



**Dayton &
Montgomery
County**

Infant Mortality

Periods of Perinatal Risk Analysis 2008 - 2011

Montgomery County, Ohio

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Background

This report was prepared to present the results of the Perinatal Periods of Risk Analysis (PPOR) completed for Montgomery County for 2008 through 2011. All data collected and analyzed in this report were provided by Ohio Public Health Information Warehouse (OPHIW) birth and death certificate data and Ohio's Behavioral Risk Factor Surveillance System (BRFSS) Survey.

Information in this report is intended to be used by Montgomery County's Infant Mortality Coalition and the lead organizations addressing objectives related to the Birth Outcomes priority of the Community Health Improvement Plan to help guide their selections of appropriate evidence-based interventions addressing infant mortality. In addition, this report is available to provide data needed by organizations for grants as well as to university students and the general public with a need for or interest in the infant mortality issue in Montgomery County.

Please note: The data were provided by the Center for Public Health Statistics and Informatics, Ohio Department of Health. The Department specifically disclaims responsibility for any analyses, interpretations, or conclusions.

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Executive Summary

Infant mortality rate is an important index of the overall health of a society and how well the society cares for its women and children. With a rate of 7.4 per 1,000 live births, Ohio had the 6th worst infant mortality rate in the United States in 2013; a rate that has remained the same from 2006 through 2013. In Montgomery County, the infant mortality rate increased 12.5% in one year; moving from 8.0 in 2012 to 9.0 in 2013. With an infant mortality rate of 19.5 among Black residents and 5.3 among White residents in 2013, there is a clear disparity between races within Montgomery County.

The Perinatal Periods of Risk (PPOR) analysis addresses the issue of infant mortality through the use of data analysis and community involvement. The analytical portion of the PPOR consists of two phases. In Phase I, fetal and infant deaths are divided into four groups (or four periods of risk) to identify populations and periods of risk with the largest excess mortality. These four periods are maternal health/prematurity, maternal care, newborn care, and infant health. An external reference group with optimal pregnancy outcomes is used to compare to the community to determine excess deaths and excess death rates. Phase II examines each period of risk to determine causal pathways and risk and/or preventive factors and then estimates the potential impact of addressing these risk and preventive factors. Once data have been analyzed and presented, it is then up to the community stakeholders to use the PPOR data for evidence-based public health planning.

This report provides an outline of the methods used to conduct the analytical portion of the PPOR and presents the results of the PPOR analysis conducted in Montgomery County, Ohio from 2008 to 2011. The greatest percentage of excess deaths within the county as a whole (41%) and among the Blacks (56%) occurred during the Maternal Health/Prematurity period. Birthweight distribution was a more significant causal factor of excess deaths for both groups than birthweight-specific mortality. Premature rupture of membranes was an influential risk factor for very low birth weight births for all births in Montgomery County and for Blacks specifically. The majority of excess deaths for Whites were in the Maternal Care period. When considering risk factors for Maternal Care among Whites, smoking during pregnancy was attributed to the highest percentage of excess fetal deaths and among women 18 to 44 years of age, obesity is an additional risk factor in the Maternal Care period.

Introduction

Infant Mortality

Infant mortality rate is an important index of the overall health of a society and how well that society cares for its women and children. With a rate of 7.4 per 1,000 live births, Ohio had the 6th worst infant mortality rate in the United States in 2013. Although the overall infant mortality rate in Ohio has changed minimally in more than a decade (Figure 1), early 2014 infant mortality data indicates a marked improvement; 6.1 per 1,000 live births.

There is also a profound racial disparity in regards in infant mortality between Whites and Blacks in Ohio. In 2013, the Black infant mortality rate was more than two times higher than the White infant mortality rate; 13.8 compared to 6.0 per 1,000 live births.

The infant mortality rate in Montgomery County did not improve from 1998 to 2013 (Figure 2). In fact, infant mortality in the County reached its highest point in a decade in 2013; 9.0 per 1,000 live births. A clear disparity exists between races within Montgomery County. The infant mortality rate was more than three and half times greater among Black residents than White residents (19.2 vs. 5.3 per 1,000 live births) (Figure 3).

Figure 1

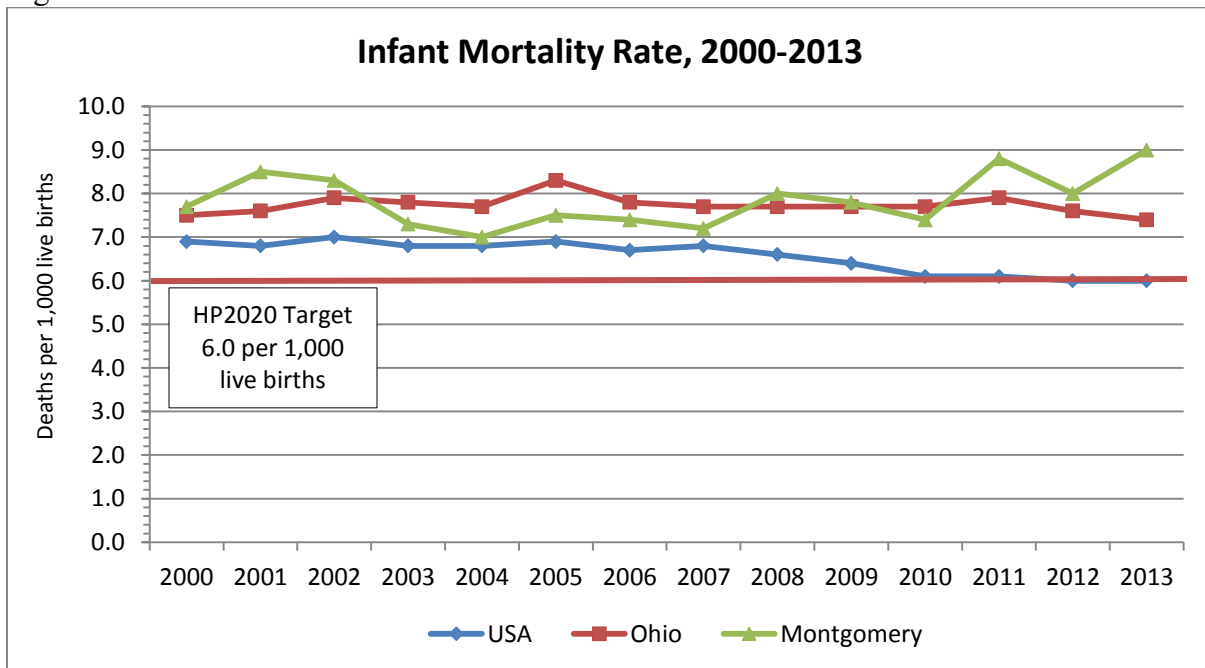


Figure 2

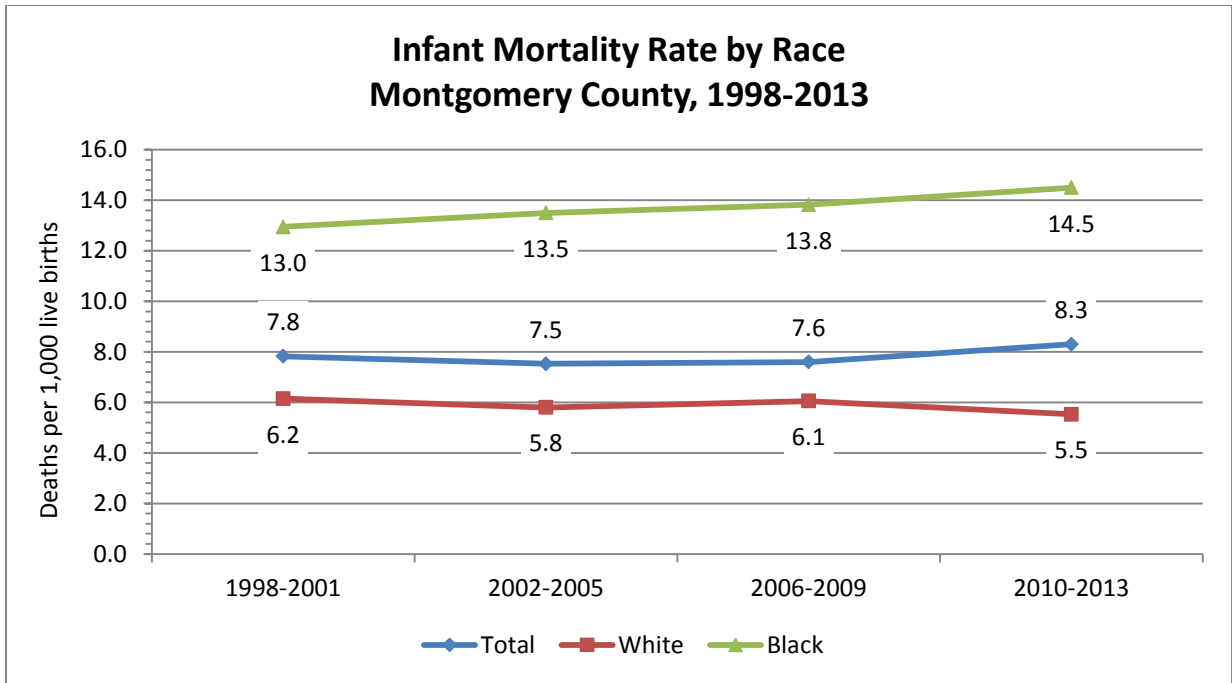
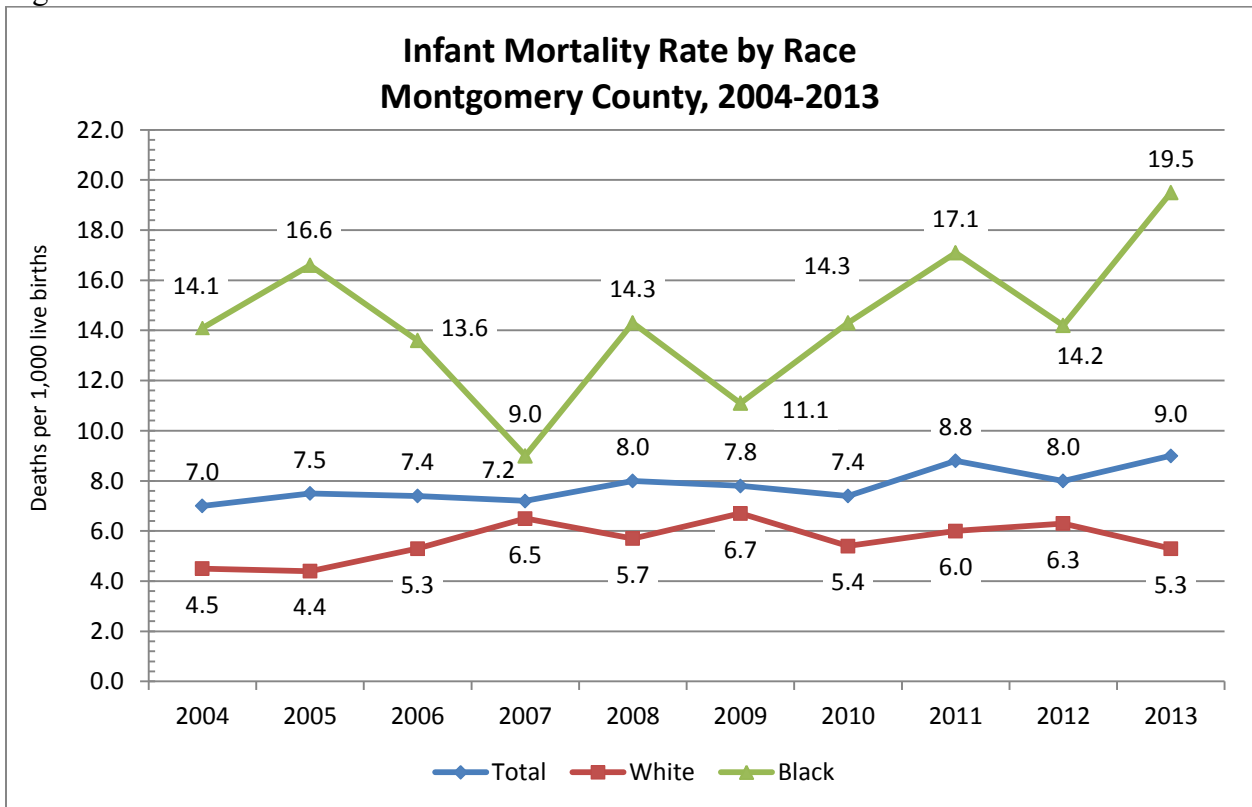


Figure 3



Perinatal Periods of Risk (PPOR)

The Perinatal Periods of Risk (PPOR) analysis addresses the issue of infant mortality through the use of data analysis and community involvement. By using vital records data, the PPOR approach examines infant mortality in a novel way by combining deaths that have a common set of risk factors. Infant mortality in this approach includes both fetal and infant deaths (> 24 weeks) and considers the impact of birthweight and gestational age simultaneously on mortality. With a focus on very low birthweights (VLBW), birthweights less than 1,500 grams; the PPOR approach examines the excess deaths in the community and generates a “map” that assists the community in prioritizing potential prevention efforts. Once data have been analyzed and presented, it is then up to the community stakeholders to use the PPOR data for evidence-based public health planning.

The objectives of this PPOR report are:

1. To present the methods of conducting the analytical portion of the PPOR
2. To communicate the results of Montgomery County’s PPOR analysis
3. To compare the results of the this PPOR analysis to the PPOR analysis completed for the years 2006 to 2009

Conducting a PPOR Analysis

The analytical portion of the PPOR consists of two phases. In Phase I, fetal and infant deaths are divided into four groups (or four periods of risk) to identify populations and periods of risk with the largest excess mortality (Figure 4). Phase II examines each period of risk to determine causal pathways and risk and/or preventive factors and then estimates the potential impact of addressing these risk and preventive factors (Figure 5).

Figure 4: PPOR Periods of Risk

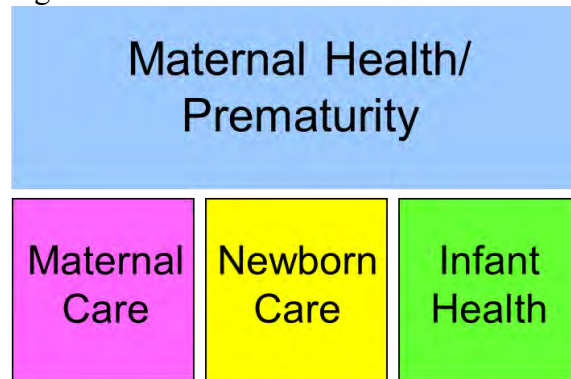
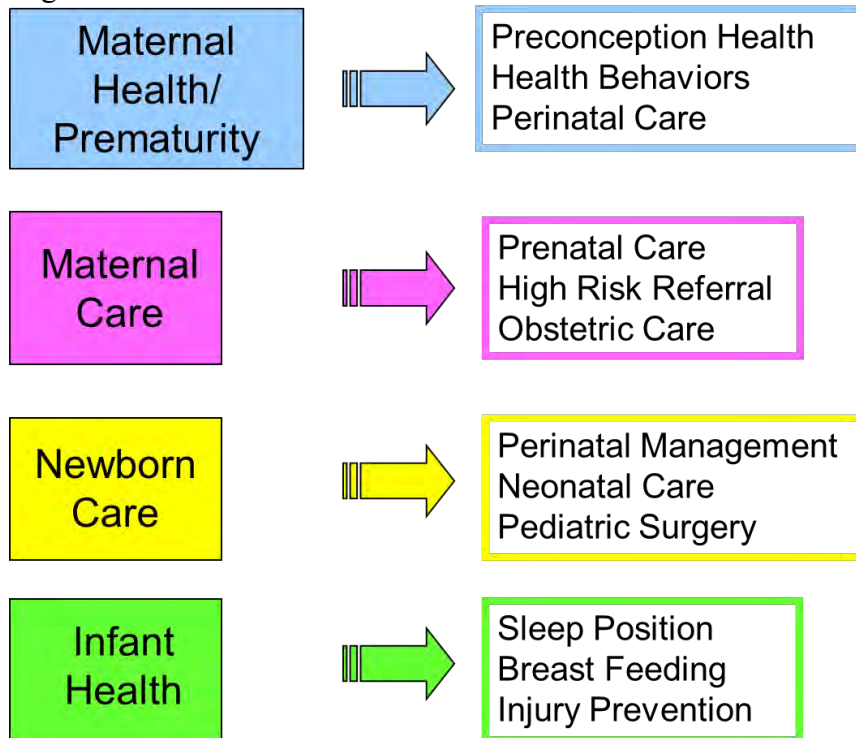


Figure 5: Common Risk Factors and Possible Interventions for each Period



Data

PPOR uses three vital record file types; live births, fetal deaths, and birth-death linked. The study group used for this PPOR report included births and deaths that occurred between 2008 and 2011 in Montgomery County, Ohio.

The criteria for a record's use in the PPOR analysis are:

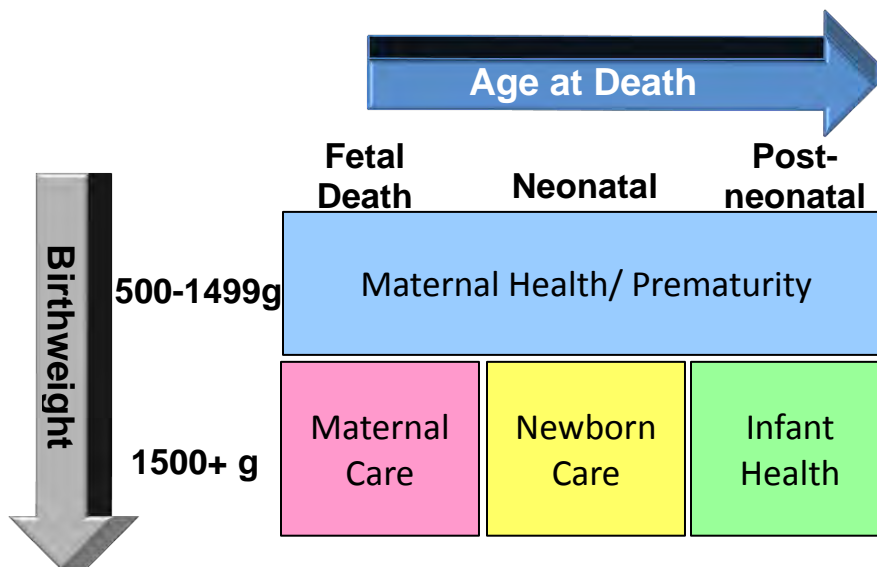
- $\geq 500\text{g}$ birthweight
- ≥ 24 weeks gestation

Steps in Phase I

1. Infant and fetal deaths are separated into their appropriate period of risk (Figure 6).
 - Maternal Health/Prematurity – all fetal and infant VLBW deaths (500g to 1499g)
 - Maternal Care – fetal deaths $\geq 1500\text{g}$
 - Newborn Care – infant deaths 0 – 27 days (Neonatal) and $\geq 1500\text{g}$
 - Infant Health – infant deaths 28 – 364 days (Post-neonatal) and $\geq 1500\text{g}$

This is accomplished for the population as a whole, but by analyzing subpopulations as well, disparities within the population may become apparent. This PPOR report compared deaths within the Black and White populations of Montgomery County.

Figure 6: PPOR Map



2. Fetal-Infant Mortality Rate (FIMR) is calculated for each period and for the overall group.

$$\text{FIMR} = \text{Deaths in the Period} / (\text{Live Births} + \text{Fetal Deaths}) \times 1000$$

3. A reference group is selected for comparison with the study group. The assumption is that if one population group can achieve low infant mortality, another group can also reach that goal. The reference group should have better or optimal pregnancy outcomes.

The criteria for the external reference chosen for this PPOR analysis were:

- Ohio Resident
- Non-Hispanic, White
- 13 or more years of education
- 20 or more years of age

4. The excess mortality rates are calculated for each period of risk by subtracting the FIMR of the reference population from the FIMR of the study population. This is also completed for the selected subpopulations.

5. The excess number of deaths for each period can be calculated using the FIMR.

$$\text{Excess Deaths} = \text{FIMR} \times (\text{Live Births} + \text{Fetal Deaths}) / 1000$$

Steps in Phase II

1. Identify the causal pathways or biologic mechanisms for excess mortality.
2. Estimate the prevalence of risk and preventative factors by type of mechanism.
3. Estimate the impact of the risk and preventative factors.
(Step 3 was not completed at this time for Montgomery County)

Maternal Health/Prematurity

Step 1 of Phase II for the Maternal Health/Prematurity period is completed by performing a Kitagawa analysis. The Kitagawa analysis:

- Considers every live birth, infant death, and fetal death (24+ weeks) in the target and reference population by birthweight groups
- Attributes excess mortality to either birthweight distribution (VLBW) or birthweight-specific mortality

In **Step 2**, the percentage of all VLBW babies born to women with medical conditions and/or identified lifestyle factors that are known to contribute to the birth of babies born <1500g is collected from all live births.

Risk factors considered in this analysis included:

- Trimester of first prenatal care visit
- Body Mass Index (BMI)
- Sexually Transmitted Diseases (STDs)
- < 18 months spacing between pregnancies
- Premature rupture of membranes
- Diabetes (pre-pregnancy or gestational)
- Hypertension (pre-pregnancy or gestational)
- Eclampsia
- Delivery by c-section
- Smoking
- Previous preterm birth
- Plurality

Maternal Care

Due to incomplete and missing information in fetal death records, it is difficult to determine a causal pathway for fetal deaths. **Step 1** is skipped for this period of risk.

To determine risk factors (**Step 2**) associated with fetal deaths, medical conditions and lifestyle factors are gathered from fetal death records and the Behavioral Risk Factor Surveillance System (BRFSS) Survey. The prevalence of these risk factors represented all females age 18-44 in Montgomery County.

Risk factors from the fetal death records considered in this analysis included:

- Hypertension (pre-pregnancy and gestational)
- Eclampsia
- Diabetes
- Smoking during pregnancy
- STDs/Herpes
- RH disease
- Plurality
- Previous live births that died
- Trimester of first prenatal care visit

Risk factors considered in this analysis from the BRFSS included:

- General Health (Excellent/Very Good/Good or Fair/Poor)
- Health care coverage
- Last dental visit
- Smoking
- Heavy drinking
- BMI (Underweight, Normal, Overweight, or Obese)

Infant Health

Identifying the causal pathway (**Step 1**) in the Infant Health period involves identifying the underlying cause of death from the death files.

The causes of death are grouped into the following categories:

- Perinatal conditions
- Congenital anomalies
- Infections
- Injury/External Causes
- SIDS/Suffocation (sleep-related)
- Ill-defined
- Other

Step 2 was not completed for Montgomery County. Identifying risk factors associated with infant deaths requires more details surrounding the circumstances of each death.

Results of Montgomery County's PPOR Analysis (2008-2011)

Phase I

Table 1: Fetal and Infant Death and Live Birth Counts, Montgomery County 2008-2011

	All Races	White	Black	Reference
Fetal Deaths	125	68	49	576
Infant Deaths	151	87	59	909
Feto-Infant Deaths	276	155	108	1,485
Live Births	27,477	18,877	7,412	248,926

Figure 7: Feto-Infant Deaths Map; Montgomery County, All Races 2008-2011

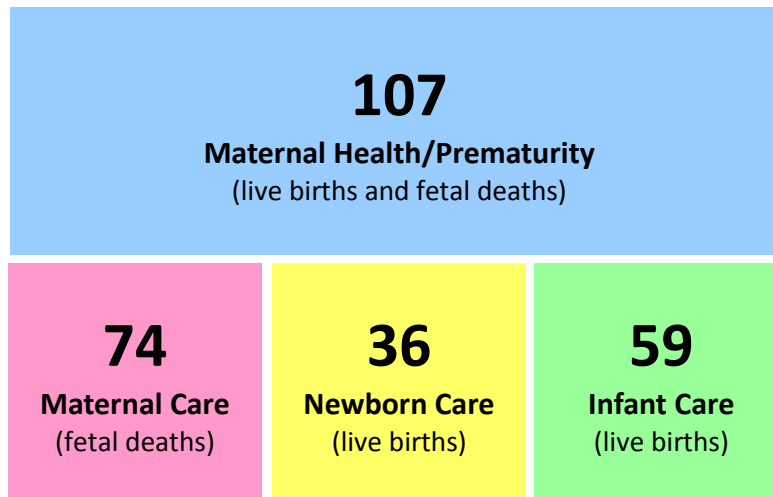
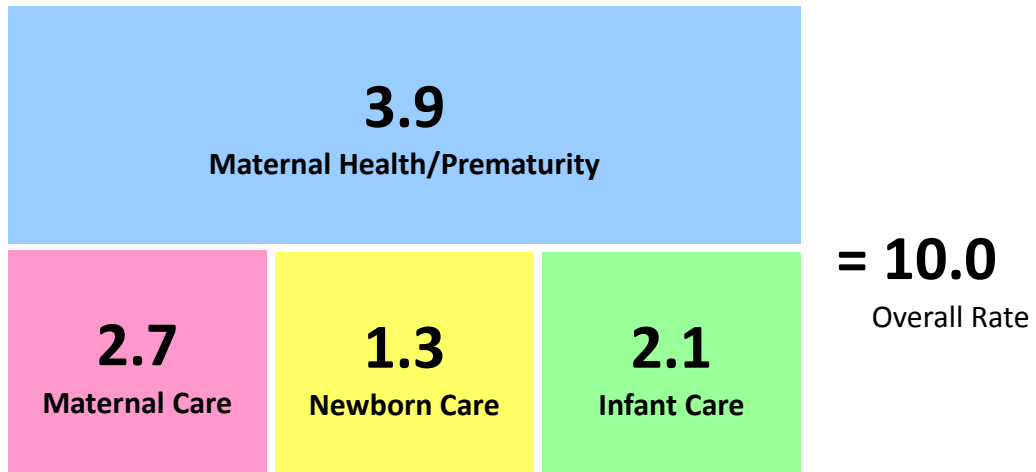


Figure 8: Feto-Infant Mortality Rates, All Races; Montgomery County, 2008-2011



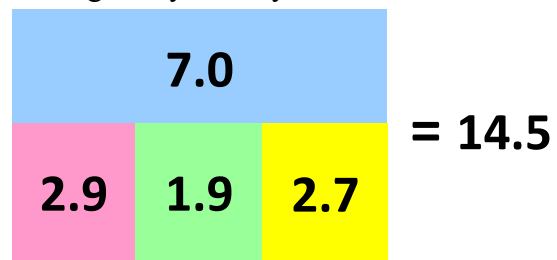
Conclusion:

- In Montgomery County, the period with the highest feto-infant mortality rate for all races was Maternal Health/Prematurity (3.9 per 1,000 live births and fetal deaths).

Figure 9: Feto-Infant Mortality Rates, White Montgomery County, 2008-2011



Figure 10: Feto-Infant Mortality Rates, Black Montgomery County, 2008-2011



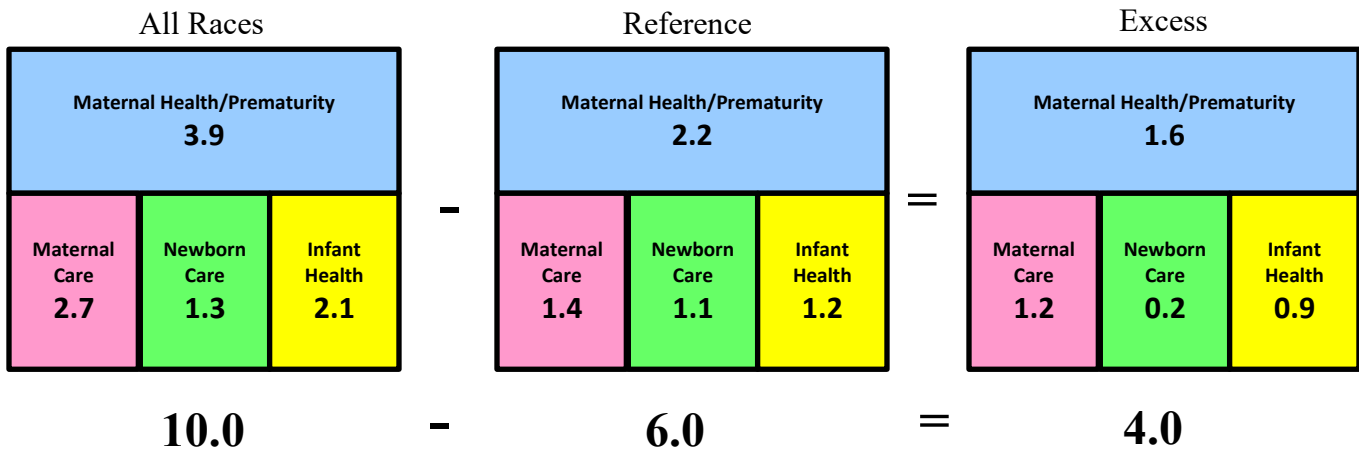
Conclusion:

- The highest feto-infant mortality rate among both White and Black residents was in the Maternal Health/Prematurity period, 2.6 and 7.0 per 1,000 live births and fetal deaths, respectively.

Table 2: Feto-Infant Mortality Rates; Montgomery County, 2008-2011

Group	Maternal Health/Prematurity	Maternal Care	Newborn Care	Infant Health	Feto-Infant Mortality
All Races	3.9	2.7	1.3	2.1	10.0
White	2.6	2.5	1.1	2.0	8.2
Black	7.0	2.9	1.9	2.7	14.5
External Reference (Ohio)	2.2	1.4	1.1	1.2	6.0

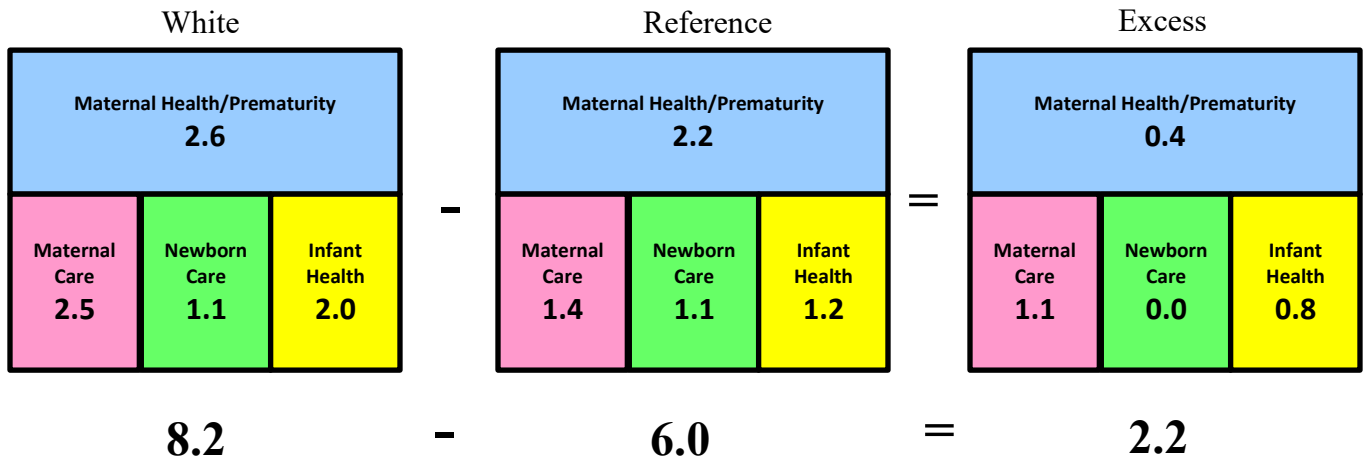
Figure 11: Excess Feto-Infant Mortality, All Races; Montgomery County, 2008-2011



Conclusion:

- Among all races, the Maternal Health/Prematurity period (1.6 per 1,000 live births and fetal deaths) was associated with the greatest excess feto-infant mortality.

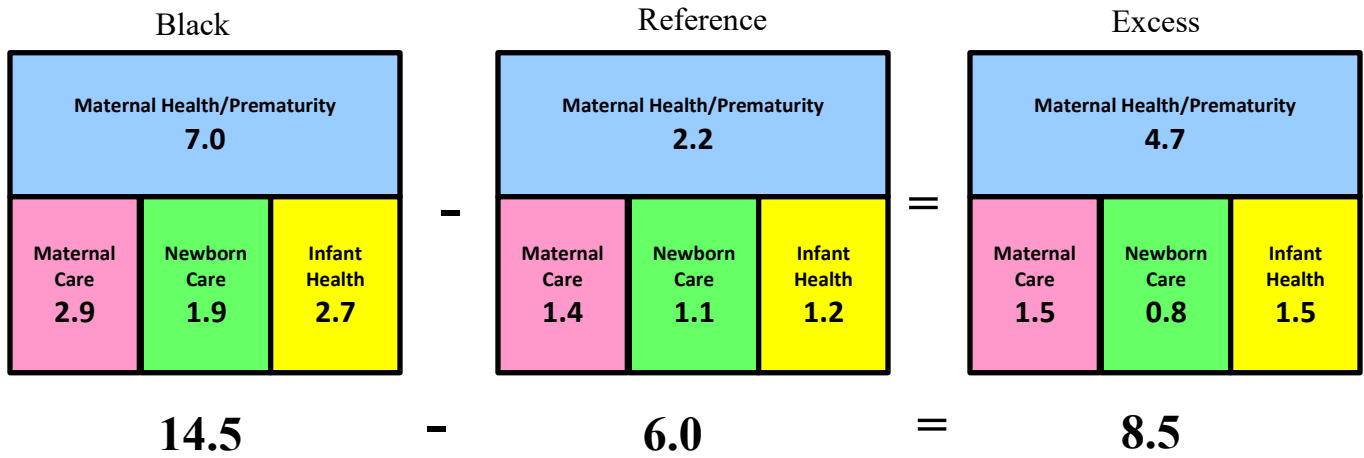
Figure 12: Excess Feto-Infant Mortality, White; Montgomery County, 2008-2011



Conclusion:

- The greatest excess feto-infant mortality for Whites was in the Maternal Care period (1.1 per 1,000 live births and fetal deaths).

Figure 13: Excess Feto-Infant Mortality, Black; Montgomery County, 2008-2011



Conclusion:

- The greatest excess feto-infant mortality among Blacks was in the Maternal Health/Prematurity period (4.7 per 1,000 live births and fetal deaths).

Table 3: Excess Feto-Infant Mortality, Montgomery County, 2008-2011

Group	Maternal Health/ Prematurity	Maternal Care	Newborn Care	Infant Health	Feto-Infant Mortality
All Races	<u>1.6</u>	1.2	0.2	0.9	4.0
White	0.4	<u>1.1</u>	0.0	0.8	2.2
Black	<u>4.7</u>	1.5	0.8	1.5	8.5

Table 4: Excess Number of Deaths, Montgomery County, 2008-2011

Group	Maternal Health/ Prematurity	Maternal Care	Newborn Care	Infant Health	Feto-Infant Mortality
All Races	<u>46</u>	35	6	26	112
White	7	<u>21</u>	-1	15	42
Black	<u>35</u>	11	6	11	64

Figure 14

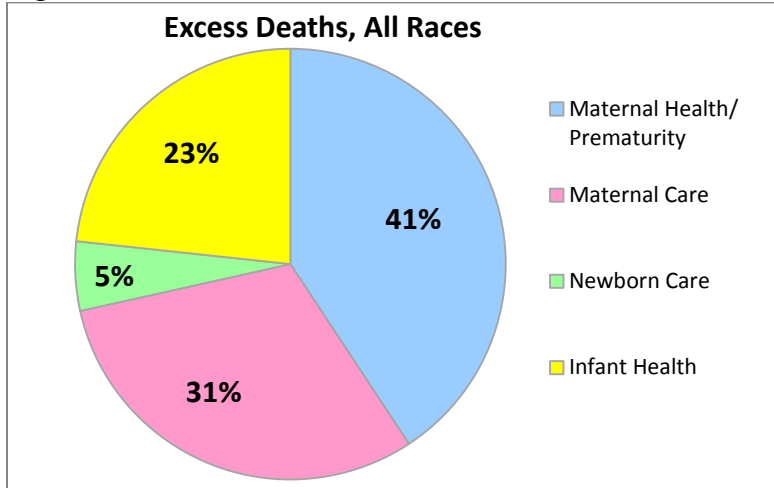


Figure 15

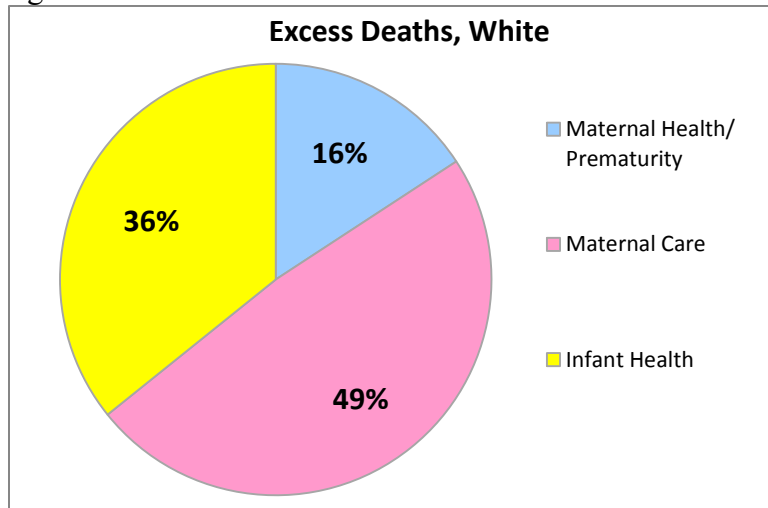


Figure 16

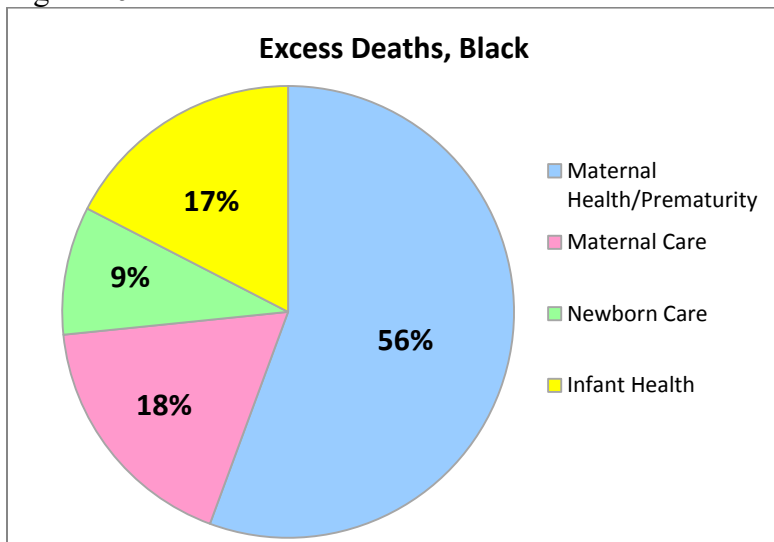


Table 5: Change in Excess Feto-Infant Mortality Rates from 2006-2009 to 2008-2011

	PPOR Report		Change
	2006-2009	2008-2011	
ALL RACES			
Maternal Health/Prematurity	1.1	1.6	↑
Maternal Care	1.1	1.2	↑
Newborn Care	0.0	0.2	—
Infant Health	1.3	0.9	↓
FIMR	3.5	4.0	↑
WHITE			
Maternal Health/Prematurity	0.1	0.4	↑
Maternal Care	1.3	1.1	↓
Newborn Care	0.0	0.0	—
Infant Health	1.4	0.8	↓
FIMR	2.7	2.2	↓
BLACK			
Maternal Health/Prematurity	3.5	4.7	↑
Maternal Care	1.0	1.5	↑
Newborn Care	0	0.8	—
Infant Health	1.3	1.5	↑
FIMR	5.8	8.5	↑

↑ indicates the period with the greatest percent increase

↓ indicates the period with the greatest percent decrease

Conclusion:

- Overall, excess feto-infant mortality rates increased in all races and Blacks.
- The greatest percent increase for all races and Whites occurred in Maternal Health/Prematurity period.
- The greatest percent increase for Blacks occurred in the Maternal Care period.
- The greatest percent decrease for all races and Whites occurred in Infant Health period.
- Among Blacks, excess feto-infant mortality rates increased in all periods of perinatal risk.

Summary of Phase 1

All Races

- Greatest percent of excess deaths - Maternal Health/Prematurity
- 2006-2009 PPOR - Infant Health

White

- Greatest percent of excess of deaths - Maternal Care
- 2006-2009 PPOR - Infant Health

Black

- Greatest percent of excess deaths - Maternal Health/Prematurity
- 2006-2009 PPOR - Maternal Health/Prematurity

Phase II

Maternal Health/Prematurity (MH/P)

Step 1 Causal Pathway (Kitagawa analysis)

Figure 17: Relationship between Birthweight Distribution and Birthweight-Specific Mortality for Maternal Health/Prematurity Excess Rates, All Races; Montgomery County, 2008-2011

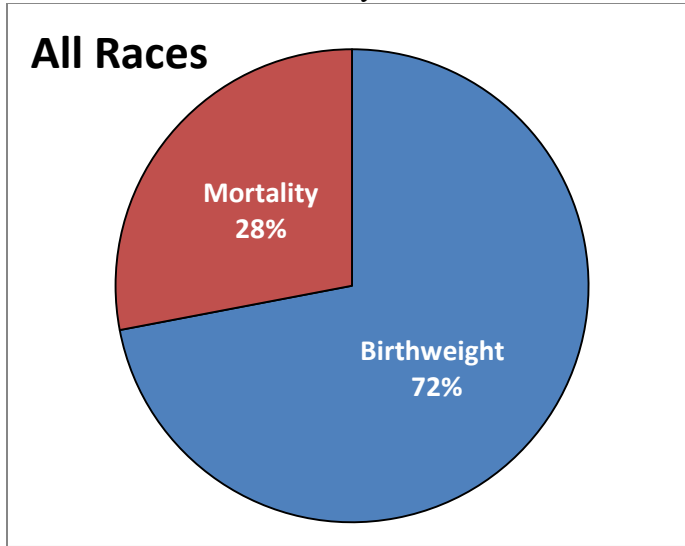


Figure 18: Relationship between Birthweight Distribution and Birthweight-Specific Mortality for Maternal Health/Prematurity Excess Rates, White; Montgomery County, 2008-2011

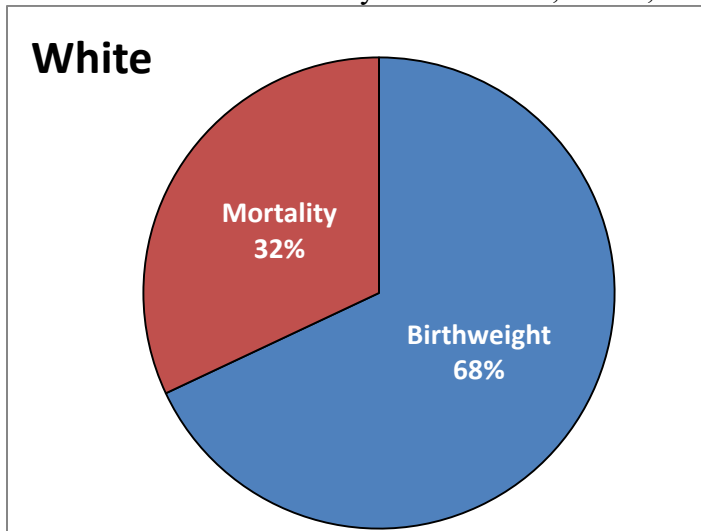
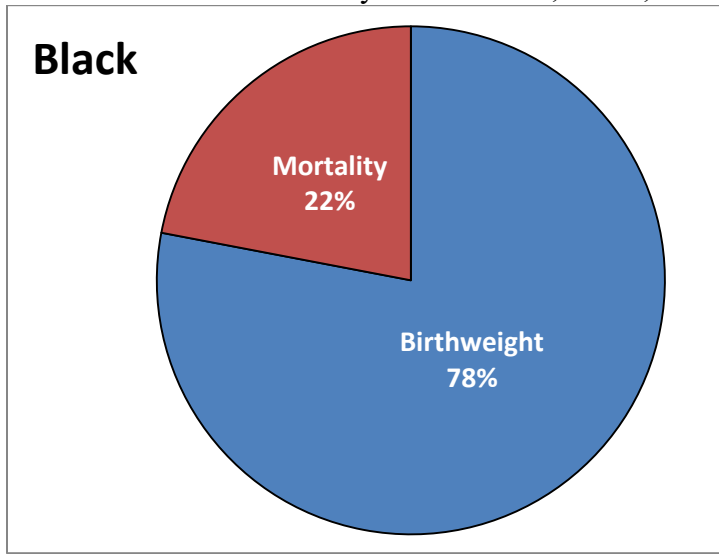


Figure 19: Relationship between Birthweight Distribution and Birthweight-Specific Mortality for Maternal Health/Prematurity Excess Rates, Black; Montgomery County, 2008-2011



Conclusion:

- In the category of Maternal Health/Prematurity, excess rates due to birthweight were greatest among Blacks (78%).

Maternal Health/Prematurity

Step 2 – Risk Factors (Live Births Records)

Table 6: Percent Excess, VLBW Births with Risk Factors; Montgomery County, 2008-2011

Risk Factor	All Races	White	Black
No prenatal care	5.4%	4.3%	6.8%
Premature rupture of membranes	5.4%	1.5%	11.8%
Plurality	2.0%	0.0%	6.2%
Previous preterm birth	1.3%	-0.8%	3.3%
Eclampsia	0.3%	1.3%	-2.3%
Hypertension pre-pregnancy	-0.5%	-2.7%	3.2%

Conclusion:

- The risk factors with the highest percent excess for VLBW births for all races were premature rupture of membranes (5.4%) and receiving no prenatal care (5.4%).
- For Whites, the highest percent excess was associated with receiving no prenatal care (4.3%).
- Premature rupture of membranes (11.8%) accounted for the highest percent excess for Black VLBW births.

Table 7: Change in Percent, Excess Maternal Health/Prematurity Risk Factors from 2006-2009 to 2008-2011

	PPOR Report		Change
	2006-2009	2008-2011	
ALL RACES			
No prenatal care	3.0%	5.4%	↑
Premature rupture of membranes	3.7%	5.4%	↑
Plurality	0.7%	2.0%	↑
Previous preterm birth	0.9%	1.3%	↑
Eclampsia	1.7%	0.3%	↓
Hypertension pre-pregnancy	-0.2%	-0.5%	↑
WHITE			
No prenatal care	2.8%	4.3%	↑
Premature rupture of membranes	0.1%	1.5%	↑
Plurality	-1.3%	0.0%	↓
Previous preterm birth	-1.1%	-0.8%	↓
Eclampsia	1.3%	1.3%	—
Hypertension pre-pregnancy	-1.1%	-2.7%	↑
BLACK			
No prenatal care	3.4%	6.8%	↑
Premature rupture of membranes	8.6%	11.8%	↑
Plurality	5.6%	6.2%	↑
Previous preterm birth	3.5%	3.3%	↓
Eclampsia	2.1%	-2.3%	↓
Hypertension pre-pregnancy	1.4%	3.2%	↑

↑ indicates the risk factor with the greatest percent increase

↓ indicates the risk factor with the greatest percent decrease

Conclusion:

- The risk factor with the greatest percent increase differs for each race category; White - premature rupture of membranes, Black - pre-pregnancy hypertension, and all races - plurality.
- The percent decrease was greatest for eclampsia for all races and Blacks.
- Among Whites, plurality is the risk factor with the greatest percent decrease.

Figure 20

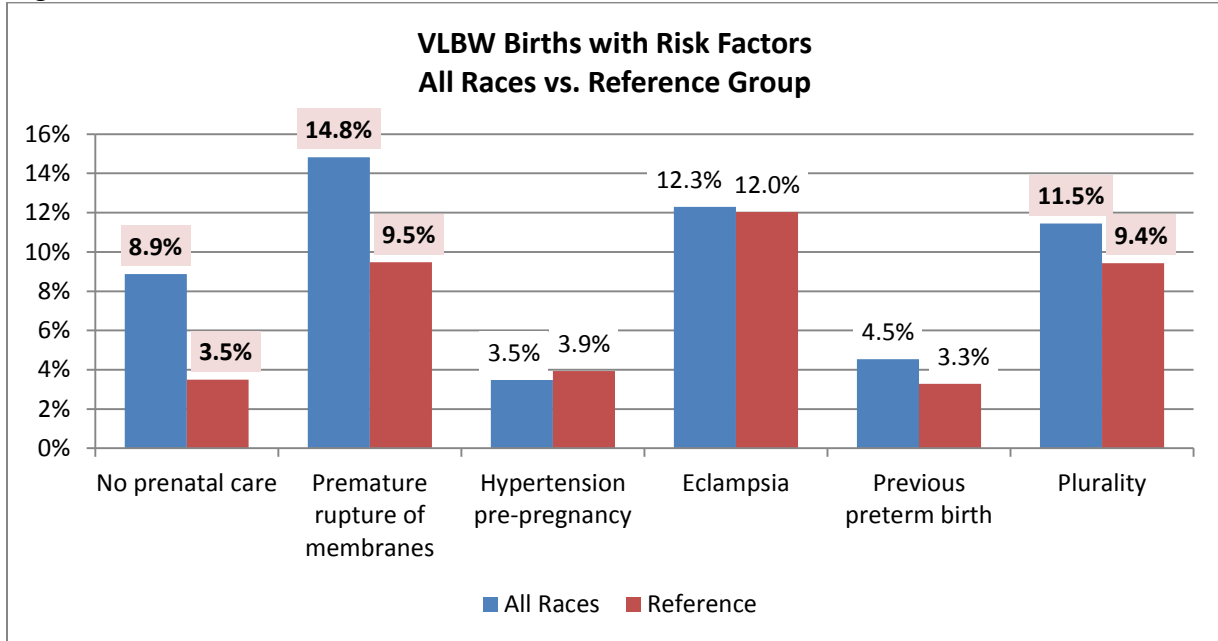


Figure 21

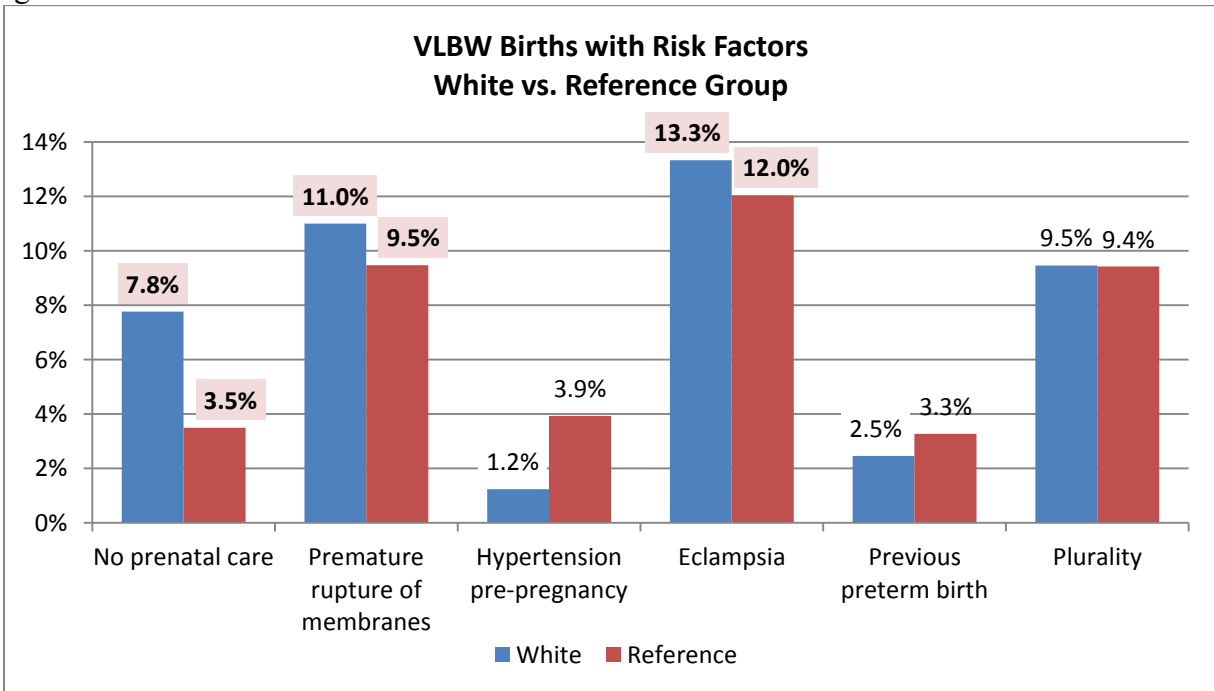
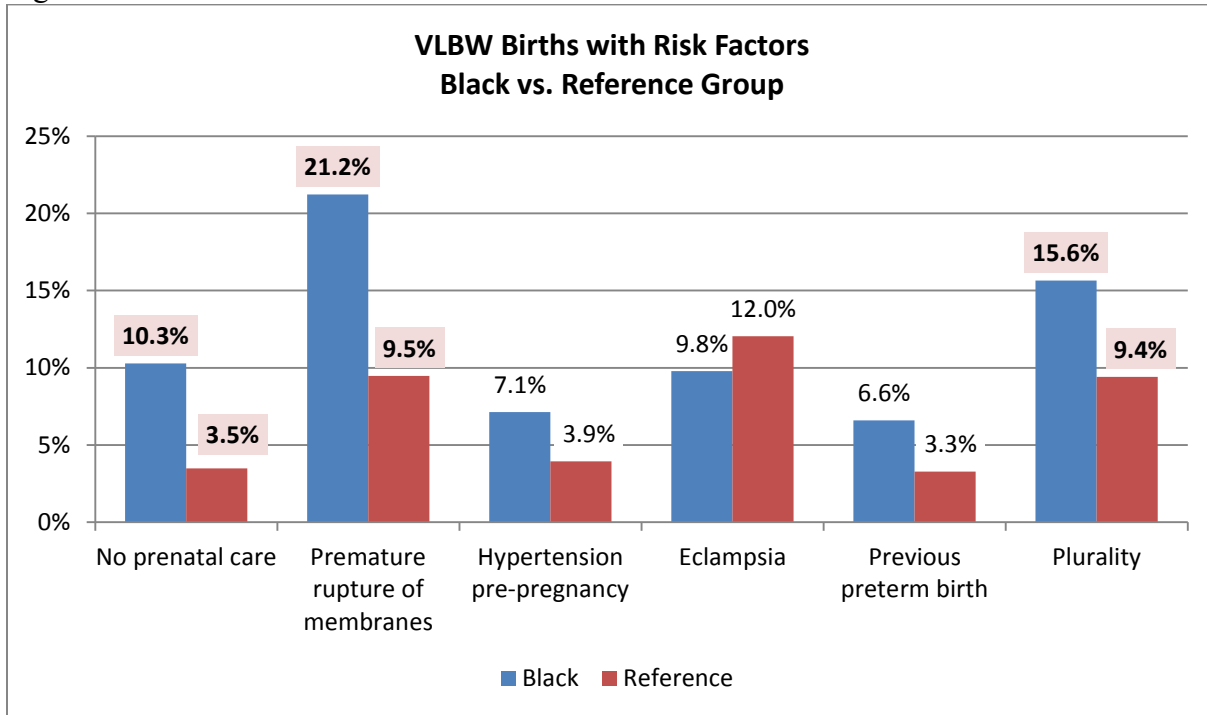


Figure 22



Maternal Care

Step 1 – Casual Pathway

Due to missing and/or incomplete information for fetal death records, Step 1 is skipped for the Maternal Care period.

Step 2 –Risk Factors (Fetal Death Records and BRFSS)

Table 8: Percent Excess, Fetal Deaths with Risk Factors¹; Montgomery County, 2008-2010²

Risk Factors	All Races	White
Smoking during pregnancy	19.8%	20.1%
No prenatal care in the 1 st trimester	14.1%	6.2%
Diabetes (pre-pregnancy and gestational)	6.4%	8.0%

¹Due to small numbers, Black fetal deaths were not included in this analysis.

²Due to a change in the type of data collected beginning in year 2011, fetal death records from 2008 to 2010 were used to ensure consistency of the variables analyzed.

Conclusion:

- Among all fetal deaths in Montgomery County and among Whites specifically, smoking during pregnancy was associated with the greatest percent of excess fetal deaths; 19.8% and 20.1% respectively.

Figure 23

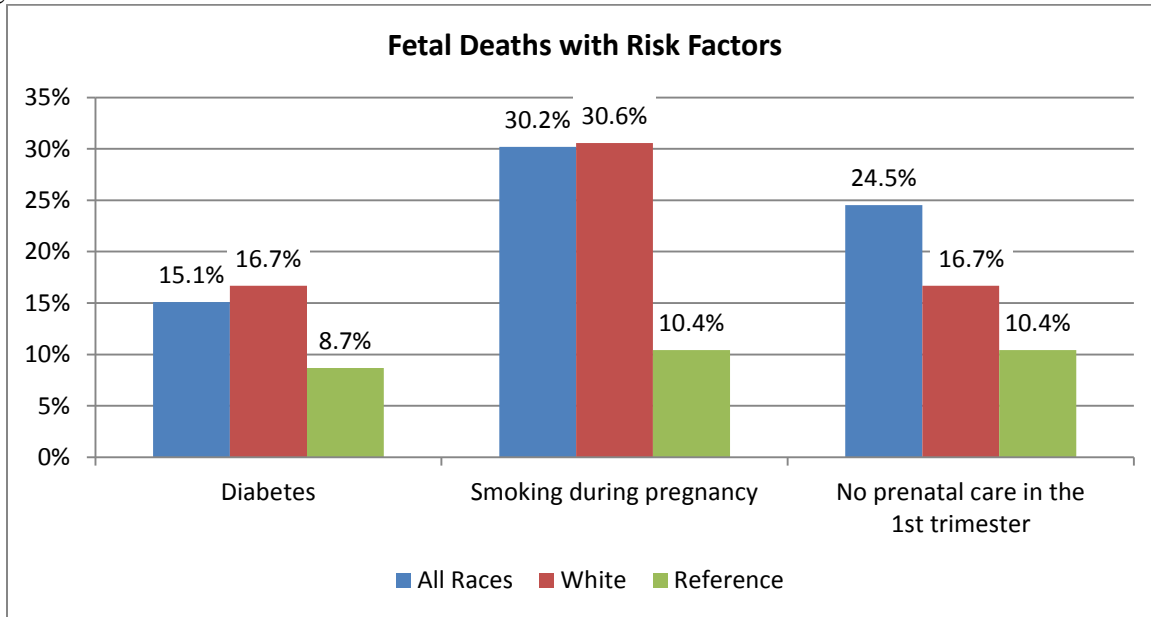


Table 9: Change in Percent Excess Maternal Care Risk Factors (Fetal Deaths) from 2006-2009 to 2008-2011

	PPOR Report		Change
	2006-2009	2008-2011	
ALL RACES			
Smoking during pregnancy	9.2%	19.8%	↑
No prenatal care in the 1 st trimester	17.3%	14.1%	↓
Diabetes (pre-pregnancy and gestational)	9.2%	6.4%	↓
WHITE			
Smoking during pregnancy	10.9%	20.1%	↑
No prenatal care in the 1 st trimester	12.1%	6.2%	↓
Diabetes (pre-pregnancy and gestational)	10.9%	8.0%	↓

↑ indicates the risk factor with the greatest percent increase

↓ indicates the risk factor with the greatest percent decrease

Conclusion:

- The only risk factor with an increase in percent excess for all races and Whites was smoking during pregnancy.
- The risk factor with greatest percent decrease for all races was diabetes (pre-pregnancy and gestational).
- Having no prenatal care in the first trimester accounted for the greatest percent decrease among Whites.

Table 10: Percent Excess, BRFSS Respondents* with Risk Factors, Montgomery County, 2011-2012

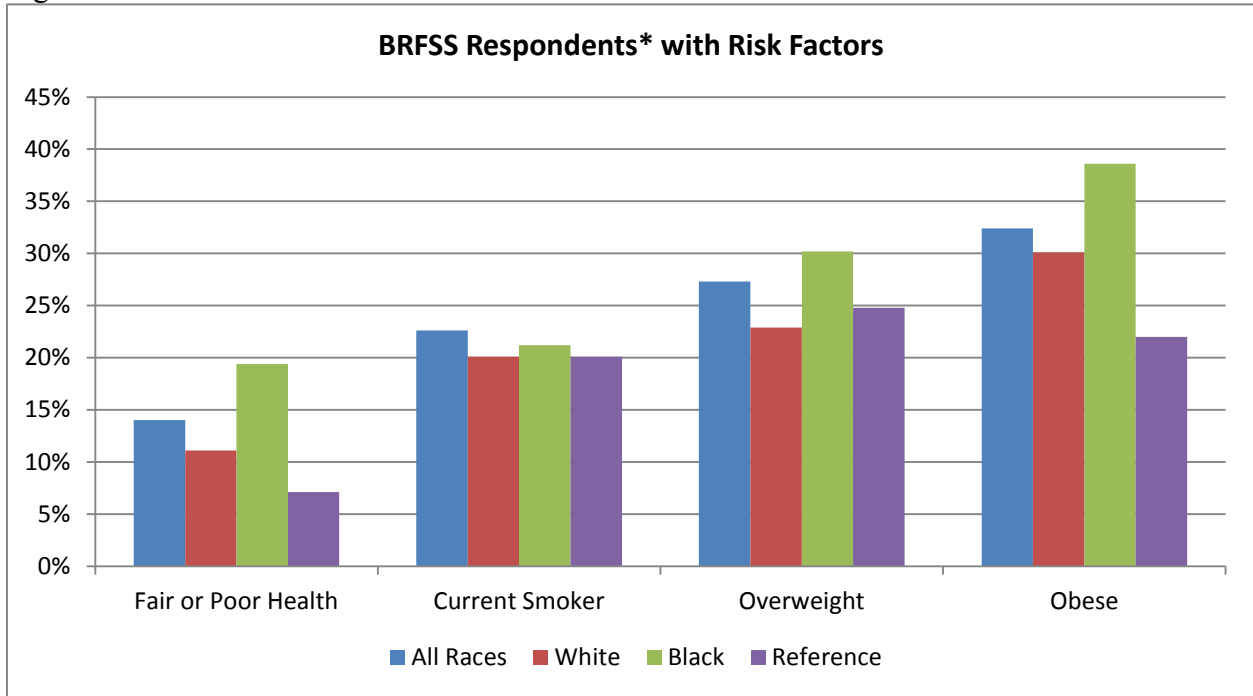
Risk Factors	All Races	White	Black
General Health - Fair or Poor	6.9%	4.0%	12.3%
Current Smoker	2.5%	0.0%	1.1%
Overweight	2.5%	-1.9%	5.4%
Obese	12.9%	10.4%	8.1%

* Females, age 18-44

Conclusion:

- The risk factor that accounted for the greatest percent excess among 18-44 year old females in Montgomery County and among Whites specifically was obesity (12.9% and 10.4%, respectfully).
- Among Black female residents, fair or poor health (12.3%) accounted for the highest percent excess.

Figure 24



* Females, age 18-44

Infant Health

Step 1 – Causal Pathways

Table 11: Excess Cause-Specific Mortality Rates, Montgomery County, 2008-2011

Cause of Death	All Races	White	Black
Perinatal Conditions	0.0	0.0	0.0
Congenital Anomalies	0.2	0.2	0.3
Infections	0.0	0.1	0.0
Injury/External Causes	0.2	0.1	0.1
SIDS/Suffocation (sleep-related)	0.3	0.3	0.7
Ill-defined	0.4	0.3	0.6
Other	-0.1	-0.1	-0.1
Total Deaths	1.0	0.8	1.6

Conclusion:

- SIDS/Suffocation (sleep-related) death accounted for the greatest percent of Black and White excess infant causes of death.

Figure 25

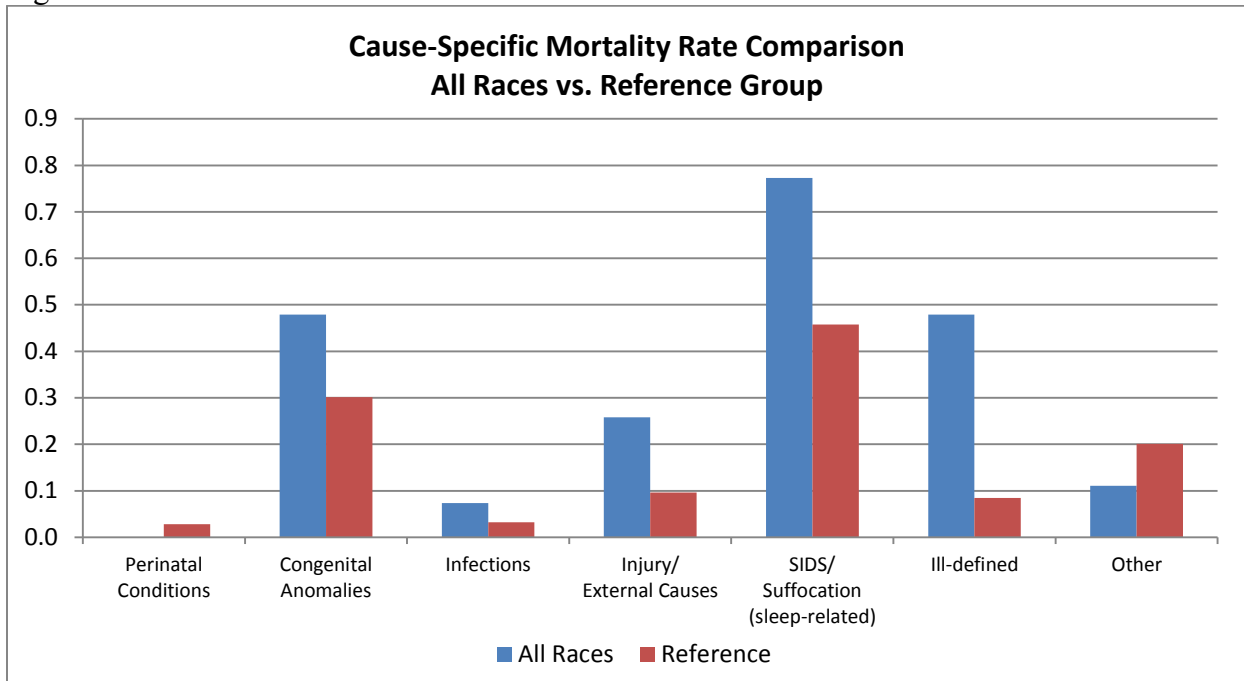


Figure 26

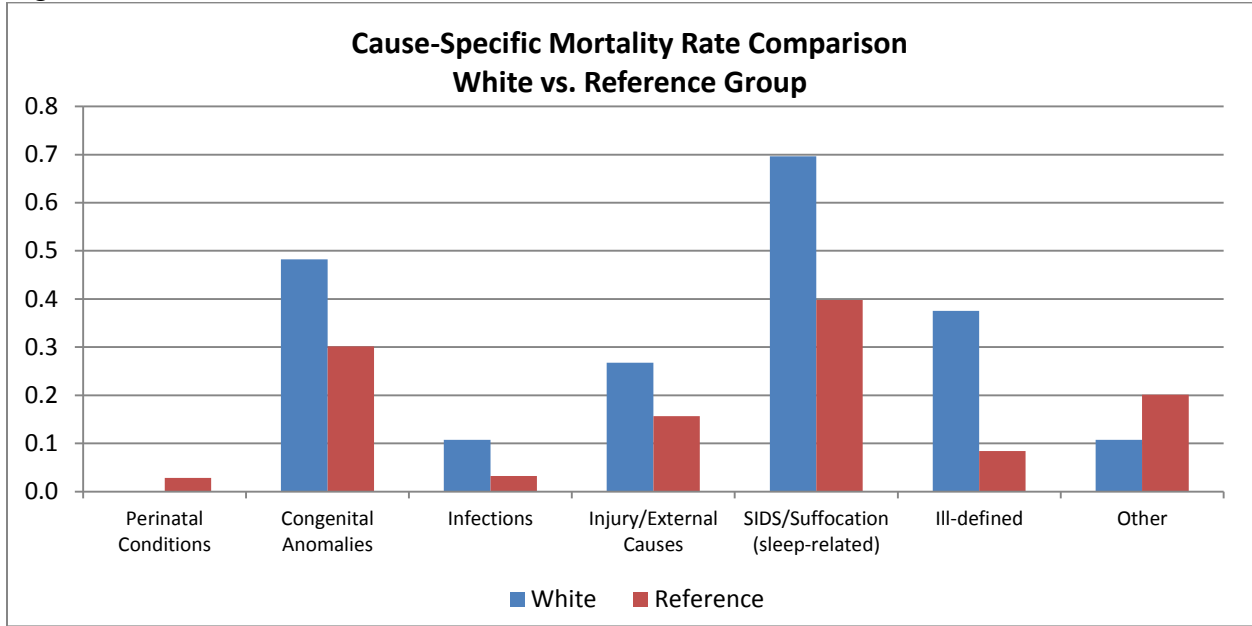


Figure 27

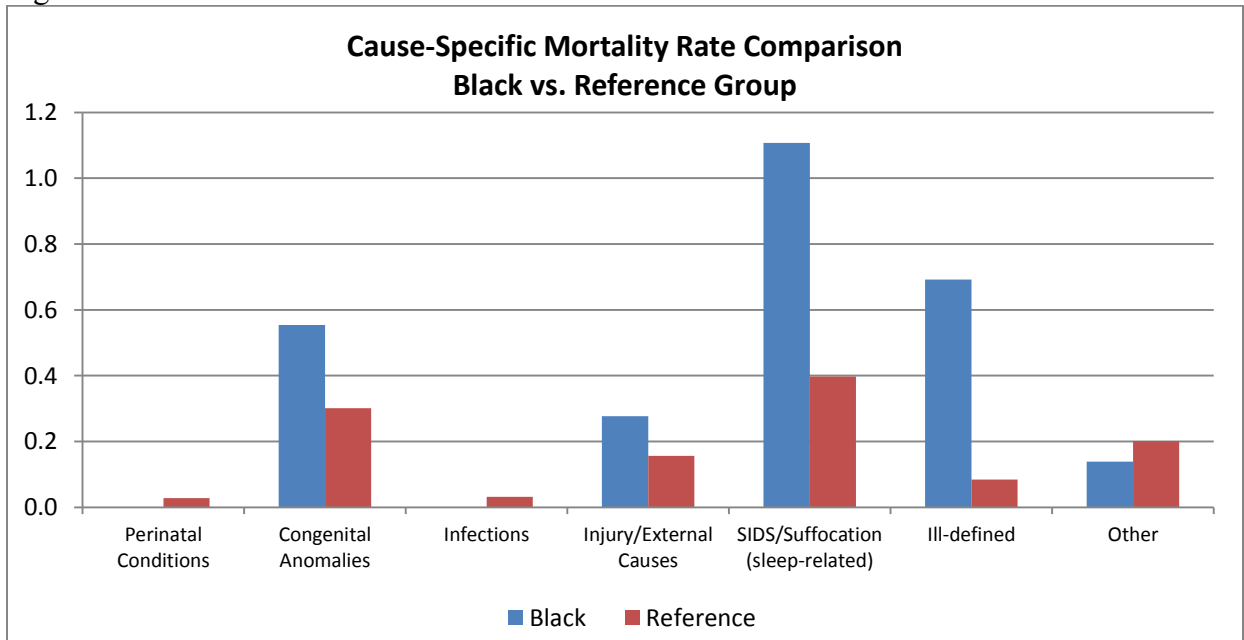


Table 12: Change in Percent Excess Infant Health Causal Factors from 2006-2009 to 2008-2011

	PPOR Report		Change
	2006-2008	2009-2011	
ALL RACES			
Perinatal Conditions	0.0	0.0	—
Congenital Anomalies	0.2	0.2	—
Infections	0.0	0.0	—
Injury/External Causes	0.1	0.2	↑
SIDS/Suffocation (sleep-related)	0.7	0.3	↓
Ill-defined	0.3	0.4	↑
Other	0.1	-0.1	↓
Total Deaths	1.4	1.0	↓
WHITE			
Perinatal Conditions	0.0	0.0	—
Congenital Anomalies	0.2	0.2	—
Infections	0.0	0.1	—
Injury/External Causes	0.2	0.1	↓
SIDS/Suffocation (sleep-related)	0.7	0.3	↓
Ill-defined	0.3	0.3	—
Other	0.1	-0.1	↓
Total Deaths	1.4	0.8	↓
BLACK			
Perinatal Conditions	0.0	0.0	—
Congenital Anomalies	0.2	0.3	↑
Infections	0.1	0.0	↓
Injury/External Causes	0.0	0.1	—
SIDS/Suffocation (sleep-related)	0.9	0.7	↓
Ill-defined	0.4	0.6	↑
Other	0.0	-0.1	—
Total Deaths	1.4	1.6	↑

↑ indicates the causal factor with the greatest percent increase

↓ indicates the causal factor with the greatest percent decrease

Conclusion:

- The causal factors with the greatest percent increase were injury/external cause among all deaths and congenital anomalies and ill-defined causes among Blacks. There were no increases among Whites.
- Infections were the causal factor with the greatest percent decrease among Blacks.

Step 2 – Risk Factors

More details surrounding these deaths are needed to determine specific risk factors.

Conclusion

Of the four periods of risk, Montgomery County had the highest rate of excess death in the Maternal Health/Prematurity period. Infant and fetal deaths in this category were mainly caused by very low birth weight most often because the mother's membranes ruptured prematurely and/or they did not receive prenatal care. When evaluated by race, Blacks also had the highest rate of excess deaths in Maternal Health/Prematurity. Whites had the highest rate of excess deaths in the Maternal Care period. The risk factor that contributed to excess White fetal deaths ($\geq 1500\text{g}$) was smoking during pregnancy. Among White women who were of reproductive age, obesity was the most concerning risk factor for excess deaths.