Health Department

2019 INFANT MORTALITY

Examining infant deaths from 2005 – 2015
in Macomb County, Michigan

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Macomb Infant Mortality Report 2019

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Executive Summary

In the State of Michigan, infant mortality is a significant public health issue. Infant mortality is defined as the death of a live-born baby before her first birthday. For every 1,000 babies born in Michigan, almost 7 die by age one – a rate much higher than the national average of 5.9. Infant mortality rates are much higher for certain racial and ethnic groups. The infant mortality rate for black and American Indian babies is more than twice that of white Americans. Causes of infant mortality include serious birth defects, preterm birth before 37 weeks gestation, Sudden Infant Death Syndrome (SIDS), maternal pregnancy complications, and injuries.

The importance of infant mortality extends far beyond the health of a newborn child. Infant mortality often serves as an indicator of a health system overall, even extending beyond that to assess education, economic opportunity, housing, and safety. Many factors can affect pregnancy and childbirth, from preconception health status to poverty. Social determinants of the mother's health, barriers to appropriate prenatal health care, and access to nutrition can largely determine the outcome of an infant's health, ultimately influencing their outcomes as adults. The calculated infant mortality rate (IMR) serves as one measurement, demonstrating the apparent association between the causes of infant mortality and other risk factors.

Healthy People 2020 (HP2020), which provides evidence-based national objectives for health, sets a target of 6.0 infant deaths per 1,000 live births as an attainable target within the next decade. Within Macomb County, the infant mortality rate has been relatively constant, averaging at around 6.2 per one thousand live births in the past decade – well below the Michigan and national averages, and meeting the Healthy People 2020 objective. However, there remains a large racial disparity; black mortality rates for infants are approximately twice that of white infants.

Infant health has been a staple of public health programs from the beginning, such as infant health visiting programs and the development of vaccines. The Macomb County Health Department's Family Health Services Division provides reproductive healthcare education, counseling, home visits by public health nurses, breastfeeding assistance, and immunizations for individuals and families.

This report contains data from vital statistic files and the United States Census Bureau. The information in this report is meant to provide an overview of key points on the circumstances surrounding infant deaths between 2005 and 2015. All data reported herein are residence data, regardless of where the event occurred. Individuals must have been less than one year of age at the time of death to be included.

The principal purpose of the Macomb County Infant Mortality Report is to provide the community and stakeholders with information and data regarding infant mortality. This information is utilized to make recommendations for improving local social services agencies, health care organizations, and coalitions in the community regarding infant mortality, such as the Baby Resource Network of Macomb. The data are also used to raise awareness regarding maternal and child risk factors. Taken together, these three foci promote initiatives that benefit the health of women, infants, and families, overall improving the population health of Macomb County.

Methodology

Data

Information regarding infant deaths was extracted from the Michigan Resident Birth and Death Files within Michigan Department of Health & Human Services' Division for Vital Records & Health Statistics. This report only looks at infants that died within the first year of life.

Cases were included if their residence was within Macomb County and age at time of death was less than one year of age.

This report also provides findings based on the linking of birth certificate and infant death certificate data. The linked birth/infant death statistics are based on a death cohort. The death cohort involves linkage of infant deaths with the corresponding live births. These births may have occurred in the same calendar year as the death or in the year prior. The birth/infant death data analyzed are based on a union of single year linked birth/infant death files created six months after a given event year ended. Linkage of the respective records is performed by the MDHHS Vital Records group.

The method of linking the data is valuable for assessing risk factors from the prenatal or birth time period with death. In these linked statistics, population groups (e.g., race or ethnicity), information is classified using the group reported on the birth certificate for the mother.

Statistics

The relative standard error (RSE) is used in this report to evaluate reliability of rates. Values with a relative standard error of 30 percent or less are considered reliable. Values with a relative standard error greater than 30 percent but less than 50 percent are considered unreliable, and rates with RSE greater than 50 percent have been suppressed in this document. This is consistent with standard National Center for Health Statistics (NCHS) practice.

Caution should be exercised in the interpretation of rates based on small numbers. Chance variations in the number of infant deaths occurring in sparsely populated areas can cause rates to fluctuate widely over time. Rates based on fewer than 20 infant deaths or fewer than 20 births in the denominator are considered unreliable for analysis purposes. Therefore, these rates are not displayed and are indicated by ** in the appropriate cell. For purposes of analyzing infant mortality rates for small areas, calculation of three- or five-year average rates and other statistical methodologies for analyzing small numbers may provide more meaningful measures.

Proportions or percentages were not rounded, and simply truncated at the 10th place.

The following statistical tests have been applied where statistically significant differences have been noted in the document:

> If there were two groups, Welch's Student T-test was used to assess difference.
>
> ANOVA with a subsequent Tukey or Scheffe post-hoc test was used to assess difference of means when there were more than two groups; individual pairwise comparisons were assessed using a post-hoc test, not individual t-tests. Confidence intervals were calculated at the 95% confidence level. If the confidence intervals of two values do not overlap it is considered a

conservative estimate of a significant difference. Statistical significance is considered at the 0.05 level. With respect to mother's race, white was the reference group.

The z-test was used for comparing two infant mortality rates and Poisson Joinpoint regression models were used for trend analysis.

Variable Definitions

Age Period of Death

The first year of life can be categorized by two major periods, the neonatal period (first 27 days of life) and the post-neonatal period (28 to 364 days of life). The infant deaths occurring in the neonatal period are also further sub-divided into the hebdomadal deaths (0-6 days) and post-hebdomadal deaths (7-27 days). Perinatal period III includes still-births and hebdomadal deaths.

Race

Race has been collapsed as follows: White, Black, Asian (Chinese, Filipino, Indian, Japanese, Korean, Vietnamese, Other Asian), Other, and Unknown. Individuals classified as American Indian, Native Hawaiian, Guaman, Samoan, Other Pacific Islanders, or multiple races were collapsed into 'Other.' Race is based on the mother's races notated on the infant's birth certificate. Ethnicities (e.g., Latino or Arab) were not evaluated in this report.

Gestational Age

Gestational age was collapsed based on standards put forth by the World Health Organization, and calculated using the estimated gestation, determined by the physician. Extreme prematurity includes any gestational age under 28 weeks, whereas birth at 28–31 weeks' gestation is defined as very preterm. Moderate prematurity refers to 32–36 weeks, and term maturity referred to any gestational age over 37 weeks.

Birthweight

Birthweight was collapsed based on standards put forth by the U.S.' Department of Health and Human Services. Low birth Weight (LBW) infants are those born weighing less than 2500 g. These are further subdivided into: 1) Very Low Birth Weight (VLBW), with infants weighing less than 1500 g and 2) Extremely Low Birth Weight (ELBW), with infants weighing less than 750 g.

Cause of Death

The cause of death referred to in this report is the primary or underlying cause of death, as noted on the death record. This the primary disease or injury that initiated the chain of events leading directly to death. The underlying causes of death are established through a system known as the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10).

Cause of death was collapsed into the following categories:

Cause Group	ICD-10 Code	Example
Congenital Anomalies	Q00 – Q99	Microcephaly
Birth Trauma	P10 – P15	Intracranial laceration
Maternal Factors	P00 – P04	Newborn affected by complications of placenta, cord and membranes
Perinatal	P (not previously classified)	Transitory neonatal disorders of calcium and magnesium metabolism
Short Gestation and Low Birthweight	P07	Disorders of newborn related to short gestation and low birth weight, not elsewhere classified
SUID (SIDS/Suffocation in Bed, Unknown)	R95, R99, W75	Sudden infant death syndrome
External Causes[1]	V01 – Y89	Car occupant injured in collision with railway train or railway vehicle
Other	All other	--

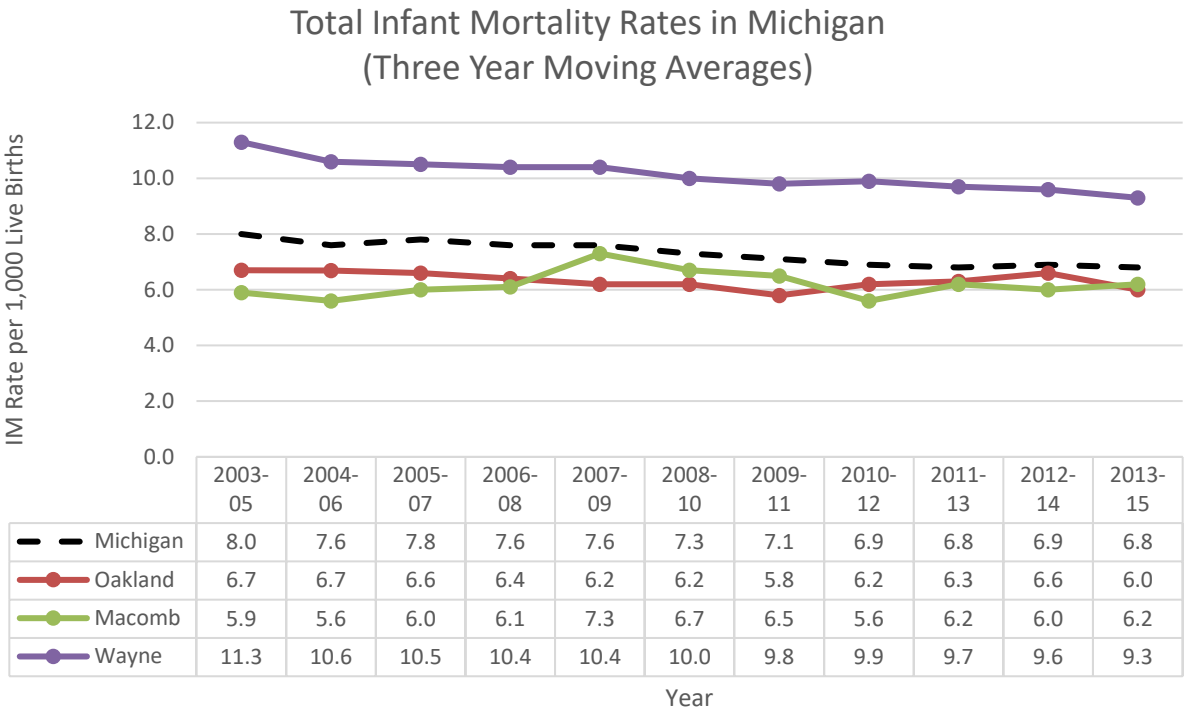
[1] Excludes suffocation in bed.

Results

County Comparisons[2]

The basic IMR data in this section come from the Michigan Department of Health and Human Services.

Figure 1. Total Infant Mortality Rates in Michigan (Three Year Moving Averages)

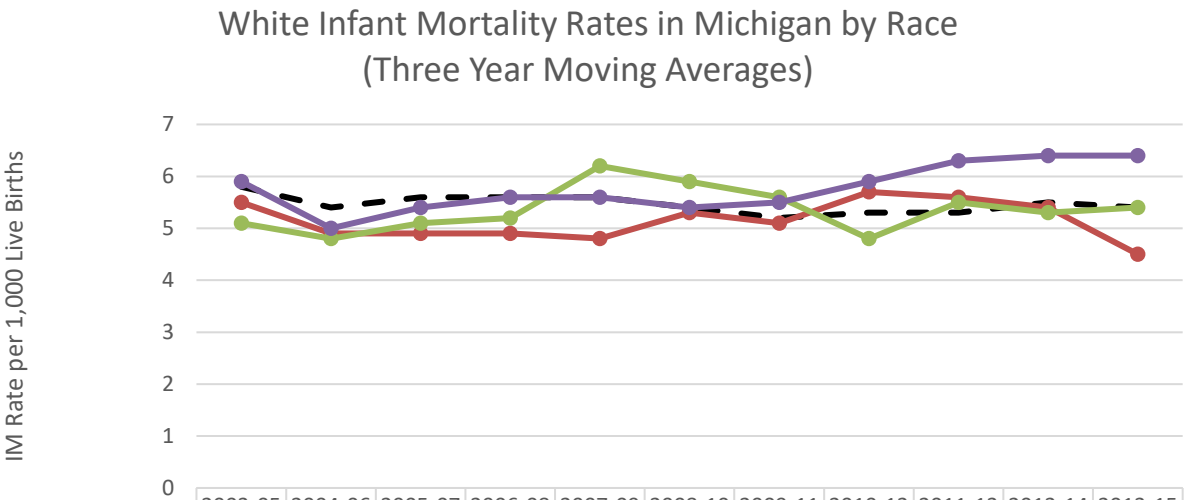


	2003-05	2004-06	2005-07	2006-08	2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15
Michigan	8.0	7.6	7.8	7.6	7.6	7.3	7.1	6.9	6.8	6.9	6.8
Oakland	6.7	6.7	6.6	6.4	6.2	6.2	5.8	6.2	6.3	6.6	6.0
Macomb	5.9	5.6	6.0	6.1	7.3	6.7	6.5	5.6	6.2	6.0	6.2
Wayne	11.3	10.6	10.5	10.4	10.4	10.0	9.8	9.9	9.7	9.6	9.3

Figure 1 shows the IMR for 2003 to 2015 for comparable counties in Michigan, as well as the state IMR. Macomb and Oakland are relatively similar, both below the state IMR and greatly below that of neighboring Wayne County. There is a slight decrease in the state-wide IMR rate and that of Wayne County; Oakland and Macomb have remained relatively constant, increasing slightly in the past six years.

[2] 2003-2015 Geocoded Michigan Death Certificate Registries. Division for Vital Records & Health Statistics, Michigan Department of Health & Human Services.

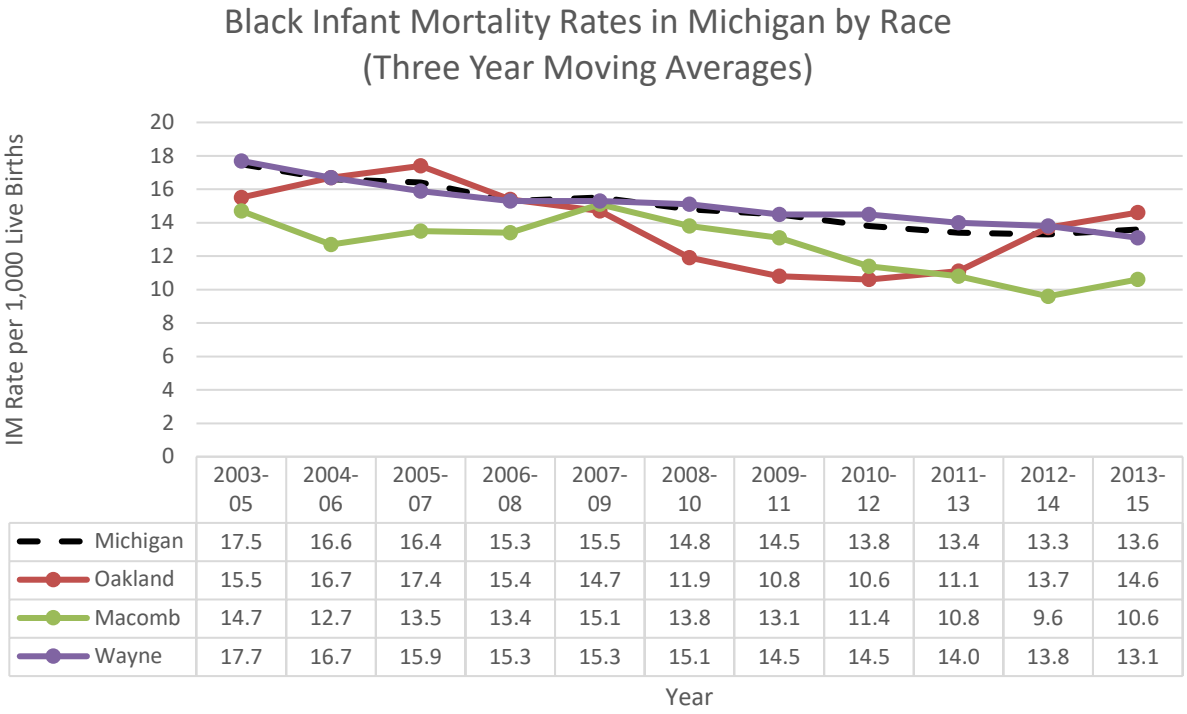
Figure 2. White Infant Mortality Rates in Michigan (Three Year Moving Averages)



	2003-05	2004-06	2005-07	2006-08	2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15
Michigan	5.8	5.4	5.6	5.6	5.6	5.4	5.2	5.3	5.3	5.5	5.4
Oakland	5.5	4.9	4.9	4.9	4.8	5.3	5.1	5.7	5.6	5.4	4.5
Macomb	5.1	4.8	5.1	5.2	6.2	5.9	5.6	4.8	5.5	5.3	5.4
Wayne	5.9	5.0	5.4	5.6	5.6	5.4	5.5	5.9	6.3	6.4	6.4

Figure 2 shows the IMR for white infants during 2003 to 2015 for comparable counties in Michigan, as well as the state IMR. While the rates have remained relatively constant, Macomb has experienced greater variability than its neighboring counties. It is important to note that the white IMR is smaller than the overall IMR.

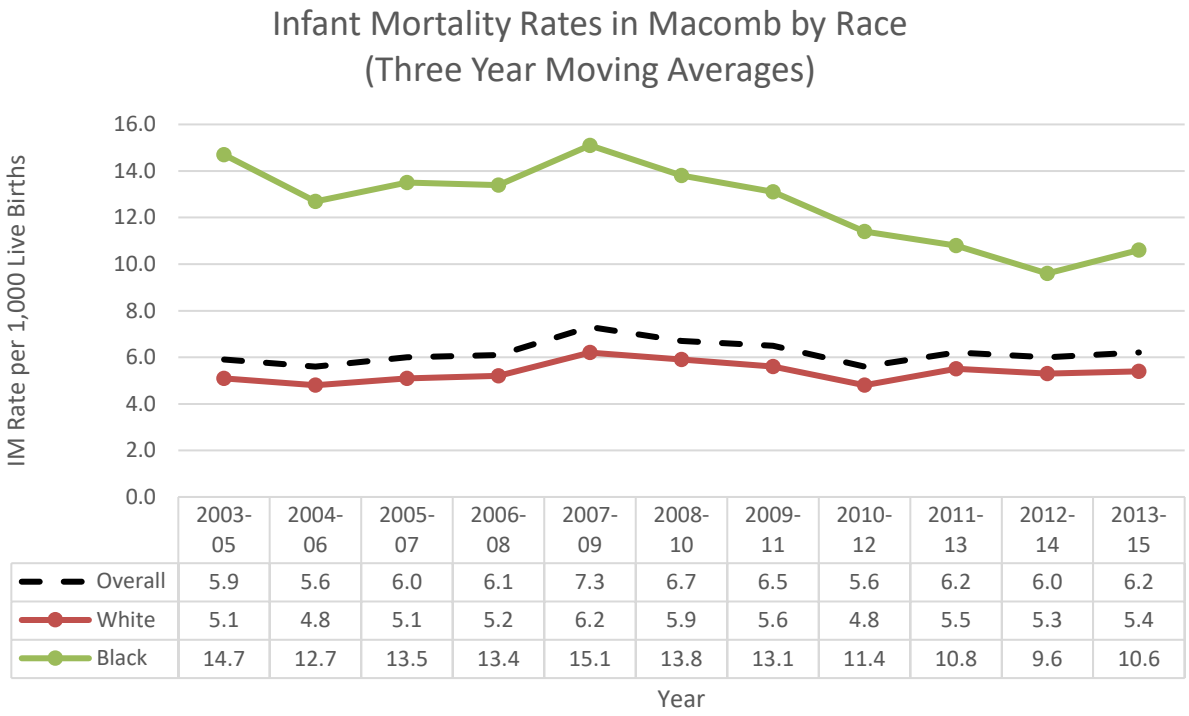
Figure 3. Black Infant Mortality Rates in Michigan (Three Year Moving Averages)



	2003-05	2004-06	2005-07	2006-08	2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15
Michigan	17.5	16.6	16.4	15.3	15.5	14.8	14.5	13.8	13.4	13.3	13.6
Oakland	15.5	16.7	17.4	15.4	14.7	11.9	10.8	10.6	11.1	13.7	14.6
Macomb	14.7	12.7	13.5	13.4	15.1	13.8	13.1	11.4	10.8	9.6	10.6
Wayne	17.7	16.7	15.9	15.3	15.3	15.1	14.5	14.5	14.0	13.8	13.1

Figure 3 shows the IMR for black infants during 2003 to 2015 for comparable counties in Michigan, as well as the state IMR. In contrast to the earlier figures, these rates are 2 to 3 times higher than that of both the overall and white-only IMRs, illustrating a clear racial disparity. While there was a slight decrease in overall IMR for Michigan, there is a more marked decrease in the IMR for black infants. Though Macomb experienced an increase in the rate of black infant deaths in the 2000s, it began decreasing around 2008. Even with a slight uptick in the 2013-2015 estimates, Macomb currently has the lowest black infant mortality rates in the tri-county area.

Figure 4. Infant Mortality Rates by Race in Macomb (Three Year Moving Averages)



	2003-05	2004-06	2005-07	2006-08	2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15
Overall	5.9	5.6	6.0	6.1	7.3	6.7	6.5	5.6	6.2	6.0	6.2
White	5.1	4.8	5.1	5.2	6.2	5.9	5.6	4.8	5.5	5.3	5.4
Black	14.7	12.7	13.5	13.4	15.1	13.8	13.1	11.4	10.8	9.6	10.6

Figure 4 shows the IMR for 2003 to 2015 for different races in Macomb County, as well as the overall IMR. There continues to be a large disparity between black infant deaths and white infant deaths. In the late 2000s, there was an increase in the rate of black infant deaths, followed by a steady decrease in the rate (at an average of -5% each year). However, in 2015 the rate has risen again.

Descriptive

The data in this section include all 649 infant deaths in Macomb County from 2005 to 2015. Tables are divided into two sections, mother and infant. The Mother section will include data on mother's age, marital status, number of prenatal care appointments the mother had, month prenatal care began, WIC registration, and multiple gestation. The Infant section will include data on infant's birth weight, gestational age, zip codes, and cause of death.

Figure 5. Infant Deaths by Mother's Residential Zipcode

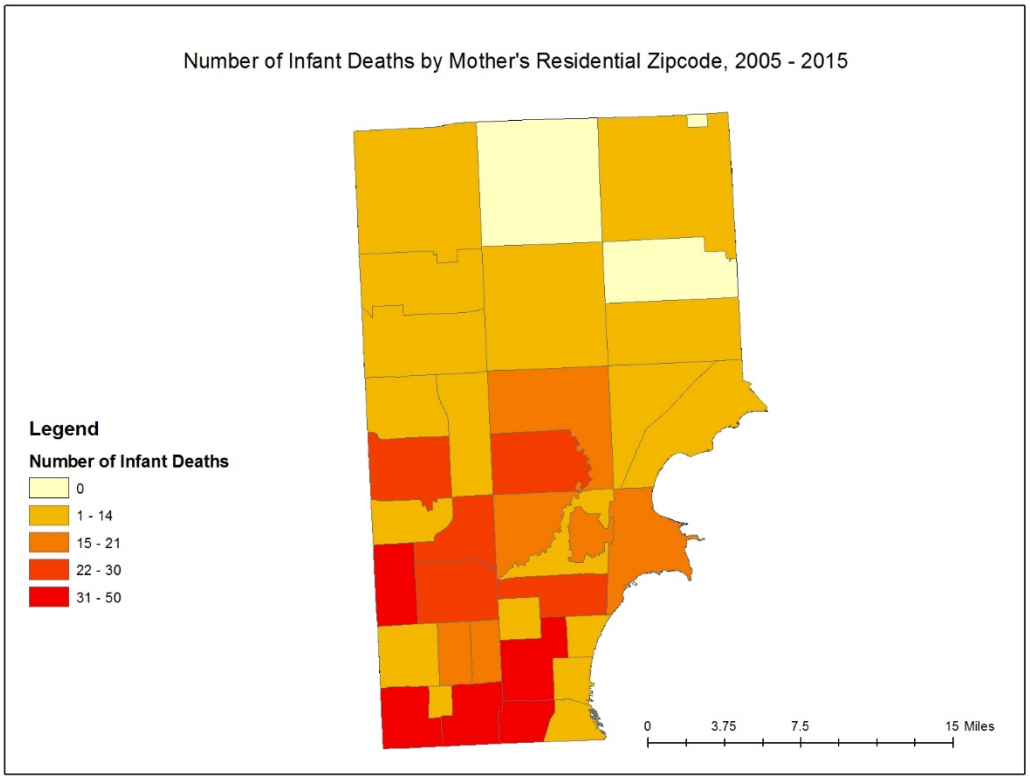


Figure 5 shows the number of infant deaths based on the mother's residential zipcode. More infant deaths occurred in the southern half other county; however it is important to note that this area is also more populated.

Mother Characteristics

Table 1. Mother's Age by Mother's Race for Infant Deaths: numbers and column-wise percentages[i]

	White	Black	Asian	Other	Unknown	Total
17 or less	6 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (0.9)
18 – 19	16 (3.6)	16 (9.6)	0 (0.0)	0 (0.0)	0 (0.0)	32 (4.9)
20 – 29	207 (47.2)	98 (59.0)	9 (50.0)	7 (46.6)	3 (25.0)	324 (49.9)
30 – 39	187(42.6)	42 (25.3)	6 (33.3)	5 (33.3)	4 (33.3)	244 (37.5)
40+	17 (3.8)	4 (2.4)	3 (16.6)	2 (13.3)	3 (25.0)	29 (4.4)
Unknown	5 (1.1)	6 (3.6)	0 (0.0)	1 (6.6)	2 (16.6)	14 (2.1)
Mean	28.9	26.0**	31.0	30.8	43.0**	28.5
Standard Deviation	5.95	6.24	6.21	7.36	26.95	7.3
10th Percentile	21.0	19.0	24.0	25.4	24.0	20.0
25th Percentile	25.0	21.0	27.2	27.0	29.2	24.0
Median	29.0	24.5	30.0	29.0	31.0	28.0
75th Percentile	33.0	30.0	32.8	34.5	40.8	33.0
90th Percentile	36.0	36.0	41.0	41.0	93.4	37.0

[i] * denotes statistical significance at 0.05; ** denotes statistical significance at 0.001

Table 1 relates the age of the mother at the time of birth to her race/ethnicity. The impact of maternal age in infant mortality in Macomb County is greatest for all races in the age range of 20 – 29 years of age, with 49.9% of all infant deaths having mothers in this age range. The next highest age range for infant mortality is the 30 – 39 range. There was a statistically significant difference between group means as determined by one-way ANOVA ($F(4,644) = 19.5$, $p = <.001$). Black mothers were statistically significantly different than white mothers, as were mothers of an unknown race ($p < 0.001$).

Table 2. Mother's Marital Status by Mother's Race: numbers and column-wise percentages[ii]

	White	Black	Asian	Other	Unknown	Total
Never Married	82 (32.0)	87 (75.6)	0 (0.0)	3 (25.0)	0 (0.0)	172 (42.6)
Currently Married	164 (64.0)	24 (20.8)	13 (100.0)	8 (66.6)	7 (100.0)	216 (53.6)
Divorced	10 (3.9)	4 (3.4)	0 (0.0)	1 (8.3)	0 (0.0)	15 (3.7)
Unknown	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

[ii] Does not include 2005-2008 infant deaths. This variable was not recorded prior to 2009.

Table 2 shows the marital status of the mother at the time of birth. The impact of marital status in infant mortality in Macomb County is greatest for individuals who are married, with 53.6% of all infant deaths. However, marital status is significant to infant mortality as marriage is associated with higher socioeconomic status, greater social support of the mother, and higher rates of pregnancy intendedness. In general, marriage serves as a protective factor for the infant. There was a significant association found between mother's race and mother's marital status ($X^2(8, N= 403) = 80$, $p<.01$).

Table 3. Mother's Insurance by Mother's Race: numbers and column-wise percentages

	White	Black	Asian	Other	Unknown	Total
Private Insurance	270 (61.6)	90 (54.2)	8 (44.4)	13 (86.6)	6 (50.0)	387 (59.6)
Medicaid	149 (34.0)	72 (43.3)	9 (50.0)	2 (13.3)	3 (25.0)	235 (36.2)
Self-Pay	6 (1.3)	1 (0.6)	1 (0.6)	0 (0.0)	0 (0.0)	8 (1.2)
Other	4 (0.9)	2 (1.2)	0 (0.0)	0 (0.0)	0 (0.0)	6 (0.9)
Unknown	9 (2.0)	1 (0.6)	0 (0.0)	0 (0.0)	3 (25.0)	13 (2.0)

Table 3 shows the insurance payment used at the time of birth. The impact of insurance type in infant mortality in Macomb County is greatest for individuals who used private insurance, with 59.6% of all infant deaths. The next group most at risk overall was that of women who used Medicaid, comprising of 36.2% of all infant deaths. There was a statistically significant association found between mother's race and payment type ($X^2(20, N= 649) = 50, p<.01$).

Table 4. Month of Gestation at Entrance to Prenatal Care by Mother's Race: numbers and column-wise percentages[iii]

	White	Black	Asian	Other	Unknown	Total
0	7 (1.9)	2 (1.5)	1 (8.3)	0 (0.0)	0 (0.0)	10 (1.9)
1-2	233 (63.1)	73 (57.0)	6 (50.0)	8 (66.6)	3 (60.0)	323 (61.4)
3-4	91 (24.6)	31 (24.2)	4 (33.3)	3 (25.0)	1 (20.0)	130 (24.7)
5-6	15 (4.0)	7 (5.4)	1 (8.3)	0 (0.0)	1 (20.0)	24 (4.5)
7-9	23 (6.2)	15 (11.7)	0 (0.0)	1 (8.3)	1 (20.0)	39 (7.4)
Mean	2.7	3.2	2.1	3.0	2.4	2.8
Standard Deviation	2.1	2.5	1.4	2.3	1.6	2.2
10th Percentile	1.0	1.0	1.0	2.0	1.0	1.0
25th Percentile	2.0	2.0	1.0	2.0	1.0	2.0
Median	2.0	2.0	2.0	2.0	2.0	2.0
75th Percentile	3.0	3.5	3.0	3.0	3.0	3.0
90th Percentile	5.0	7.0	3.9	3.9	4.2	5.0

[iii] Does not include answers for month of gestation prenatal care was initiated that were coded as unknown.

Table 4 relates the month of gestation when prenatal care began to the mother's race/ethnicity. The impact of prenatal care entrance in infant mortality in Macomb County is greatest for all races of prenatal care being started in the first two months of gestation, with 61.4% of all infant deaths having mothers in this prenatal-gestation period. The next highest prenatal care for infant mortality was the third and fourth months. There was no statistically significant difference between group means as determined by one-way ANOVA ($F(4,535) = 1.61, p = 0.17$).

Table 5. Number of Prenatal Visits by Mother's Race[iv]

	White	Black	Asian	Other	Unknown	Total
Mean	9	7	6	6	8	8
Standard Deviation	5	5	4	4	7	5
10th Percentile	3	0.9	3	4	4	2
25th Percentile	5	4	3	4	6	5
Median	9	6	6	5	8	8
75th Percentile	12	10	8	8	10	12
90th Percentile	15	14	10	12	12	15

[iv] Does not include answers for number of prenatal care visits that were coded as unknown.

Table 5 shows the number of prenatal appointments the mother had during her pregnancy. Women typically go to between seven and 11 prenatal care appointments during their pregnancy. Overall, the median of prenatal visits among all infant deaths was 8. There was a significant difference between racial group means ($F(4,528) = 2.67$, $p = 0.03$).

Table 6. Number of Total Children (including those born stillborn or now deceased) by Mother's Race

	White	Black	Asian	Other	Unknown	Total
Mean	1.6	1.8	1.8	0.9	1.3	2.0
Standard Deviation	2.0	2.0	2.0	1.0	2.0	2.0
10th Percentile	0	0	0	0	0	0
25th Percentile	0	0	0	0	0	0
Median	1	1	2	2	1	1
75th Percentile	2	3	3	3	2	2
90th Percentile	4	4	4	4	3	4

Table 6 shows the number of total children, including stillborns, the mother had borne prior to her latest pregnancy. Overall, the median of total prior births among all infant deaths was 1, with a range of 0 to 16. There was no significant difference between racial group means ($F(4,633) = 1.08$, $p = 0.36$).

Table 7. Number of Stillborn Children by Mother's Race

	White	Black	Asian	Other	Unknown	Total
Mean	0.5	0.7	0.3	0.3	0.6	0.5
Standard Deviation	1.2	1.3	0.7	1.0	0.9	1.0
10th Percentile	0.0	0.0	0.0	0.0	0.0	0.0
25th Percentile	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
75th Percentile	1.0	1.0	0.0	0.0	1.0	1.0
90th Percentile	2.0	2.0	1.3	0.6	2.0	2.0

Table 7 shows the number of stillborns the mother had borne prior to her latest pregnancy. Overall, the average of number of previous stillborns among all infant deaths was less than one, with a range of 0 to 15. There was no significant difference between racial group means ($F(4,633) = 0.66$, $p = 0.62$).

Table 8. Participation in WIC by Mother's Race: numbers and column-wise percentages[v]

	White	Black	Asian	Other	Unknown	Total
Yes	69 (0.3)	33 (0.3)	3 (0.2)	3 (0.2)	0 (0.0)	108 (0.3)
No	150 (0.6)	51 (0.4)	7 (0.5)	7 (0.6)	2 (0.2)	217 (0.5)
Unknown	38 (0.1)	32 (0.3)	3 (0.2)	2 (0.2)	6 (0.8)	81 (0.2)

[v] Does not include 2005-2008 infant deaths. This variable was not recorded prior to 2009.

Table 8 shows the participation in WIC by the mother's race among all infant deaths. It is important to note that 20% of all infant deaths had an unknown status regarding WIC participation. Only 30% of all infant deaths had mothers who participated in the WIC program. There was a statistically significant association found between mother's race and WIC participation ($p = 0.001$).

The next set of data look at first pregnancies, of which there were 213 between 2005 and 2015[3].

Table 9. First Pregnancy by Mother's Race and Year: numbers and column-wise percentages

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
White	13 (0.8)	10 (0.7)	16 (0.6)	12 (0.7)	10 (0.4)	11 (0.7)	7 (0.6)	16 (0.6)	20 (0.7)	10 (0.4)	14 (0.7)	139 (0.6)
Black	2 (0.1)	2 (0.1)	6 (0.2)	5 (0.2)	8 (0.3)	3 (0.2)	4 (0.3)	9 (0.3)	6 (0.2)	6 (0.2)	5 (0.2)	56 (0.2)
Asian	0 (0.0)	0 (0.0)	2 (0.1)	0 (0.0)	1 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.1)	0 (0.0)	6 (0.0)
Other	1 (0.0)	1 (0.0)	0 (0.0)	0 (0.0)	2 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)	2 (0.1)	1 (0.0)	8 (0.0)
Unknown	0 (0.0)	0 (0.0)	1 (0.0)	0 (0.0)	2 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)	0 (0.0)	0 (0.0)	4 (0.0)

[3] Calculated as first baby if previous children born living, dead, or now dead = 0.

Figure 6. First Pregnancies by Mother's Residential Zipcode

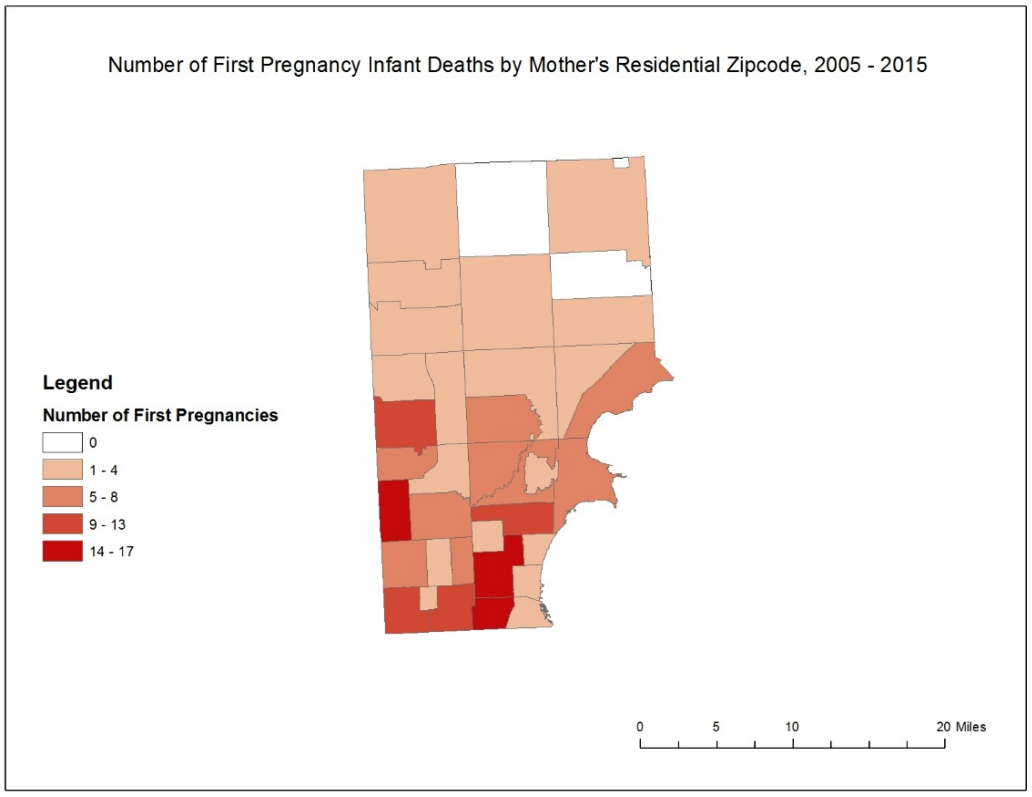
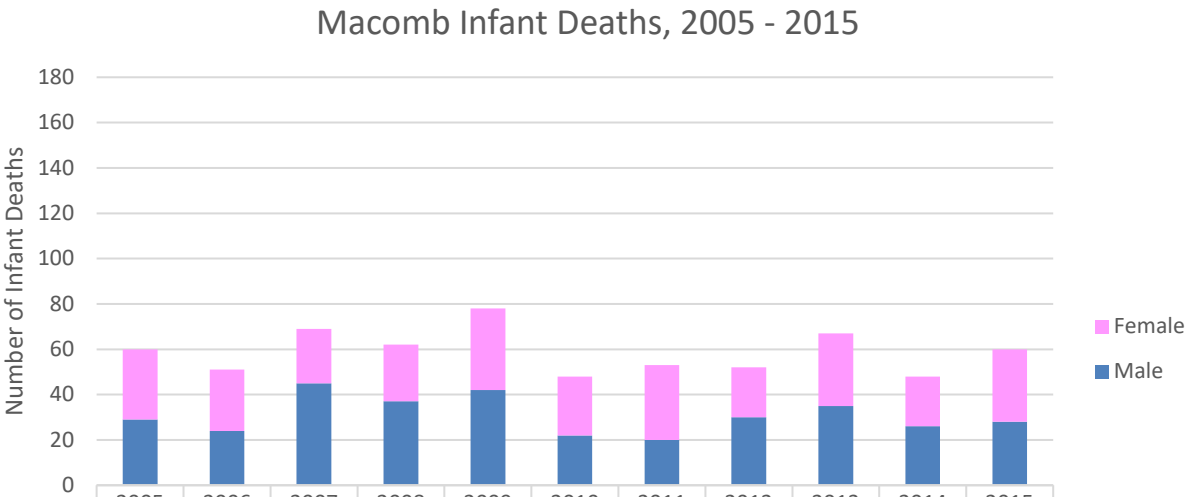


Table 9 shows the number of first pregnancies by both race and year; Figure 6 maps them according to the mother's residential zipcode. There have been an increase in the number of infant deaths from first pregnancies over time. The majority of these types of deaths were from white mothers (65%), followed by black mothers (26%).

Infant Characteristics

Between 2005 and 2015, there were 649 infant deaths. It is important to note that the race of the baby is not notated on birth certificates, only on death certificates; thus, only mother's race is assessed and serves as a proxy for that of the infant.

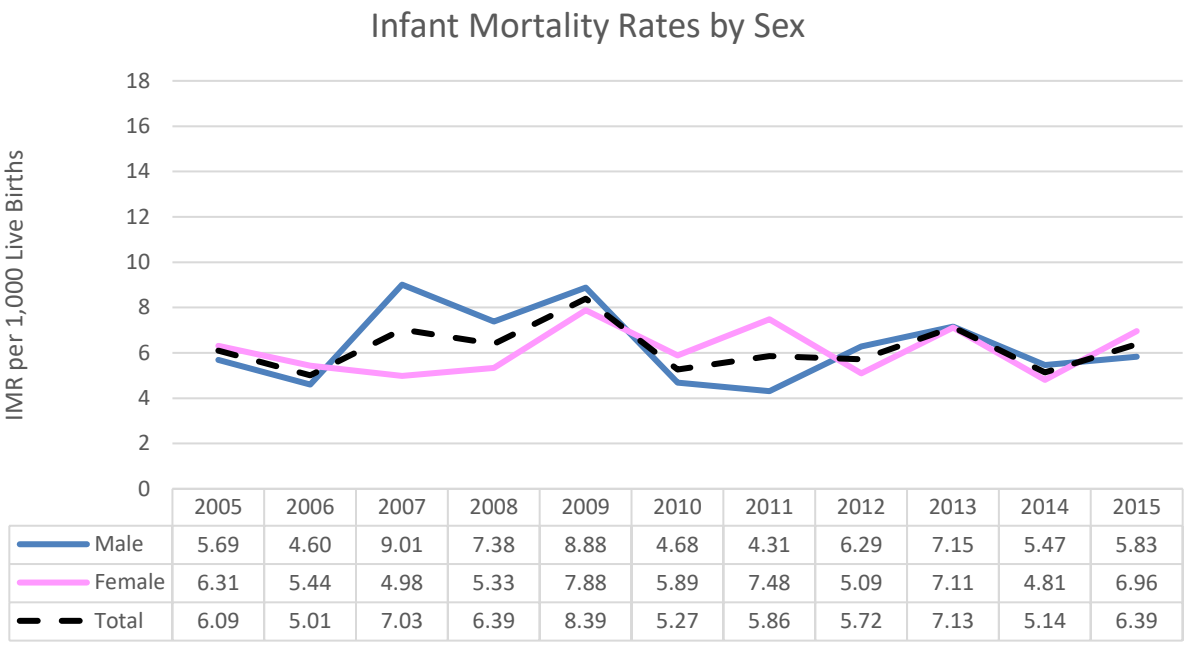
Figure 7. Number of Infant Deaths by Sex



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	60	51	69	62	78	48	53	52	67	48	60
Female	31	27	24	25	36	26	33	22	32	22	32
Male	29	24	45	37	42	22	20	30	35	26	28

Figure 7 shows the number of infant deaths occurring in Macomb County over time, as well as the sex difference within years. The death count was much higher before 2010, where it fell by 38%. Since 2010, the death count has been more fluctuating, with percent changes ranging from -28% to 29%. The gender difference has been fairly similar throughout the years, hovering around 50-50. Sex did not serve as either a risk or protective factor; over the time period, the rate ratio ranged between 0.72 and 1.74 for females as compared to males.

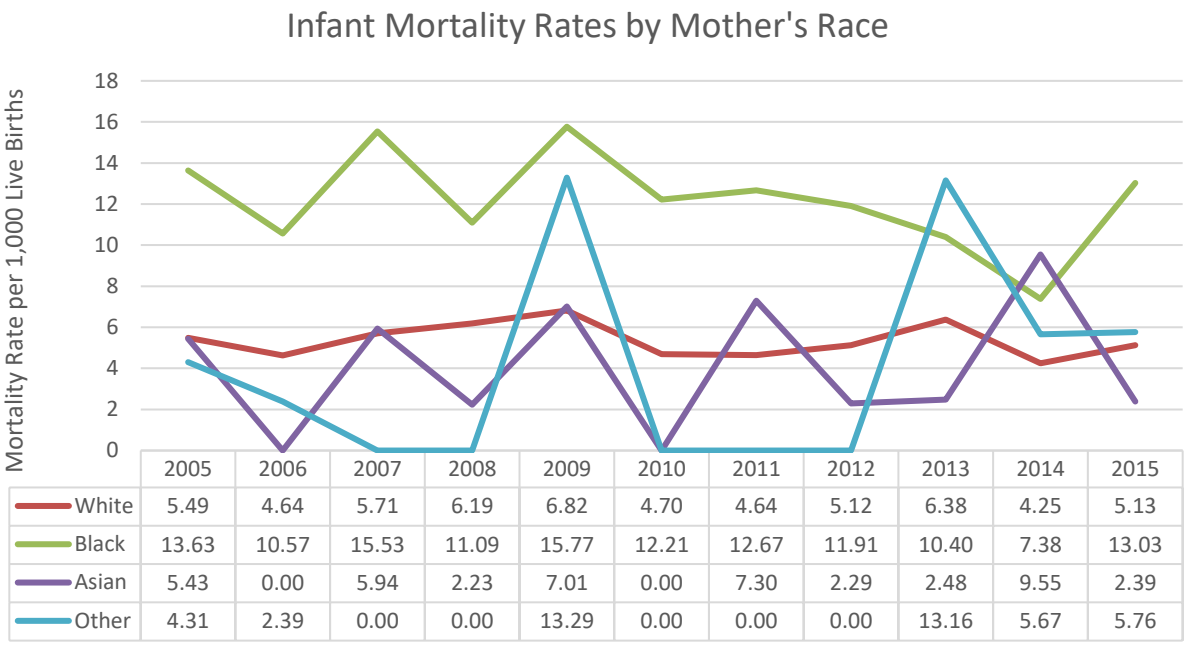
Figure 8. IMRs by Sex



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Male	5.69	4.60	9.01	7.38	8.88	4.68	4.31	6.29	7.15	5.47	5.83
Female	6.31	5.44	4.98	5.33	7.88	5.89	7.48	5.09	7.11	4.81	6.96
Total	6.09	5.01	7.03	6.39	8.39	5.27	5.86	5.72	7.13	5.14	6.39

Figure 8 shows the same data as Figure 6, but converted into mortality rates per 1,000 live births. This illustrates that while 2010 and 2011 had a large sex difference, overall the two sex IMRs are nearly parallel to the overall IMR. Moreover, the IMR since 2009 has remained relatively constant.

Figure 9. IMR by Mother's Race



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
White	5.49	4.64	5.71	6.19	6.82	4.70	4.64	5.12	6.38	4.25	5.13
Black	13.63	10.57	15.53	11.09	15.77	12.21	12.67	11.91	10.40	7.38	13.03
Asian	5.43	0.00	5.94	2.23	7.01	0.00	7.30	2.29	2.48	9.55	2.39
Other	4.31	2.39	0.00	0.00	13.29	0.00	0.00	0.00	13.16	5.67	5.76

Figure 9 shows the IMR by the maternal race group. As seen earlier in the three-year averages, mortality rates overall have generally remained stable. Black IMR have decreased sharply in the six years, though still remain much higher than both the overall and white IMRs. While the Asian and other IMRs have large variability, it is due to a very low numbers rather than large changes. Over the course of the six years there have only been 10 Asian and 8 other deaths, as compared to 235 white and 95 black deaths. These small numbers result in large changes in IMR when even a single additional death occurs.

Figure 10. IMR Racial Disparity (as compared to the overall IMR)

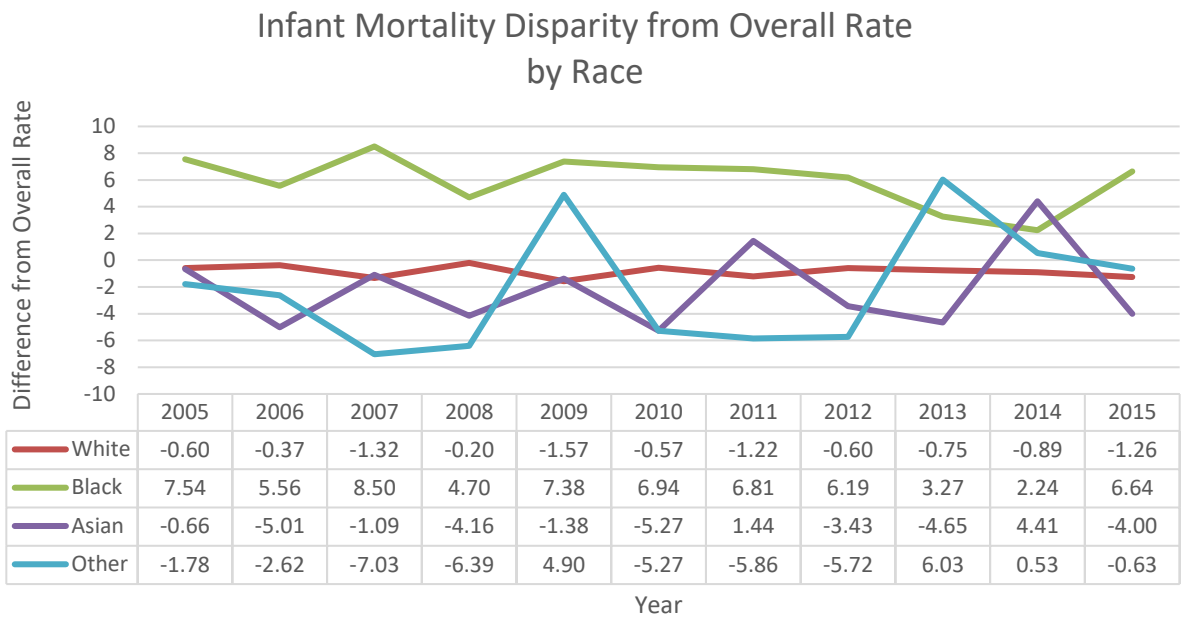


Figure 10 better illustrates the racial disparity occurring between the black and overall IMRs through rate difference. The disparity was calculated by subtracting a specific race group's IMR from the overall IMR each year: a negative disparity means that the subgroup is better than the overall IMR; a positive value means that the subgroup has a higher mortality rate than the overall. While the white IMR is slightly below the overall IMR for Macomb County, the black IMR was historically 7 or 8 deaths per 1,000 live births more than the overall IMR. Though in 2013, the gap closed to a difference of 2 deaths per 1,000 live births, there is still a clear disparity.

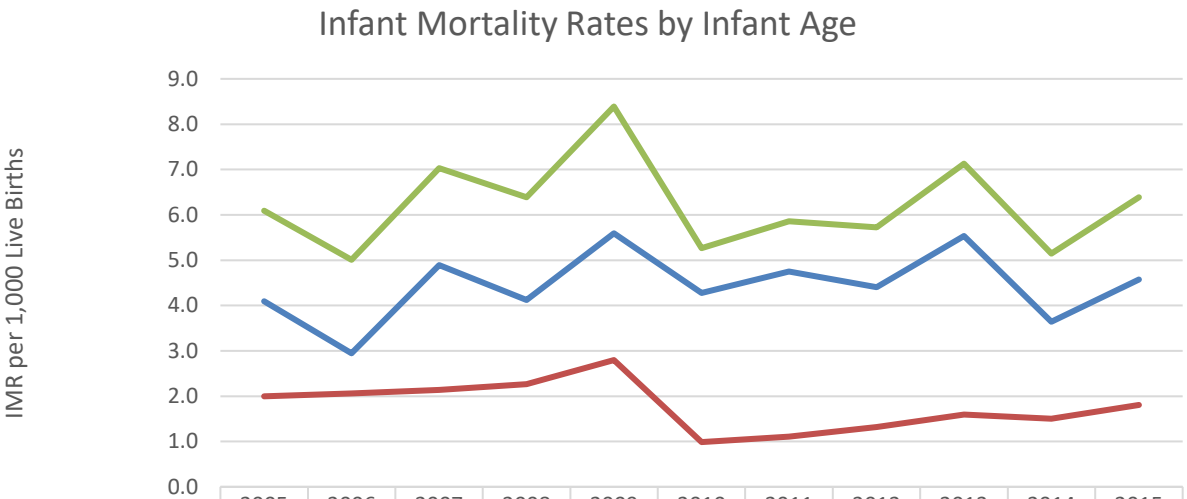
Table 10. Rate Ratios across Racial Groups over time

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
White	Ref[4]	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Black	2.48	2.28	2.72	1.79	2.31	2.60	2.73	2.32	1.63	1.74	2.54
Asian	0.99	0.00	1.04	0.36	1.03	0.00	1.57	0.45	0.39	2.25	0.46
Other	0.78	0.51	0.00	0.00	1.95	0.00	0.00	0.00	2.06	1.33	1.12

Moreover, when calculating rate ratios across the years, as showin Table 10, the infant mortality rate among blacks is more than twice times as high as the rate among whites. Interestingly, the other minorities generally had a protective rate ratio; that may be in part to the few deaths occurring.

[4] Reference Value; what the other groups are compared to.

Figure 11. Infant Mortality Rates by Infant Age[vi] in Macomb County over time

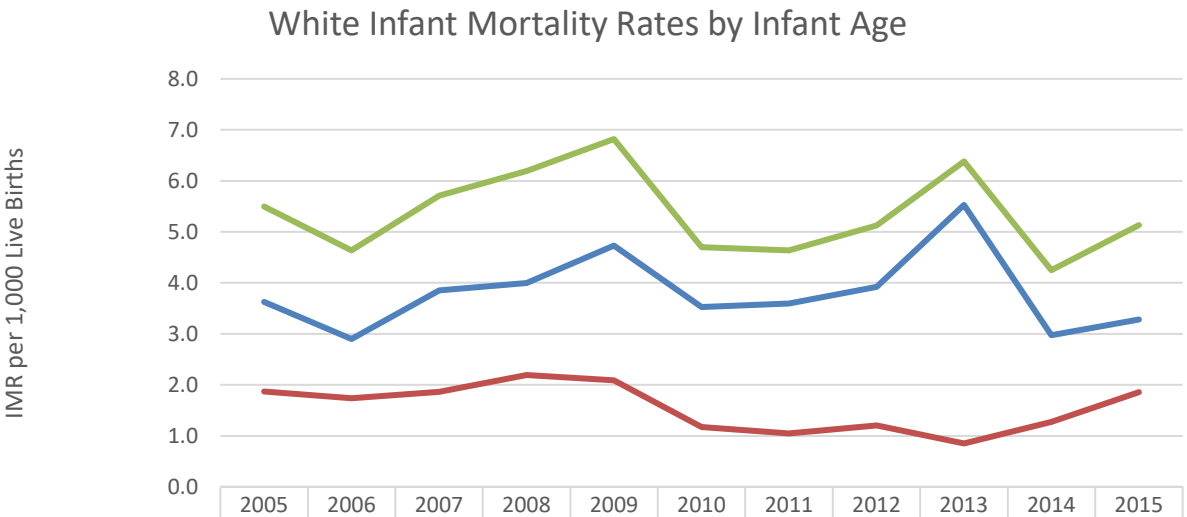


	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Neonatal	4.10	2.95	4.89	4.12	5.59	4.28	4.75	4.40	5.54	3.64	4.58
Post-Neonatal	2.00	2.06	2.14	2.27	2.80	0.99	1.10	1.32	1.60	1.50	1.81
Infant	6.09	5.01	7.03	6.39	8.39	5.27	5.86	5.72	7.13	5.14	6.39

[vi] Neonatal Death — Death of live-born infant during first 27 days of life; Post-neonatal Death — Death of infant between 28 and 364 days. The total number of infant deaths by year includes all races.

Figure 11 shows the IMR from 2005 to 2015 for all races in Macomb County, for neonatal, post-neonatal, and infants. While mortality rates for all three groups increased between 2008 and 2009, they have since remained relatively stable. The figure also shows that neonatal mortality rates are much higher than those of post-neonatal.

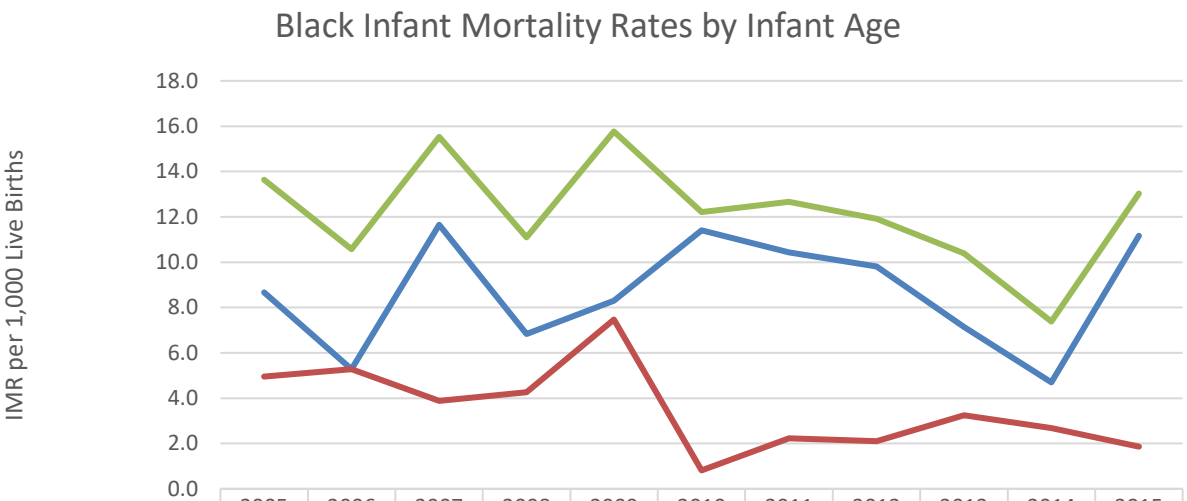
Figure 12. White Infant Mortality Rates by Infant Age in Macomb County over time



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Neonatal	3.62	2.90	3.85	4.00	4.73	3.53	3.59	3.92	5.53	2.97	3.28
Post-Neonatal	1.87	1.74	1.86	2.19	2.09	1.18	1.05	1.21	0.85	1.27	1.85
Infant	5.49	4.64	5.71	6.19	6.82	4.70	4.64	5.12	6.38	4.25	5.13

Figure 12 demonstrates the IMR from 2005 to 2015 for white infants in Macomb County, for neonatal, post-neonatal, and infants. Among white infants, all three rates follow a similar trend: increasing slightly between 2008 and 2009, and falling and remaining relatively constant until 2012. At 2012, infant and neonatal mortality rates increased, where post-neonatal rates decreased. Between 2008 and 2013, infant mortality increases by 5.6 deaths per 1,000 live births on average, and neonatal increases by 4.2 deaths. In the past two years, both neonatal and infant rates have fallen and risen; post-neonatal have steadily risen at 1.3 deaths per 1,000 live births on average.

Figure 13. Black Infant Mortality Rates by Infant Age in Macomb County over time



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Neonatal	8.67	5.29	11.65	6.83	8.30	11.40	10.43	9.81	7.15	4.70	11.17
Post-Neonatal	4.96	5.29	3.88	4.27	7.47	0.81	2.24	2.10	3.25	2.68	1.86
Infant	13.63	10.57	15.53	11.09	15.77	12.21	12.67	11.91	10.40	7.38	13.03

Figure 13 demonstrates the IMR from 2005 to 2015 for black infants in Macomb County, for neonatal, post-neonatal, and infants. Among black infants, infant mortality rises in 2009, and then falls continuously through 2013, with a net gain of 1.2 deaths per 1,000 live births. The neonatal mortality rate increases sharply after 2009 (with a net gain of more than 4.0 deaths by 1,000 live births), gradually decreasing. It is important to note that the 2013 neonatal mortality rate is still higher than it was in 2008. In contrast, the post-neonatal rate dropped sharply after 2009, though it has risen in the years since.

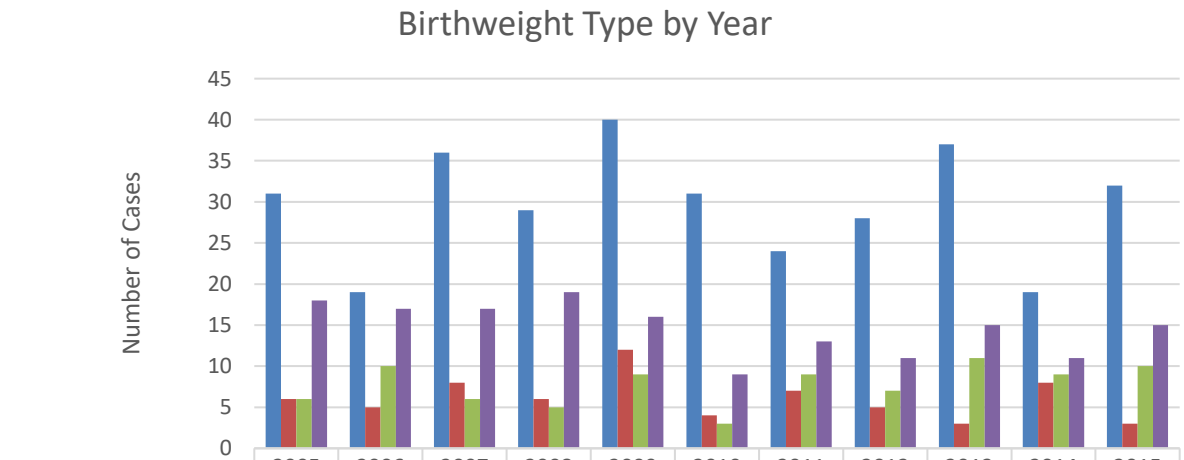
When broken down into age, in 2015, neonatal mortality rate among blacks is 3.4 times as high as the rate among whites, and post-neonatal mortality rate has a rate ratio of 1.00.

According to the United Health Foundation's 2015 Annual Report, Michigan is ranked 29th in the country for low birth weight (the first rank is viewed as favorable health conditions; in this case the state that does not have a high percentage of underweight infants). County Health Rankings, a program run by the Robert Wood Johnson Foundation, ranked Macomb 9th out of the 83 counties in the state for low birth weight, with 5,536 of live births (8.4%) weighing less than 2500 grams at birth.

To better understand the specific subpopulations of infants that may be vulnerable to mortality, birth weights have been collapsed into categories. Refer to the Methodology at the beginning of the report for definitions.

352 of the infants had data regarding their birthweight.

Figure 14. Birthweight Type by Year



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ELBW (under 750g)	31	19	36	29	40	31	24	28	37	19	32
VLBW (750 – 1499g)	6	5	8	6	12	4	7	5	3	8	3
LBW (1500 – 2499g)	6	10	6	5	9	3	9	7	11	9	10
Normal BW (2500+g)	18	17	17	19	16	9	13	11	15	11	15

Figure 14 shows the number of deaths per year, classified into birthweight category. 52% of all infant deaths during this time interval had a birth weight less than 750g, classified as ELBW. Each year, more deaths were from ELBW infants, followed by normal birth weight infants.

Table 11. Birth weight by Mother's Race: numbers and column-wise percentages

	White	Black	Asian	Other	Unknown	Total
ELBW (under 750g)	198 (45.2)	99 (59.6)	12 (66.7)	10 (66.7)	7 (58.3)	326 (50.0)
VLBW (750 – 1499g)	45 (10.3)	19 (11.4)	1 (5.6)	2 (13.3)	0 (0.0)	67 (10.0)
LBW (1500 – 2499g)	65 (14.8)	14 (8.4)	3 (16.7)	1 (6.7)	2 (16.7)	85 (13.0)
Normal BW (2500+g)	124 (28.3)	33 (19.9)	2 (11.1)	2 (13.3)	0 (0.0)	161 (25.0)
Unknown	6 (1.4)	1 (0.6)	0 (0.0)	0 (0.0)	3 (25.0)	10 (2.0)
Mean	1530	1191	1028	1021	717	1405
Standard Deviation	1234	1136	1083	957	630	1206
10th Percentile	300	265	262	418	249	280
25th Percentile	472	415	333	443	385	439
Median	887	576	403	600	505	720
75th Percentile	2683	2110	1682	1081	555	2514
90th Percentile	3342	3164	2468	2476	1761	3266

Table 11 shows birth weights for all infant deaths from 2005 to 2015, by mother's race. There was no significant difference between racial group means ($F(4,354) = 1.99$, $p = 0.095$).

The percentage of white infant deaths with a normal birthweight (more than 2500g) was 27% in the 2005 – 2010 time period, and 24% in the 2011 – 2015 period, a decrease of 13%. While ELBW and VLBW percentages either remained constant or decreased (0% and -27%, respectively), the proportion of white infant deaths with a low birthweight (1500 – 2499g) increased by 75%.

The percentage of black infant deaths with a normal birthweight (more than 2500g) was 13% in the 2005 – 2010 time period, and 24% in the 2011 – 2015 period, an increase of 80%. While ELBW remained constant at 62% of all black infant deaths. VLBW and LBW percentages fell by 40 and 30%, respectively.

Table 12. Birth weight by month of initiation into prenatal care: numbers and column-wise percentages

	0-3	4-6	7-9	Unknown	Total
ELBW (under 750g)	210 (48.8)	26 (36.6)	2 (20.0)	88 (63.8)	326 (50.2)
VLBW (750 – 1499g)	51 (11.0)	6 (8.5)	0 (0.0)	10 (7.2)	67 (10.3)
LBW (1500 – 2499g)	51 (13.5)	10 (14.1)	0 (0.0)	17 (12.3)	85 (13.1)
Normal BW (2500+g)	107 (24.9)	28 (39.4)	8 (80.0)	18 (13.0)	161 (24.8)
Unknown	4 (0.9)	1 (1.4)	0 (0.0)	5 (3.6)	10 (1.5)
Mean	1423	1822	2414	1052	1405
Standard Deviation	1207	1244	1165	1067	1206
10th Percentile	302	394	520	224	280
25th Percentile	456	510	2531	353	439
Median	762	1960	2636	539	720
75th Percentile	2516	2957	3161	1795	2514
90th Percentile	3303	3402	3307	2998	3266

Seen in Table 12, among all infant deaths, 50% were categorized as extremely low birth weight, and 74% had a birth weight less than 2500g. While there was a correlation between month of initiation into prenatal care and birth weight, there was no significant difference group means ($F(3,355) = 2.08$, $p = 0.1$).

Table 13. Birth weight by number of prenatal care visits: numbers and column-wise percentages

	0	1-5	6-10	11-15	16-20	21-25	26-30	Unknown	Total
ELBW (under 750g)	27 (69.0)	118 (76.0)	74 (42.0)	27 (21.0)	5 (19.0)	2 (40.0)	0 (0.0)	73 (63.0)	326 (50.2)
VLBW (750 – 1499g)	5 (13.0)	17 (11.0)	19 (11.0)	12 (9.0)	3 (12.0)	2 (40.0)	1 (25.0)	8 (7.0)	67 (10.3)
LBW (1500 – 2499g)	4 (10.0)	6 (4.0)	29 (16.0)	24 (19.0)	9 (35.0)	0 (0.0)	0 (0.0)	13 (11.0)	85 (13.1)
Normal BW (2500+g)	3 (8.0)	11 (7.0)	52 (29.0)	65 (51.0)	9 (35.0)	1 (20.0)	3 (75.0)	17 (15.0)	161 (24.8)
Unknown	0 (0.0)	3 (2.0)	2 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (4.0)	10 (1.5)
Mean	882	746	1554	2249	2052	1201	2900	1087	1405
Standard Deviation	844	814	1176	1207	1043	929	1316	1119	1206
10th Percentile	282	221	371	546	660	501	1600	237	280
25th Percentile	366	312	485	1026	1002	545	2252	359	439
Median	567	485	1150	2565	2168	932	3172	538	720
75th Percentile	794	666	2664	3239	3084	1300	3820	1650	2514
90th Percentile	2410	2029	3260	3617	3350	2172	3982	2990	3266

Table 13 shows the relationship between birthweight and the number of prenatal visits the mother obtained. While there was a correlation between number of prenatal care visits and birth weight, that trend stopped after the number of visits exceeded 20. This may be due to the fact that a quantity of visits far above the normal (7-12) may be associated with known problems with the fetus. There was a significant difference between group means ($F(7,351) = 4.83$, $p < 0.001$). Specifically, the "1 – 5" visits was significantly different than the "11 – 15" visits ($p = 0.05$).

Table 14 Birth weight by mother's age: numbers and column-wise percentages

	17 or less	18 – 19	20 – 29	30 – 39	40+	Unknown	Total
ELBW (under 750g)	1 (16.7)	14 (42.8)	152 (46.9)	134 (54.9)	19 (65.5)	6 (42.9)	326 (50.2)
VLBW (750 – 1499g)	1 (16.7)	5 (15.6)	32 (9.9)	24 (9.8)	4 (13.8)	1 (7.1)	67 (10.3)
LBW (1500 – 2499g)	0 (0.0)	2 (6.2)	40 (12.3)	41 (16.8)	2 (6.9)	0 (0.0)	85 (13.1)
Normal BW (2500+g)	4 (66.7)	10 (31.2)	96 (29.6)	42 (17.2)	4 (13.8)	5 (35.7)	161 (24.8)
Unknown	0 (0.0)	1 (3.1)	4 (1.2)	3 (1.2)	0 (0.0)	2 (14.3)	10 (1.5)
Mean	2282	1518	1509	1259	1061	1664	1405
Standard Deviation	1255	1193	1261	1099	1206	1397	1206
10th Percentile	680	454	266	285	266	317	280
25th Percentile	1293	534	440	425	353	473	439
Median	2891	922	794	629	510	986	720
75th Percentile	3108	2849	2751	2040	932	3032	2514
90th Percentile	3274	3176	3288	3103	2712	3384	3266

In Table 14, mother's age was examined as an impact on birth weight among infants that died. There was no correlation between mother's age on birth weight. There was no significant difference between group means ($F(5,353) = 4.83$, $p = 0.38$).

The next set of data regard the gestational age of the infant at birth.

Gestational age is generally calculated from the first day of the mother's last menstrual period (LMP). Infants born prior to 37 weeks gestation are considered premature.

To better understand the specific subpopulations of infants that may be vulnerable to mortality, gestational ages have been collapsed into categories. Refer to the Methodology at the beginning of the report for definitions.

Rates of infection and sudden infant death syndrome decrease with increasing gestational age at birth. Infants born before 34 weeks, and even late preterm infants (born between 32 – 37 weeks) present 3-5 times higher risk of dying than those born at term. Even among preterm infants that survive, they are more likely to develop cognitive and neurologic impairments.

Table 15. Gestational Age by Mother's Race: numbers and column-wise percentages[5]

	White	Black	Asian	Other	Unknown	Total
Extreme Preterm (<28 wks)	217 (49.5)	113 (68.1)	13 (72.2)	11 (73.3)	7 (58.3)	361 (55.6)
Very Preterm (28 – 31 wks)	35 (8.0)	9 (5.4)	0 (0.0)	1 (6.7)	0 (0.0)	45 (6.9)
Moderate-late Preterm (32-36 wks)	60 (13.7)	14 (8.4)	1 (5.6)	1 (6.7)	1 (8.3)	77 (11.9)
Term (37+ wks)	126 (28.8)	30 (18.1)	4 (22.2)	2 (13.3)	1 (8.3)	163 (25.1)
Unknown	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (25.0)	3 (0.5)
Mean	29.1	26.5	25.6	25.9	24.3	28.2
Standard Deviation	7.7	7.1	7.7	5.9	7.0	7.6
10th Percentile	20.0	19.0	19.7	21.4	20.4	20.0
25th Percentile	22.0	21.0	20.2	22.0	21.0	22.0
Median	28.0	24.0	21.0	23.0	21.0	25.0
75th Percentile	37.0	32.8	30.2	28.0	22.0	37.0
90th Percentile	39.0	39.0	38.3	35.8	35.6	39.0

As shown in Table 15, the percentage of all infant deaths considered to be premature (less than 37 weeks gestation), was 76.9%. A greater percent of black infant deaths were premature at 82.1%, compared to white infant deaths (74.1%). When looking at the subtypes of prematurity, 58.2% of all infant deaths were extremely preterm – again that percentage increased among black infants (70.5%), and was lower among white infants (51.9%). There was no significant difference between racial group means ($F(4,354) = 2,3$, $p = 0.058$).

The percentage of all infant deaths that were considered extremely preterm fell by 1% between 2005-2010 and 2011-2015. In contrast, both the percentages of very preterm and moderate-late preterm infant deaths increased by 4% and 10%, respectively.

[5] Does not include answers that were coded as unknown; uses estimated gestation age as determined by physician.

Among white infants, the trends remain similar to that of overall infant death proportions. Extreme preterm fell by 4%, and the proportion of infant deaths that were considered term decreased by 3%. However, the proportion of white infant deaths that were very preterm or moderate-late preterm increased by 13% and 15%, respectively.

Among black infants, the trends were different. Extreme preterm grew by 4%, but the proportion of infant deaths that were considered term remained unchanged. Additionally, the proportion of black infant deaths that were very preterm decreased by 17%, whereas the proportion of moderate-late preterm deaths decreased by 1%.

Cause of Death

The next set of data examine the cause of death. The cause of death is taken verbatim from the infant's death certificate and grouped into six categorizes to standardize these summaries according to definitions used by other state health departments. The rules for the groupings are explained in the Methodology section.

Table 16. Cause of Death by Mother's Race: numbers and column-wise percentages

	White	Black	Asian	Other	Unknown	Total
Congenital Anomalies	97 (22.1)	23 (13.9)	3 (16.7)	0 (0.0)	2 (16.7)	125 (19.2)
Maternal Factors	60 (13.7)	15 (9.0)	5 (27.8)	2 (13.3)	2 (16.7)	84 (12.9)
Perinatal	88 (20.1)	41 (24.7)	1 (5.6)	3 (20.0)	0 (0.0)	133 (20.4)
Short Gestation and Low Birthweight	97 (22.1)	53 (31.9)	5 (27.8)	4 (26.7)	6 (50.0)	165 (25.4)
SUID (SIDS/Suffocation in Bed, Unknown)	38 (8.7)	15 (9.0)	0 (0.0)	2 (13.3)	0 (0.0)	55 (8.4)
External Causes	10 (2.3)	6 (3.6)	1 (5.6)	0 (0.0)	2 (16.7)	19 (2.9)
Other	48 (11.0)	13 (7.8)	3 (16.7)	4 (26.7)	0 (0.0)	0 (0.0)

Figure 15. Cause of Death by Mother's Race

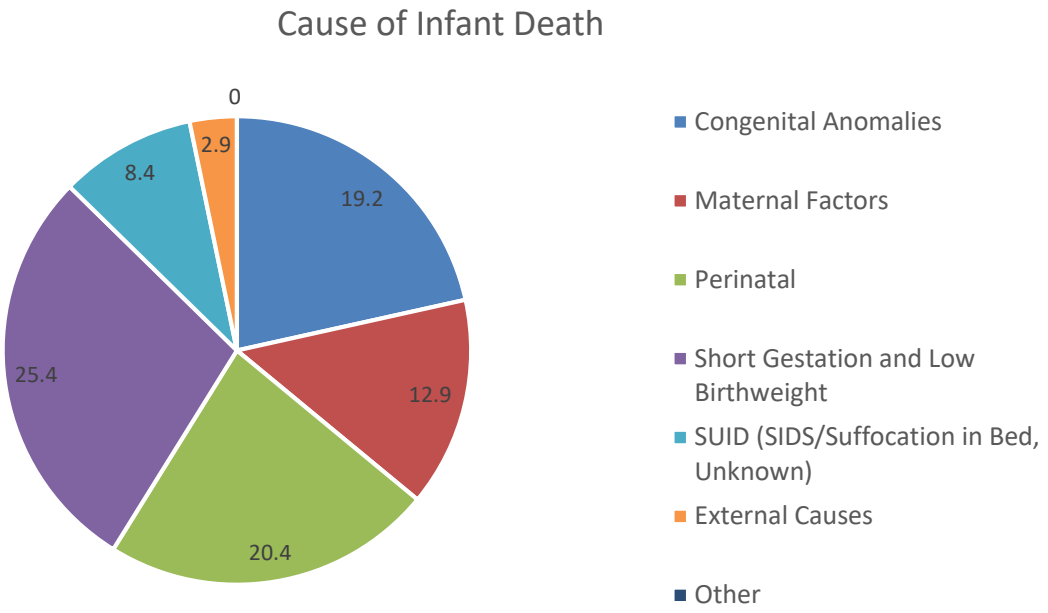


Table 16 and Figure shows the cause of deaths for all infant deaths, classified by mother's race. The primary cause of infant death is short gestation and low birthweight at 25.4%, followed by perinatal causes at 20.4%, and congenital anomalies at 19.2%. There was a statistically significant association found between mother's race and cause of death ($X^2(20, N= 359) = 40$, $p = 0.03$).

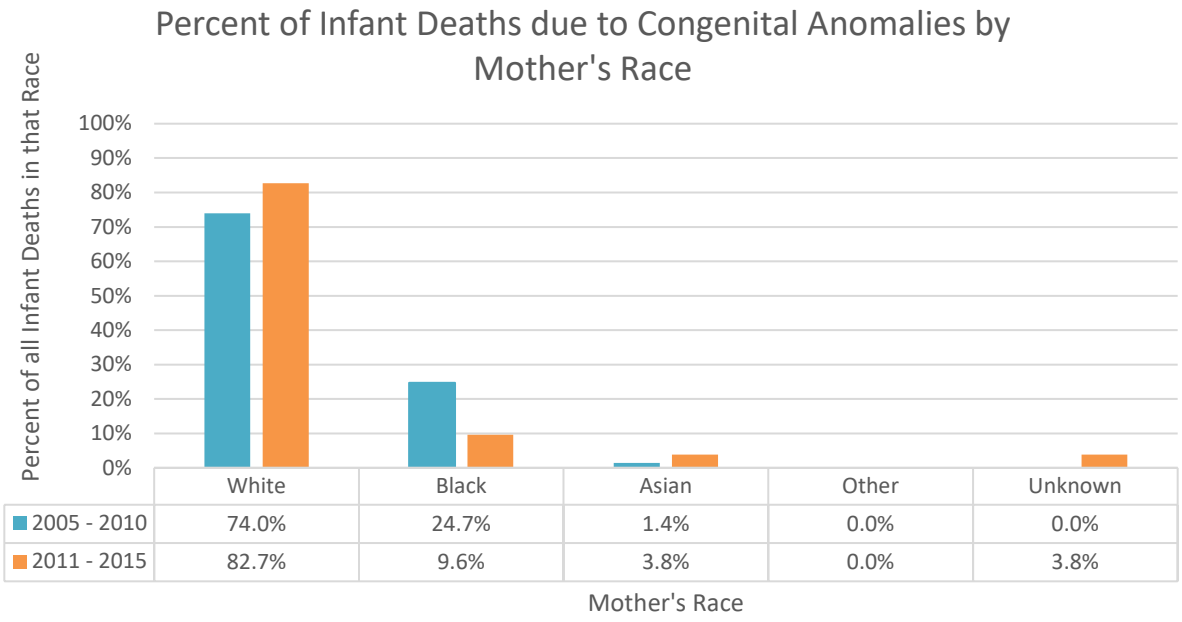
The percentage of all infant deaths due to SUIDS increased by 25% between 2005-2010 and 2011-2015, along with maternal factors and short gestation/low birthweight (17% for both). In contrast, the percentages of infant deaths due to congenital anomalies, perinatal factors, external, and other causes decreased by 5%, 14%, 33%, and 9%, respectively.

Among white infants, the trends remained similar to that of overall infant death proportions. The percentage of white infant deaths due to SUIDS increased by 25% between 2005-2010 and 2011-2015, along with congenital anomalies, maternal factors, and short gestation/low birthweight (14%, 8%, and 14%, respectively). In contrast, all other causes decreased by approximately 30%.

Among black infants, the trends were more distinct. Where overall and in white groups, congenital anomalies percentages had increased, the percentage of black infant deaths due to congenital anomalies decreased by 71%. The percentage of black infant deaths due to SUIDS increased by 25% between 2005-2010 and 2011-2015, along with maternal factors, perinatal, and short gestation/low birthweight (57%, 17% and 21%, respectively). In contrast, other causes decreased by 13%. The percentage of black infant deaths remained unchanged.

The next seven figures (Figures 16 – 22) will show racial disparities for each cause of death, broken down by time. Only white, black, and Asian infant percentages will be discussed due to only 6 other-race and 7 unknown deaths occurring over the study period.

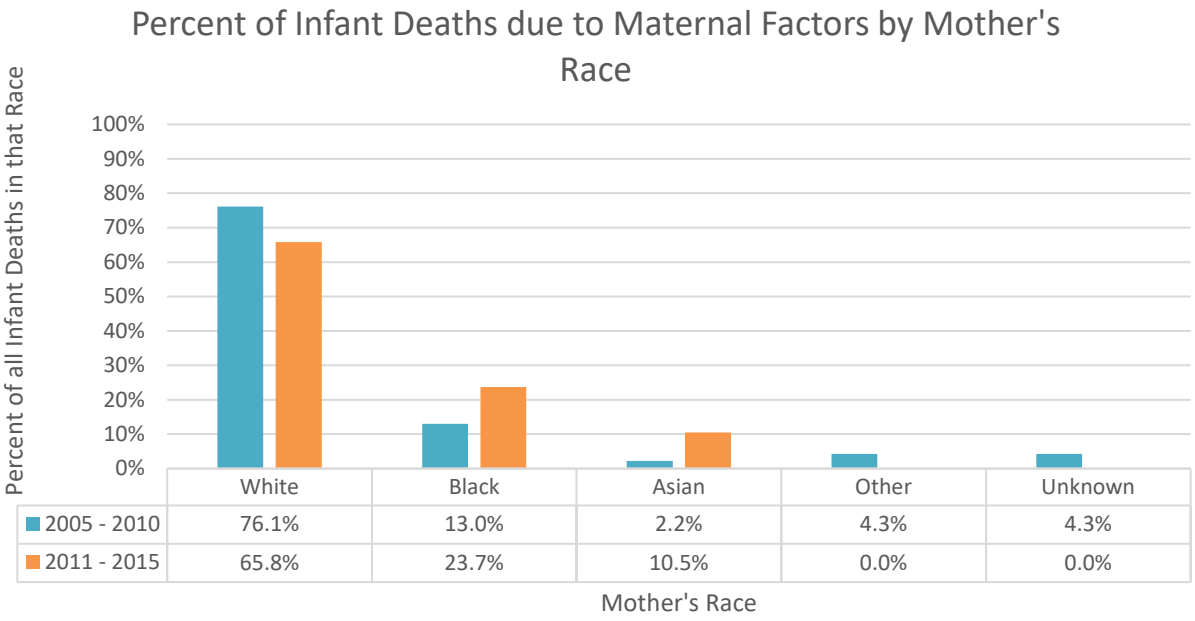
Figure 16. Percent of Infant Deaths due to Congenital Anomalies, by Time and Mother's Race



	White	Black	Asian	Other	Unknown
2005 - 2010	74.0%	24.7%	1.4%	0.0%	0.0%
2011 - 2015	82.7%	9.6%	3.8%	0.0%	3.8%

Figure 16 shows cause of death by mother's race for congenital anomaly infant deaths. For white infants, the percentages increased; for black and Asian infants, they decreased.

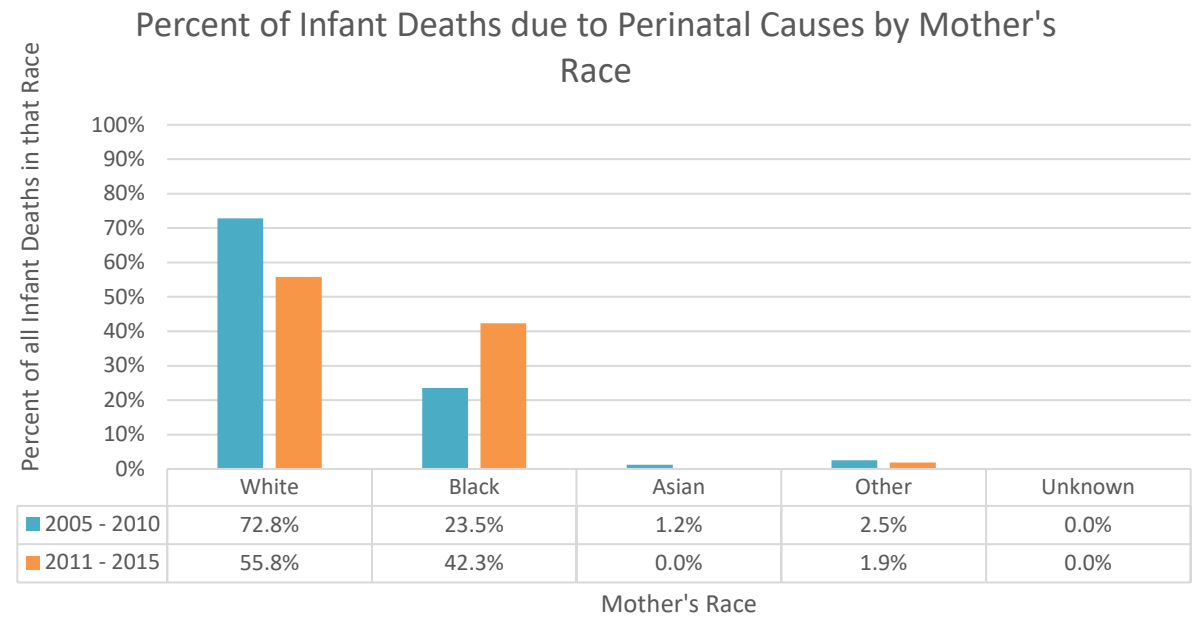
Figure 17. Percent of Infant Deaths due to Maternal Factors, by Time and Mother's Race



	White	Black	Asian	Other	Unknown
2005 - 2010	76.1%	13.0%	2.2%	4.3%	4.3%
2011 - 2015	65.8%	23.7%	10.5%	0.0%	0.0%

Figure 17 shows cause of death by mother's race for maternal factors relating to infant deaths. For black and Asian infants, the percentages increased; a fewer proportion of white infant deaths were due to maternal factors in the second time period.

Figure 18. Percent of Infant Deaths due to Perinatal Causes, by Time and Mother's Race



	White	Black	Asian	Other	Unknown
2005 - 2010	72.8%	23.5%	1.2%	2.5%	0.0%
2011 - 2015	55.8%	42.3%	0.0%	1.9%	0.0%

Figure 18 shows cause of death by mother's race due to perinatal causes. For white infants, the percentage of infant deaths due to perinatal causes fell; the reverse was true for black infants.

Figure 19. Percent of Infant Deaths due to Short Gestation and Low Birthweight Causes, by Time and Mother's Race

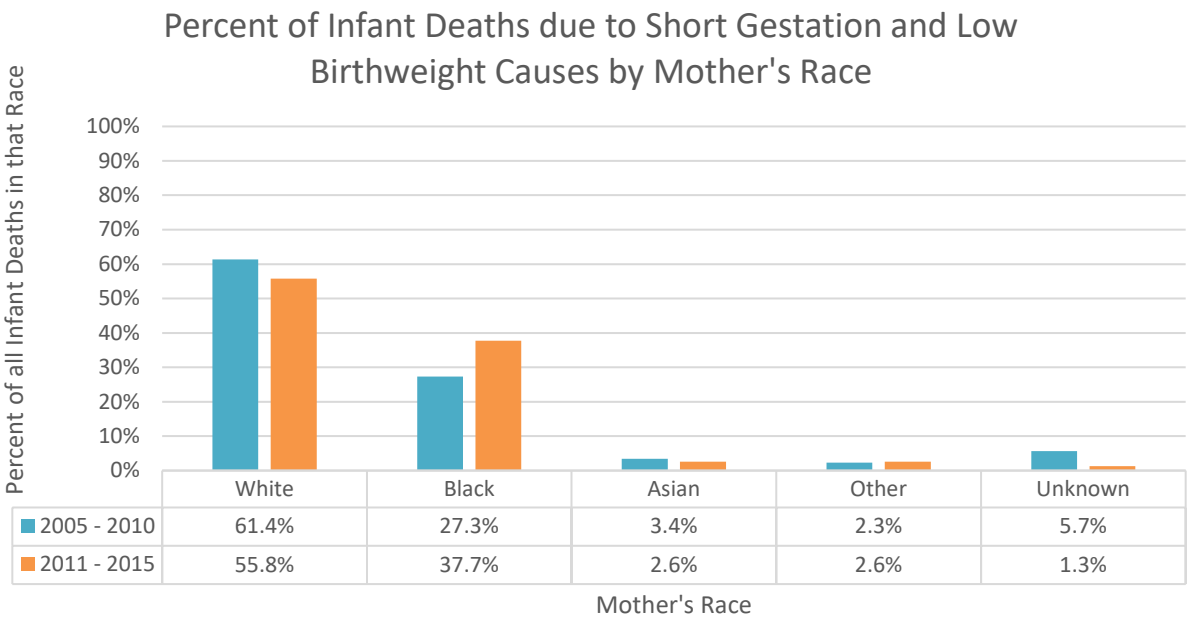


Figure 19 shows cause of death by mother's race due to short gestation and low birthweight causes. For white infants, the percentage of infant deaths due to perinatal causes increased over time; the reverse was true for both black and Asian infants.

Figure 20. Percent of Infant Deaths due to SUID Causes, by Time and Mother's Race

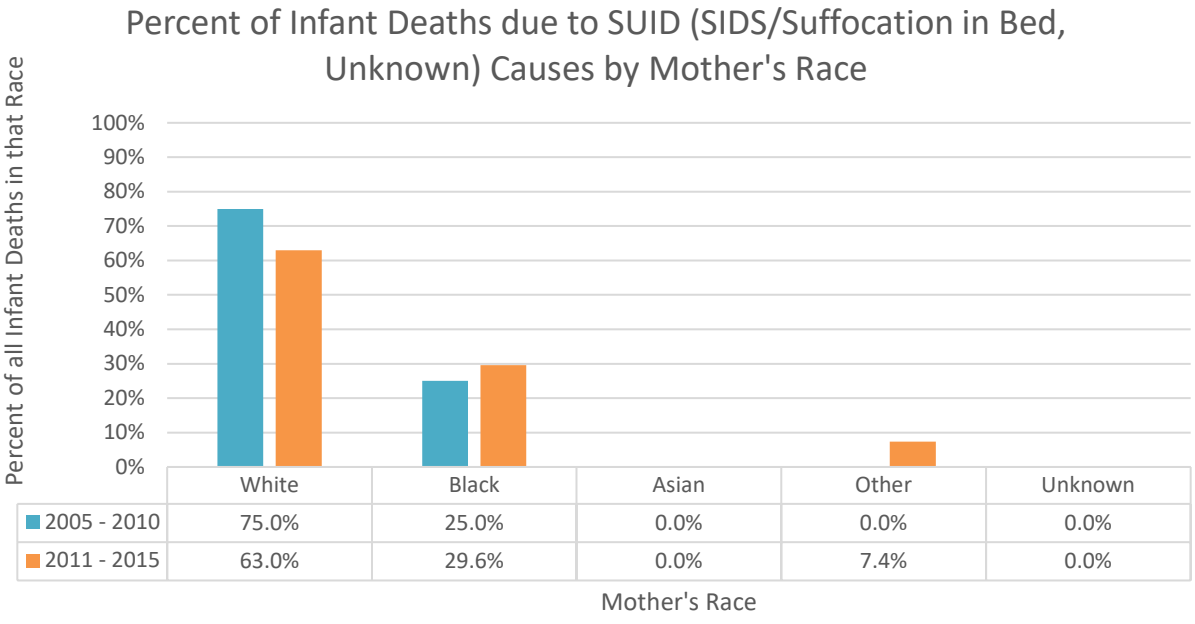
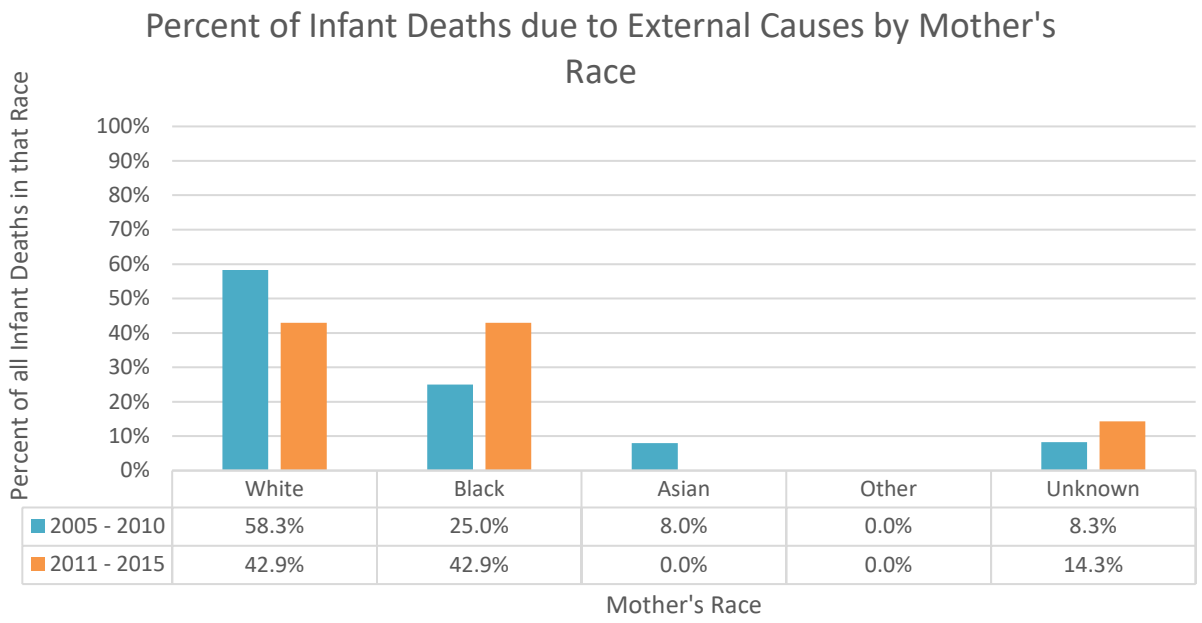


Figure 20 shows cause of death by mother's race due to SUID causes. For white infants, the percentage of infant deaths due to perinatal causes decreased over time; the reverse was true for black infants.

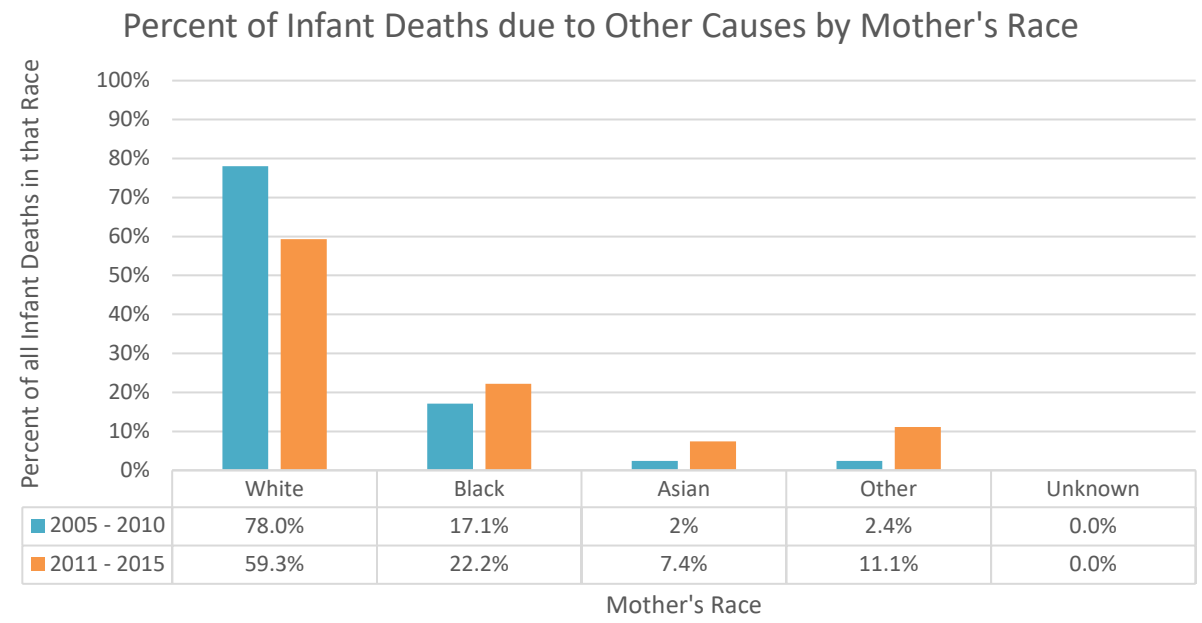
Figure 21. Percent of Infant Deaths due to External Causes, by Time and Mother's Race



	White	Black	Asian	Other	Unknown
2005 - 2010	58.3%	25.0%	8.0%	0.0%	8.3%
2011 - 2015	42.9%	42.9%	0.0%	0.0%	14.3%

Figure 21 shows cause of death by mother's race due to extenral causes. For black infants, the percentage of deaths due to external causes increased over time; the reverse was true for white infants.

Figure 22. Percent of Infant Deaths due to Other Causes, by Time and Mother's Race



	White	Black	Asian	Other	Unknown
2005 - 2010	78.0%	17.1%	2%	2.4%	0.0%
2011 - 2015	59.3%	22.2%	7.4%	11.1%	0.0%

Figure 22 shows cause of death by mother's race due to other causes. For white and black infants, the percentage of their racial total infant deaths due to other causes decreased over time; the reverse was true for Asian infants.

Risk Factors

Birthweight

Table 17. Demographic Characteristics of infant deaths, by birthweight

Characteristics		Total (N = 639)	Low Birthweight (N = 478)	Normal (N = 161)	P-Value
Gender	**Female**	304 (47.5)	233 (49.0)	71 (44.0)	0.3
Mother's Age	**< 17**	6 (0.9)	2 (0.4)	4 (2.5)	< 0.001
	18 - 19	31 (4.9)	21 (4.5)	10 (6.4)	
	20 -29	320 (51.0)	224 (47.6)	96 (61.5)	
	30 - 39	241 (38.4)	199 (42.3)	42 (26.9)	
	40+	29 (4.6)	25 (5.3)	4 (2.6)	
Mother's Race	**White**	432 (68.6)	308 (65.7)	124 (77.0)	0.04
	Black	165 (26.2)	132 (28.1)	33 (20.5)	
	Asian	18 (2.9)	16 (3.4)	2 (1.2)	
	Other	15 (2.4)	13 (2.8)	2 (1.2)	
Estimated Gestation	**Extreme Preterm**	354 (55.4)	352 (73.6)	2 (1.2)	< 0.001
	Very Preterm	45 (7.0)	44 (9.2)	1 (0.1)	
	Moderate Preterm	77 (12.0)	54 (11.3)	23 (14.3)	
	Term	163 (25.5)	28 (5.9)	135 (83.9)	
Cause of Death	**Congenital Anomalies**	125 (19.6)	75 (15.7)	50 (31.1)	< 0.001
	Maternal Factors	81 (12.7)	78 (16.3)	3 (1.9)	
	Perinatal	131 (20.5)	113 (23.6)	18 (11.2)	
	Short Gestation and Low Birthweight	162 (25.4)	160 (33.5)	2 (1.2)	
	SUID (SIDS/Suffocation in Bed, Unknown)	55 (8.6)	11 (2.3)	44 (27.3)	
	External Causes	17 (2.7)	1 (0.1)	16 (9.9)	
	Other	68 (10.6)	40 (8.4)	28 (17.4)	
Trimester Prenatal Care Initiated	**First (0-3)**	426 (84.2)	319 (87.9)	107 (74.8)	< 0.001
	Second (4-6)	70 (13.8)	42 (11.6)	28 (19.6)	
	Third (7-9)	10 (19.8)	2 (0.6)	8 (5.6)	
Number of Prenatal Visits	**0**	39 (7.4)	36 (9.4)	2 (2.1)	< 0.001
	1-5	152 (28.8)	141 (36.7)	11 (7.6)	
	6-10	174 (33.0)	122 (31.8)	52 (36.1)	
	11-15	128 (24.2)	63 (16.4)	65 (45.1)	
	16-20	26 (4.9)	17 (4.4)	9 (6.2)	
	21-25	5 (0.9)	4 (1.0)	1 (0.7)	
	26-30	4 (0.8)	1 (0.3)	3 (2.1)	

Birth Payment Type	**Private Insurance**	382 (60.7)	306 (65.0)	76 (48.1)	< 0.001
	Medicaid	233 (37.0)	155 (32.9)	78 (49.4)	
	Self-Pay	8 (1.3)	7 (1.5)	1 (0.1)	
	Other	6 (0.1)	3 (0.1)	3 (1.9)	

Limitations

This report's findings are subject to several limitations. An important concern is the issue of receiving vital events from other states within the MDHHS reporting deadline. Vital statistics are gathered on an occurrence basis but are traditionally reported on a residence basis. For complete residence statistics, reports must be received from other states for events occurring to Michigan residents. Because of delays or other late reporting, some out-of-state vital event reports have not been received by MDHHS by the cutoff date of the year following the event year.

Evaluation of the linked birth/infant death cohort is subject to limitations due to the inability to link all deaths to a corresponding birth report. This inability may be due to a number of reasons related to receipt of the corresponding record from another state, name differences between the two reports, both events not occurring in Michigan, or residency changes. Additionally, comparison of Michigan linked data to other state or national data has limitations due to the timeliness of the national reports as well as differences in methodology. As mentioned earlier, out-of-state births may not be available to match infant deaths at the state level, but are available for matching at the national level.

The ICD-10 death classification system limits the bias of human coding of mortality information. The system also attempts to reduce the effect of spelling errors or placement of literal information in the cause of death fields. One limitation is the system's inability to take into account differences in knowledge and attitudes among physicians who complete the cause of death information. Individual biases, unfamiliarity with the patient, or inability to perform an autopsy may affect the information available to the physician when certifying the cause of death. While many death certificates contain four full lines of detailed information on the events or illnesses leading up to the death, some death certificates contain only limited information.

Smoking status and other potential risk factors may be under-reported on birth certificates, due to social bias.

Initiatives

The Macomb County Health Department (MCHD) is committed to reducing infant mortality, both internally through existing programs, and working with partners through the Baby Resource Network of Macomb (BRNM). The BRNM is a coalition of representatives from multiple agencies equally committed to decreasing infant mortality. This group has been very active in the education of infant safe sleep and sharing of resources through development of a webpage. The next step is creating a comprehensive Infant Mortality Reduction Plan.

In January 2017, MCHD began a Maternal Child Health Assessment to identify maternal child health needs in the county. Knowing that there are multiple reasons for infant mortality, this was an opportunity to identify causes specific to Macomb County. The BRNM was integral to this process. They were involved in identifying community themes and strengths through qualitative data collection (i.e. surveys, community walls and focus groups). In addition, designated MCHD staff compiled and analyzed population data related to the health and well-being of women, children and infants, and identified health issues of concern.

In September 2017, after careful consideration of the qualitative data and analysis of the population data, several themes emerged which led to the development of three goals:

1. To promote healthy lifestyle behaviors during pre-conception, pregnancy, post-partum, and inter-conception
2. To communicate the availability of resources
3. To reduce the number of preventable infant deaths in Macomb County

These goals formulate the beginning of the Macomb County Infant Mortality Reduction Plan. The Macomb County Health Department and Baby Resource Network of Macomb will now be working diligently to further define objectives, craft actions steps, and begin implementation of this plan. Although infant mortality was not the sole focus of the Maternal Child Health Assessment, accomplishment of the above goals can potentially have a substantial impact on infant mortality by improved maternal child health overall.