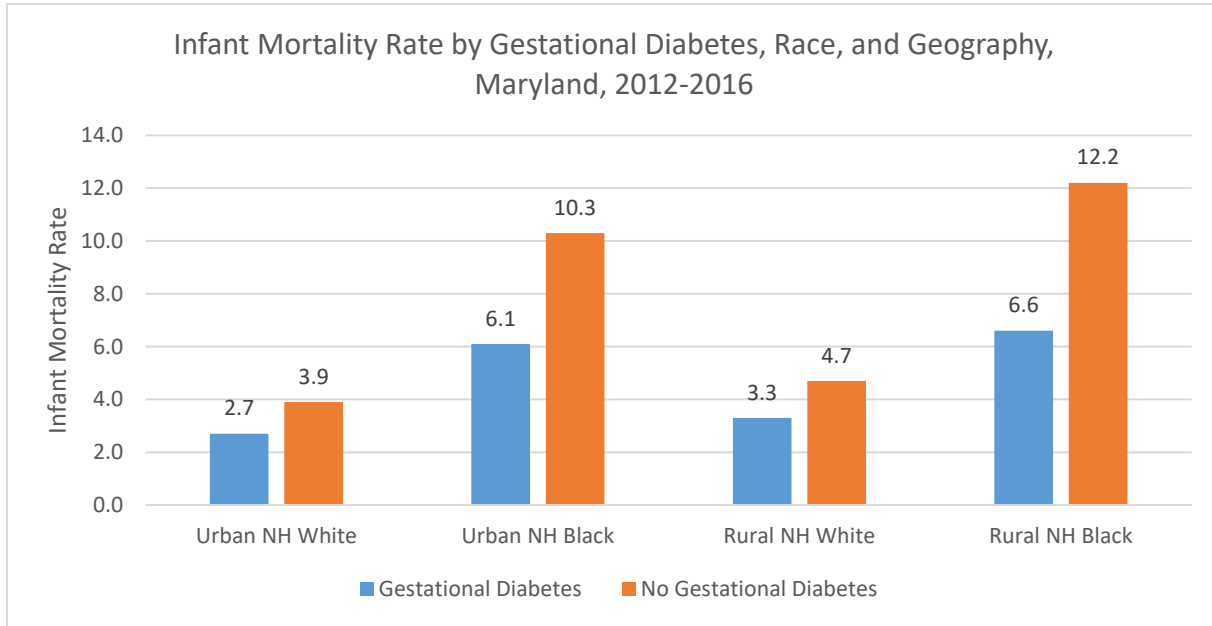


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Gestational Diabetes

Gestational diabetes is diabetes that develops during a pregnancy. This condition is controllable once it is identified. The infant mortality rates for all groups in this cohort with gestational diabetes is lower than the rate for without gestational diabetes. This may be due to close monitoring of the mother and infant with the condition before and after delivery.

Relative Risk of Infant Mortality, No Gestational Diabetes v. Gestational Diabetes, Infant Mortality, Maryland, 2012-2016		
	Rural	Urban
Black Non-Hispanic	1.85	1.69
White Non-Hispanic	1.42	1.44



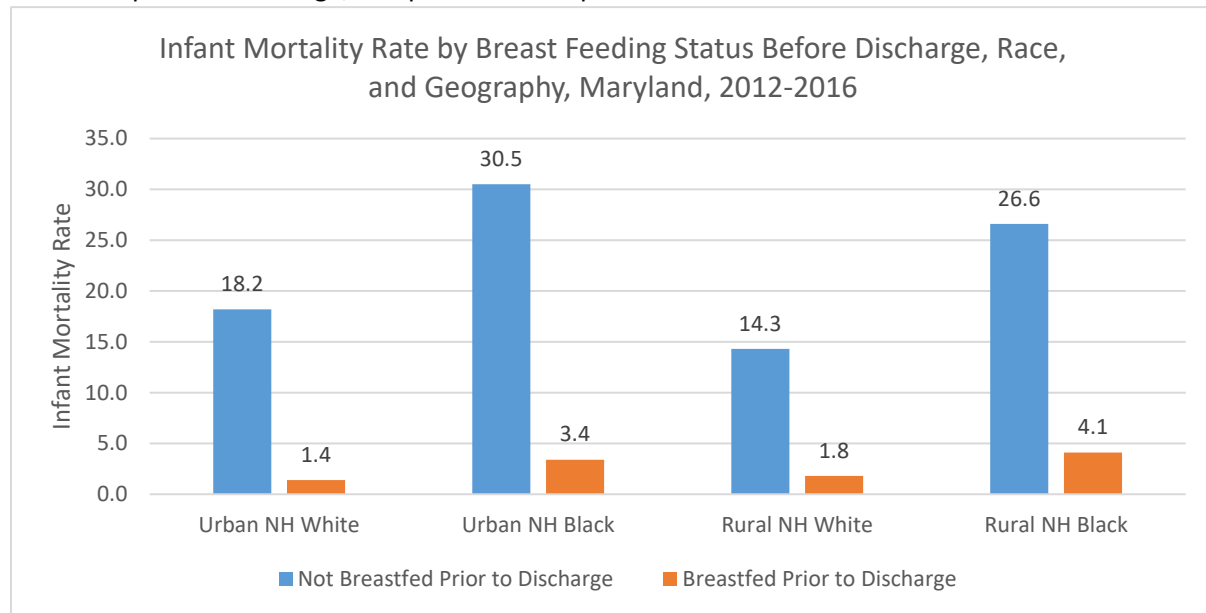
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Breastfeeding

In the women studied in Maryland, breast feeding the infant before leaving the hospital at birth has a tremendous impact on risk of infant mortality for all women. The risk of infant mortality for women who breast feed is at least 85 percent lower than the risk for women how do not breast feed. The infant mortality rates for Black women who do not breast feed are some of the highest in this study (30.5 for urban Black women and 26.6 for rural Black women), while the infant mortality rates for Black women who do breast feed are some of the lowest in the study.

Relative Risk of Infant Mortality, No Breast Feeding v. Breast Feeding, Infant Mortality, Maryland, 2012-2016		
	Rural	Urban
Black Non-Hispanic	0.15	0.11
White Non-Hispanic	0.13	0.08

Among this cohort, 81 percent of Non-Hispanic White mothers breastfed prior to discharge while 73 percent of of non-Hispanic Black mothers breastfed prior to discharge. Among rural mothers 75 percent breastfed prior to discharge, compared with 83 percent of nonrural mothers.

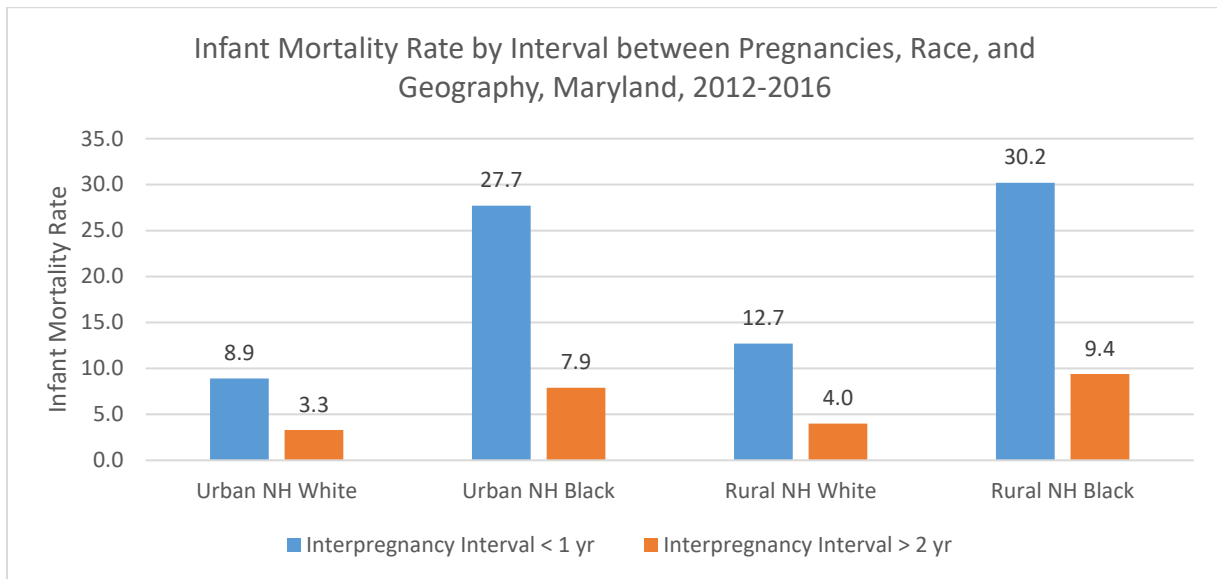


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Inter-pregnancy Interval

Short time between pregnancies (inter-pregnancy interval) was associated with infant mortality for all groups of women, compared to longer intervals between pregnancies. The highest infant mortality rates with inter-pregnancy intervals under 1 year were for black women. The protective effect (relative risk) of longer intervals between pregnancies was relatively similar for all women studied.

Relative Risk of Infant Mortality, Inter-pregnancy Interval <1year v. Inter-pregnancy Interval > 2 years, Infant Mortality, Maryland, 2012-2016		
	Rural	Urban
Black Non-Hispanic	0.31	0.29
White Non-Hispanic	0.31	0.37

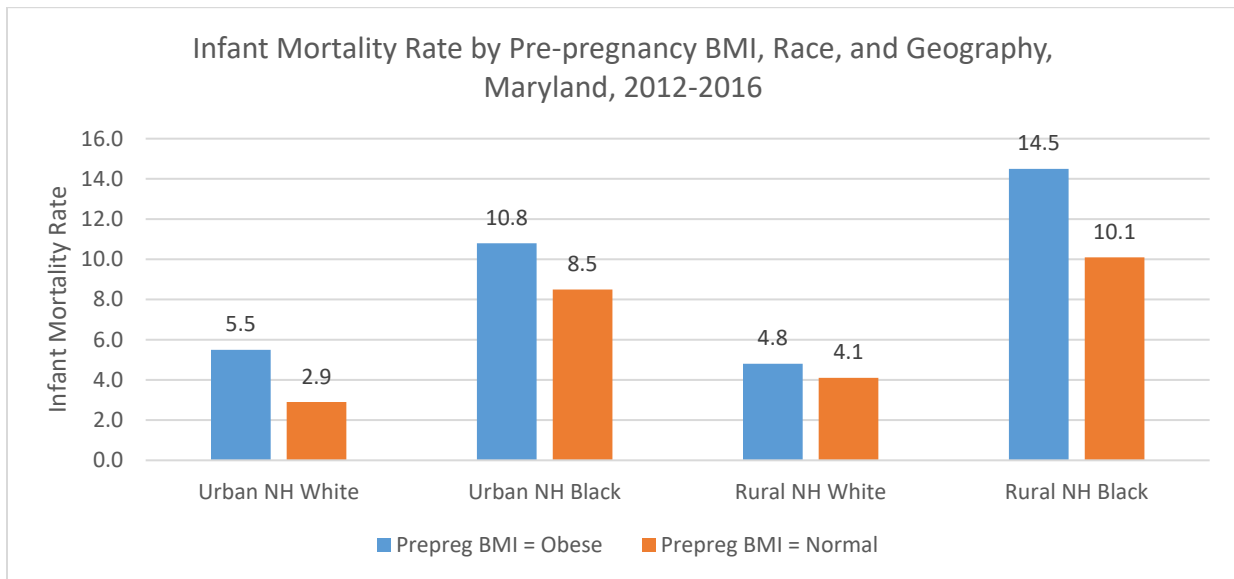


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Pre-pregnancy BMI

Body Mass Index, a measure of weight and height, is a commonly used proxy for health status and health risk. This measure was included in the study due to an interest in the impact on preconception health on outcomes. While obesity does appear to be associated with elevated infant mortality risk, relative to a normal body weight, the impact is relatively small, compared to some other measures included in this study.

Relative Risk of Infant Mortality, Pre-pregnancy BMI=Obese v. Pre-pregnancy BMI=Normal, Infant Mortality, Maryland, 2012-2016		
	Rural	Urban
Black Non-Hispanic	0.70	0.79
White Non-Hispanic	0.85	0.53



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Combined Table of Infant Mortality Rate by Risk Factor, Race, and Geography

Infant Mortality Rate, Maryland, 2012-2016				
	Urban NH White	Urban NH Black	Rural NH White	Rural NH Black
<HS Education	8.1	11.1	8.3	11.7
>= College Degree	2.6	7.9	3.3	7.5
Among Smokers	8.9	14.5	8.0	13.3
Non-Smokers	3.4	9.8	4.0	11.7
Unmarried	6.6	10.8	5.9	14.5
Married	3.1	8.8	3.9	6.9
Medicaid Payment	6.8	11.0	6.7	14.0
Private Insurance Payment	3.1	8.5	3.3	9.1
Late or No PNC	8.3	11.9	9.6	14.4
1st Trimester PNC	2.9	8.4	3.6	10.9
Chronic Hypertension	8.2	14.3	7.7	26.1
No Chronic Hypertension	3.7	9.8	4.5	11.2
Gestational Hypertension	4.7	10.0	5.3	10.5
No Gestational Hypertension	3.8	10.0	4.5	12.0
Gestational Diabetes	2.7	6.1	3.3	6.6
No Gestational Diabetes	3.9	10.3	4.7	12.2
Not Breastfed Prior to Discharge	18.2	30.5	14.3	26.6
Breastfed Prior to Discharge	1.4	3.4	1.8	4.1
Inter-pregnancy Interval < 1 yr.	8.9	27.7	12.7	30.2
Inter-pregnancy Interval > 2 yr.	3.3	7.9	4.0	9.4
Prepreg BMI = Obese	5.5	10.8	4.8	14.5
Prepreg BMI = Normal	2.9	8.5	4.1	10.1

Discussion of findings related to other poor birth outcomes

This study is focused on infant mortality. However, other poor birth outcomes, including low birth weight and preterm birth are important, in part because infants who experience these outcomes are at higher risk for infant mortality and because these infants face other long term health, educational, and economic risks.

In the cohort of 2012-2016 births in Maryland, 1.6 percent of births to rural families and 2.0 percent of births to urban families were very preterm (<32 weeks). 1.3 percent of Non-Hispanic White infants were very preterm and 3.0 percent of Non-Hispanic Black Infants were very preterm.

About 1.8% of infants living in urban areas are born with a very low birthweight (<1500 grams) compared to 1.4% of infants living in rural families. Only about 1.1 percent of Non-Hispanic White Infants are born very low birthweight, compared to 2.9percent of Non-Hispanic Black infants.

Conclusions related to infant mortality

Based on the data above, it appears that developing programs targeted on breastfeeding, inter-pregnancy intervals, and, perhaps, chronic hypertension, have the largest potential to impact outcomes for African American infants and infants in rural communities.

Attachment 1: Factors identified in 2011 Study of Infant Mortality

In 2011, the State conducted a study of Infant Mortality generally (with no focus on specific populations). This study resulted in two reports:

- [2011 Plan for Reducing Infant Mortality in Maryland](#)
- [2011 Maryland Infant Mortality Epidemiology Work Group Findings from Data Analysis and Overall Recommendations](#)

The Epidemiology Work Group Findings focused on 8 priority risk factors for intervention:

- Priority Chronic Conditions Before and During Pregnancy Maryland PRAMS Data
 - Hypertensive disorders during pregnancy (11% prevalence) and chronic hypertension before pregnancy (4% prevalence)
 - Other medical conditions such as gestational diabetes and pre-pregnancy diabetes, heart disease, obesity, and asthma as well as tobacco use, binge drinking, intimate partner violence and depression
- Fertility Treatment Maryland PRAMS Data
- Infant Sleep Position, Co-sleeping, Postpartum Maternal Tobacco Use Maryland PRAMS Data
- Timing And Effectiveness of Prenatal Care Vital Statistics data
- Maternal age
- Prior Pre-term Birth Vital Statistics data
- Birth Hospital Level of Care, if Very Low Birth Weight (VLBW) Vital Statistics data
- Early Term Deliveries (37-38 weeks gestation) Vital Statistics data

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Attachment 2: Factors and Data Elements Identified for Potential Study in 2019

Access to care	Maternal Chronic Disease
Assistance program	Maternal Drug Use
Birthweight	Maternal Mental health
Breastfeeding duration	Maternal Stress
Care process (rural v. Urban)	Nutrition
Community-level factors	Parity
Dental Care	Paternal Acknowledgement
Diabetes developed during pregnancy	Patient experience
Diabetes pre- pregnancy	Plurality
Domestic Violence/Intimate Partner Violence- Maternal	Preconception Health
Elective Early Birth	Prenatal Care
Environmental Exposure	Prior Pre-term Birth
Ethnicity	Service Gaps (rural v. Urban)
Fertility RX	SES factors (Education, Income, Employment, etc.)
Gestational Age at Birth	Smoking during pregnancy
Health services and social services utilization	Social Support
Hospital Level of Care	Structural Racism & Bias
Hypertension developed during pregnancy	Time in hospital (infant)
Hypertension pre-pregnancy	Time in Hospital (Maternal)
Immigrant/US born	Time since last birth
Infant sleep position (not on back)	Transportation Access
Insured Status	Trauma/ACE Score
Intended Pregnancy	
Jurisdiction of Residence	
Justice Involvement / Incarceration Status	
Marital Status	
Maternal Age	