Michigan Perinatal Period of Risk (PPOR)

Prepared by Haifa Haroon (haroonh@michigan.gov), Maternal and Child Health (MCH) Epidemiology Section,
Michigan Department of Health and Human Services (MDHHS)
Data source: Michigan resident live birth files, infant mortality files, and fetal death files,
Division for Vital Records and Health Statistics, MDHHS
February 2022

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This presentation provides updated 2015-2019 feto-infant mortality rates for the State of Michigan, and 2017-2019 feto-infant mortality rates by region, city and county.

This presentation was prepared by Haifa Haroon, Maternal and Child Health Epidemiology Section, Michigan Department of Health and Human Services (MDHHS)

Data source: Michigan resident live birth files (9/18/20), infant mortality files (6/10/21), and fetal death files (10/29/20), Division for Vital Records and Health Statistics, MDHHS

Revised: February 2022

Table of Contents

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

Stages of PPOR

Feto-infant mortality is mapped, excess mortality is estimated, likely causes of feto-infant mortality are determined, and appropriate actions are suggested.

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

PPOR is a comprehensive approach to help communities reduce infant mortality. It's designed as a 6-stage community-based planning process.

Stage 1 consists of engaging partners and aligning efforts, as well as assessing analytic readiness.

Stage 2, which this focus of this presentation, uses data to narrow down the likely causes of fetal and infant mortality in a population.

Stage 3 is developing action plans based on the information learned + current planning efforts.

Stage 4 and 5 are focused on implementation, monitoring, and evaluation

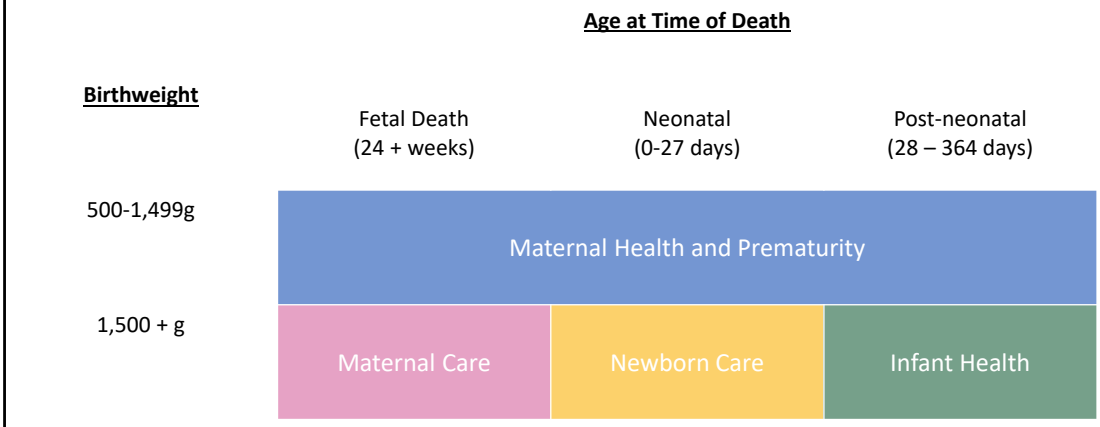
Finally, stage 6 is sustaining efforts.

METHODS

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

There are 2 phases to the analysis. Phase 1 + 2 results for Michigan are included in this presentation.

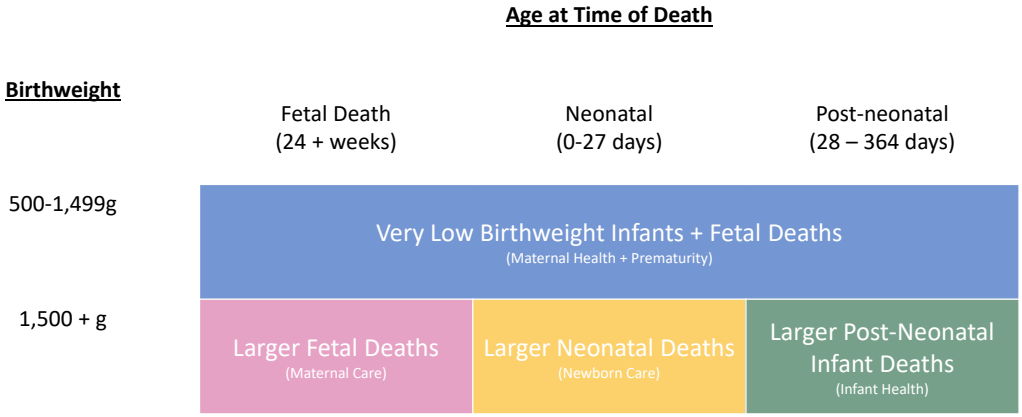
PPOR "Map" of Fetal/Infant Mortality



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

The initial analysis divides fetal and infant deaths into four perinatal periods of risk based on both birth weight and age at death. The periods of risk are useful because causes of death tend to be similar within each, so when a community finds problems in only one or two periods of risk, efforts can be focused on those periods. A feto-infant mortality rate is calculated for each period of risk, to allow the stakeholders to compare populations within their jurisdictions, to examine time trends, and to compare to other cities, or to a reference group.

PPOR "Map" of Fetal/Infant Mortality



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

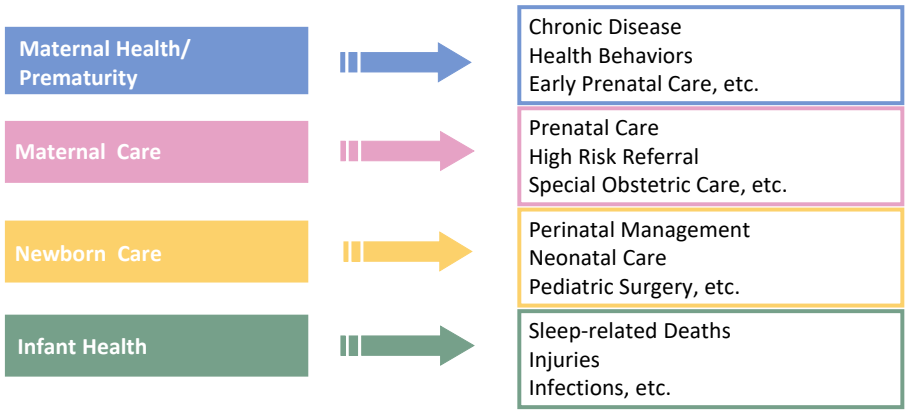
This is the same PPOR "map", but with alternate names for each period of risk.

Study Group	Reference Group
• Michigan resident • Gave birth 2017-2019	• Michigan resident • Gave birth during 2017-2019 • White, non-Hispanic mother • 20-39 years old • More than 12 years of education *or* intention to use private insurance at delivery

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

Fetal and infant deaths in both the study and reference group were organized into a period of risk and then compared. The underlying assumption with the reference group is this: if one population can experience better feto-infant mortality rates, than other populations should be able to attain the same rates.

Each period of risk has its own risk factors



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

Each period of risk is associated with its own set of risk and prevention factors. The four periods provide a framework that helps communities move from having data to using it, prioritizing limited resources, and using evidence to maximize impact.

The analysis consists of two phases. Phase 2 of the analysis digs into these risk and preventive factors + understanding the mechanism or pathway for the excess feto-infant mortality.

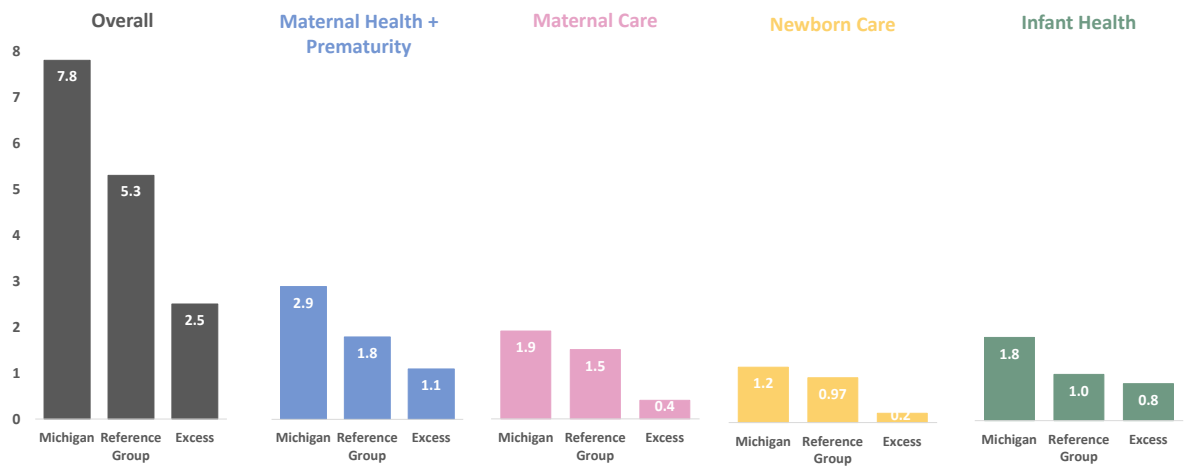
RESULTS | MICHIGAN

2017-2019

Phase 1

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

Excess Feto-Infant Mortality Rate (per 1,000 live births + fetal deaths)

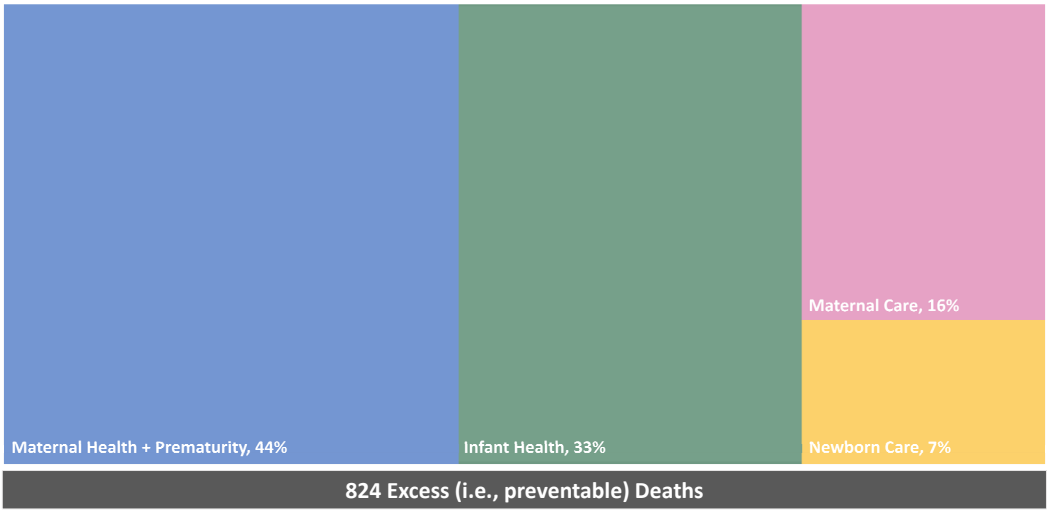


Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the feto-infant mortality rate calculated for each period of risk for both Michigan (the study group, left) and the reference group (middle), as well as the excess mortality rate (right). The excess mortality rate is calculated by subtracting the feto-infant mortality rate in the reference group from the rate in Michigan for each period of risk.

During 2017-2019, overall, the feto-infant mortality rate was 7.8 and 5.3 deaths per 1,000 live births + fetal deaths in Michigan, and the reference group, respectively. The excess mortality was 2.5 deaths per 1,000 live births + fetal deaths.

Where is the excess mortality?



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

Overall, during 2017-2019, there were 824 excess or preventable fetal + infant deaths in Michigan. 44% of the excess deaths are in the Maternal Health + Prematurity risk period. 33% of the excess deaths are in the Infant Health risk period. 16% of the excess deaths are within the Maternal Care period of risk. Lastly, 7% of the excess deaths are in the Newborn Care period of risk.

RESULTS | MICHIGAN

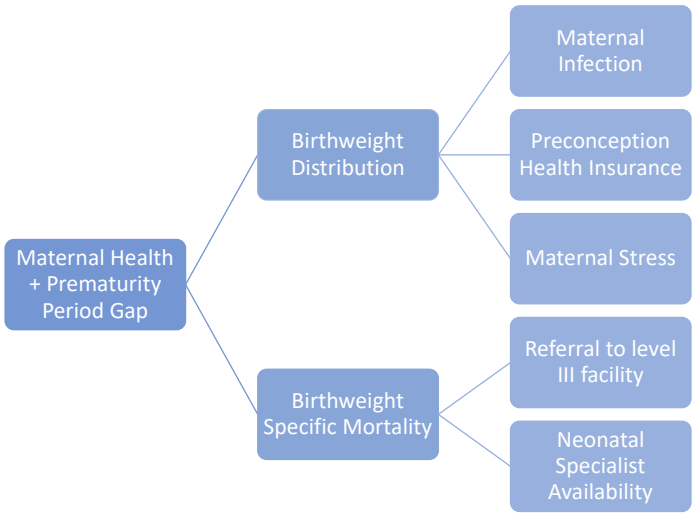
2017-2019

Phase 2

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

The following slides contain Phase 2 results for Michigan. Phase 2 of PPOR is a systematic investigation to better understand why these excess deaths occurred, by identifying the pathway/mechanism for the excess feto-infant mortality specifically in the periods of risk with the largest excess mortality. Statewide, this would include the periods of risk – maternal health + prematurity and infant health – which account for more than 75% of the excess infant deaths.

Maternal Health + Prematurity Risk Period

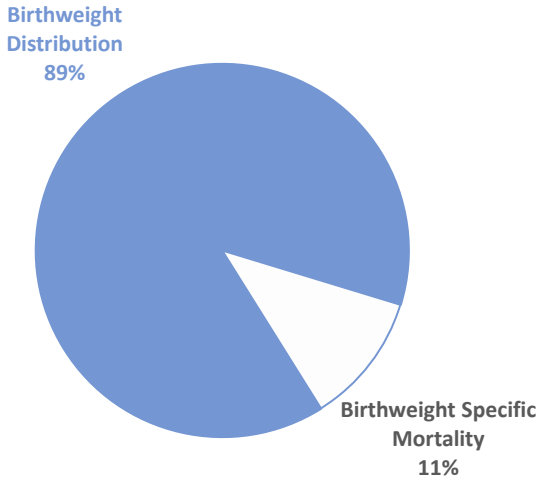


Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the two potential mechanisms that may be driving the excess mortality within the maternal health + prematurity risk period – 1) birthweight distribution: whether too many babies are born too small, which itself is associated with specific risk factors such as infection or maternal stress, and 2) birthweight specific mortality: whether the excess mortality rate is due a much higher mortality rate among very low birthweight infants statewide, which is associated with its own risk factors + potential interventions.

What is driving the maternal health + prematurity disparity?

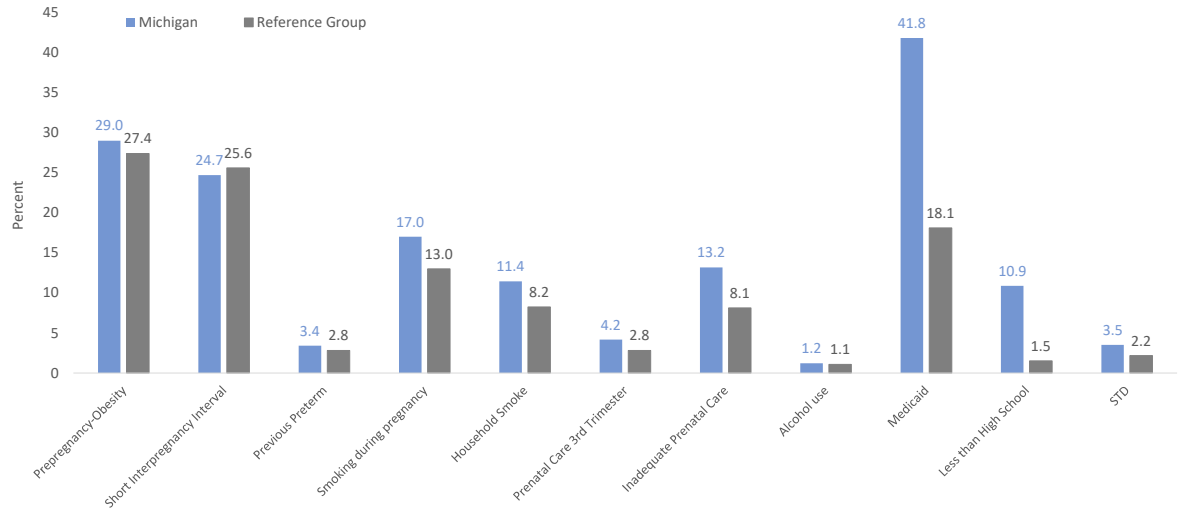
Based on the Kitagawa Analysis, the disparities in Michigan are due to **too many babies that were born too small**



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

The Kitagawa analysis was completed to determine whether birthweight distribution or birthweight specific mortality was driving the disparity in this period of risk. About 89% of the excess mortality in this risk period in Michigan is due to birthweight distribution.

Disparities in Prevalence of Risk Factors for Very low Birthweight

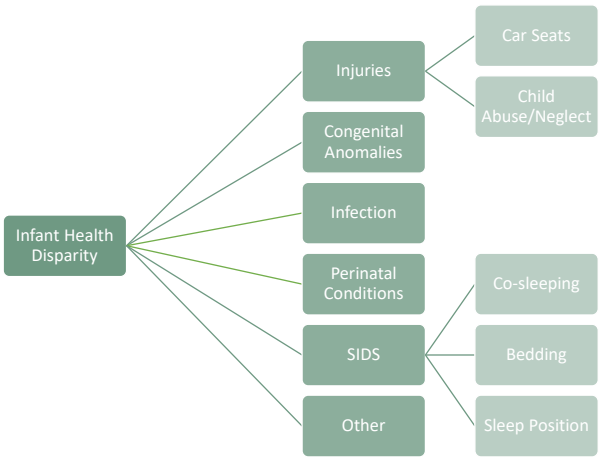


Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the prevalence of select risk and preventive factors for very low birthweight. Smoking during pregnancy and exposure to household smoke were both about 1.3-1.4 times higher in Michigan (study group) than the reference group. Inadequate prenatal care - based on the Kotelchuck Index - was 1.6 times higher statewide than the reference group.

The Kotelchuck index is based on when prenatal care began as well as the number of visits. Inadequate care refers to prenatal care begun after the 4th month or less than 50% of recommended prenatal visits were received. Medicaid as the intended method of payment at birth was 2.3 times more likely reported statewide, than the reference group. Sexually transmitted diseases (STDs) were 1.6 times greater statewide than the reference group

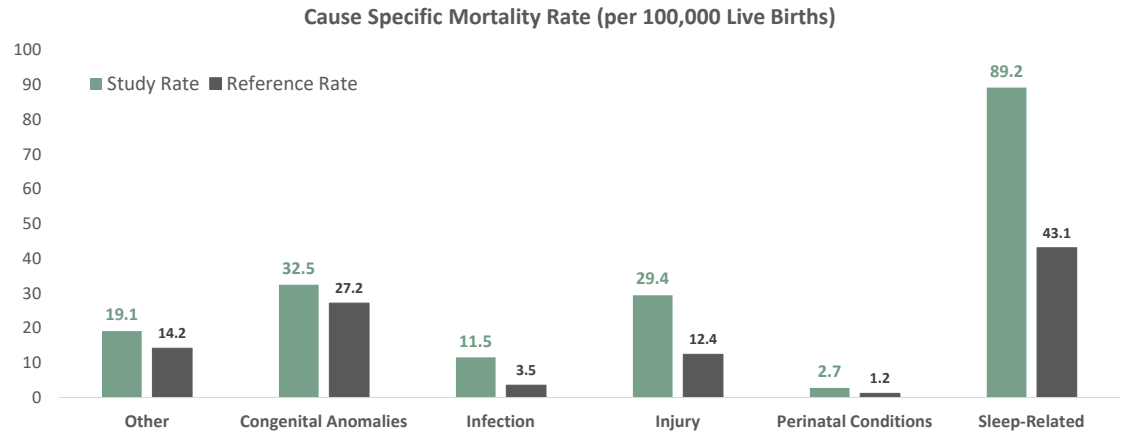
Infant Health Risk Group



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

Infant health is the other period of risk that made up a large proportion of the excess feto-infant deaths. These are infant deaths with a birthweight of 1,500g or greater, and infants who died after the 27-day mark. In order to better understand the disparity in the infant health period, the mechanism for the excess mortality – the cause of death – needs to be identified. This can help narrow points of intervention.

What is driving the infant health disparity?



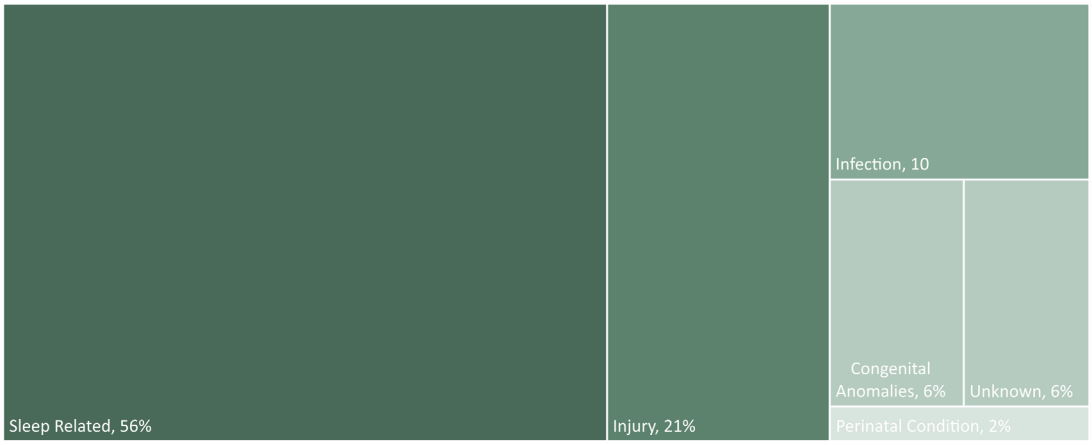
Sleep Related deaths: ICD Codes R95, R99, W84; Injury: All V + above, excluding W84; Congenital Anomaly: All Q ICD Codes; Perinatal Conditions: All P ICD Codes; Infection: All J ICD Codes.

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the cause specific mortality rates for the study group, Michigan (green), and the reference group (gray). Statewide, sleep related causes account for about 89 deaths per 100,000 live births. This is followed by cause of death: congenital anomalies (32.5 deaths per 100,000 live births) and injury (29.4 deaths per 100,000 live births).

In the reference group, sleep-related (43.1 deaths per 100,000 live births) and congenital anomalies (27.2 deaths per 100,000 live births) have the highest death rates. In terms of disparity between the two groups, the greatest disparity is in the sleep related and injury causes. Injury cause of death rates are 2.4 times higher statewide, while sleep related death rates are 2.1 times higher statewide than in the reference group.

What is driving the infant health disparity?



Sleep Related deaths: ICD Codes R95, R99, W84; Injury: All V + above, excluding W84; Congenital Anomaly: All Q ICD Codes; Perinatal Conditions: All P ICD Codes; Infection: All J ICD Codes.

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality within the infant health risk group as a proportion. More than half of the excess deaths within the infant health risk period are sleep related at 56%. Injury accounted for 21% of the excess deaths, infection 10%, and congenital anomalies 6%.

RESULTS | RACE/ETHNICITY

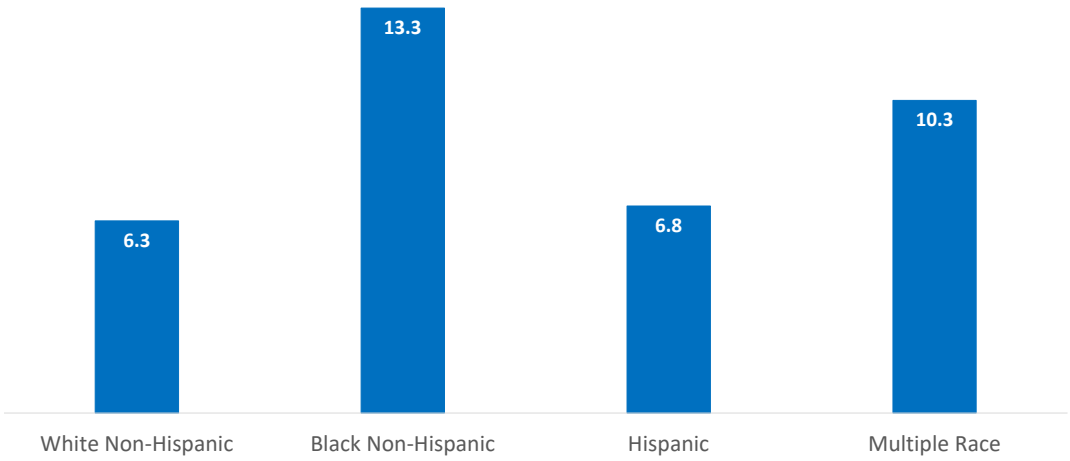
2015-2019

Phase 1

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

The following slides includes PPOR Phase 1 results by race/ethnicity during 2015-2019. The data was aggregated over 5 years in order to have a sufficient sample size. Race/ethnicity is based on maternal race/ethnicity.

Feto-Infant Mortality Rate by Race/Ethnicity

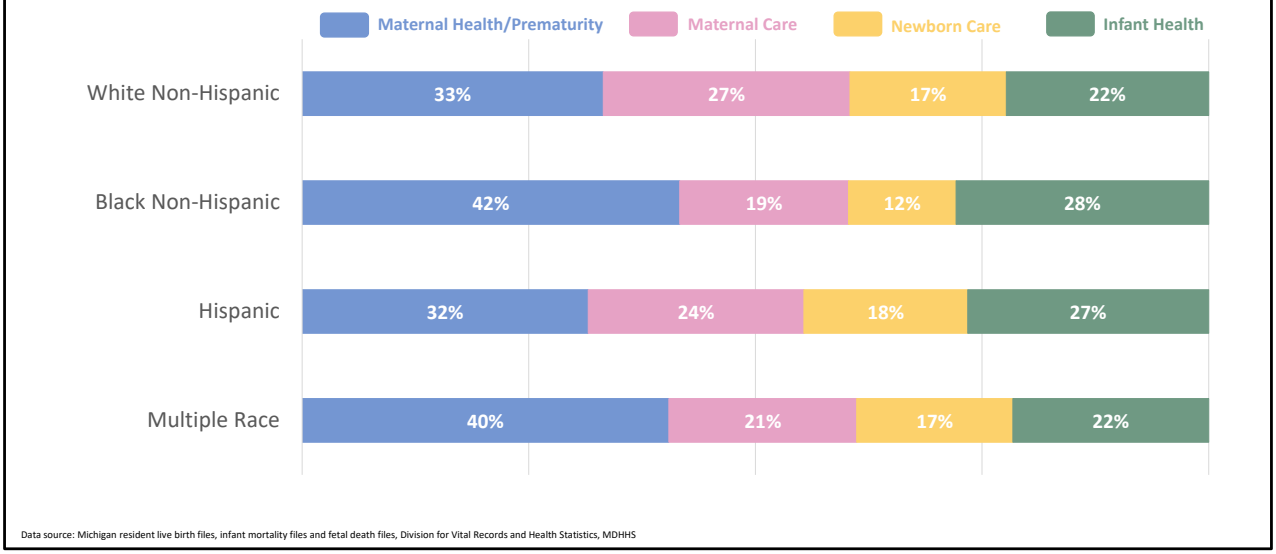


Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the feto-infant mortality by race/ethnicity in Michigan during 2015-2019.

Note: Race/ethnicity groups that did not meet minimum sample size necessary to complete phase 1 of the analysis were excluded.

Feto-Infant Mortality Rate Burden by Race/Ethnicity



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the period of risk the fetal and infant deaths are concentrated within each race/ethnicity group, as a proportion.

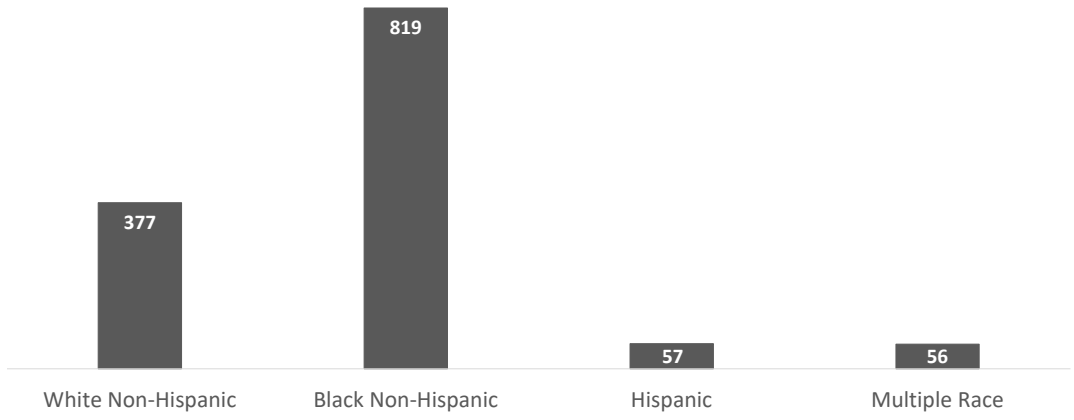
Maternal Health + Prematurity: Statewide, 37% of feto-infant deaths fall into this period of risk. The maternal health + prematurity risk group makes up a relatively larger proportion of feto-infant deaths among Black non-Hispanic (42%) infant and fetal deaths.

Maternal Care: Statewide, 25% of feto-infant deaths fall into this risk period. This is relatively consistent with other race/ethnicity groups. The maternal care risk period makes up a smaller proportion of feto-infant deaths within the Black non-Hispanic (19%), and the multiple race group (21%).

Newborn Care: Statewide, 15% of feto-infant deaths fall into this risk period. Between 12 – 18% of the feto-infant deaths by race/ethnicity fall into this risk period.

Infant Health: Statewide, 24% of the feto-infant deaths fall into this risk period. The infant health group makes up a larger proportion of Black non-Hispanic and Hispanic deaths, compared to other race/ethnicity groups.

Number of Excess Deaths by Race/Ethnicity, 2015-2019



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the total count of excess deaths by race/ethnicity. Excess mortality is calculated by comparing the 2015-2019 feto-infant mortality rate in each race/ethnicity group with that of the reference group. The greatest absolute number of excess deaths are among Black non-Hispanic group at 819 infant deaths. This is followed by White non-Hispanic group at 377 infant deaths.

Note: Race/ethnicity groups that did not meet minimum sample size necessary to complete phase 1 of the analysis were excluded.

Excess Feto-Infant Mortality by Race/Ethnicity

	Maternal Health + Prematurity (VLBW + small fetal deaths)	**Infant Health** (Large Post-Neonatal Deaths)	**Maternal Care** (Large fetal deaths)	**Newborn Care** (Large neonatal deaths)
Michigan	44%	33%	16%	7%
White Non-Hispanic	32%	40%	15%	12%
Black Non-Hispanic	47%	34%	11%	8%
Hispanic	25%	54%	3%	17%
Multiple Race	48%	24%	11%	16%

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk for each race/ethnicity group.

White Non-Hispanic: 40% of the excess feto-infant deaths in this group fall into the infant health risk period. More than 1/3 (32%) of the excess deaths fall into the maternal health + prematurity risk period.

Black Non-Hispanic: Almost half of the excess feto-infant deaths (47%) within this group fall into the maternal health + prematurity risk period. More than 1/3 (34%) of the excess deaths fall into the infant health risk period.

Hispanic: More than half (54%) of the excess deaths within this group fall into the infant health risk period. A quarter (25%) of the excess feto-infant deaths fall into the maternal health + prematurity risk period. 17% of the excess deaths fall into to the newborn care risk period.

Multiple Race: Almost half (48%) of the excess deaths in this group fall into the maternal health + prematurity risk period. Almost a quarter (24%) of the excess deaths fall into the infant health risk period.

RESULTS | PROSPERITY REGION

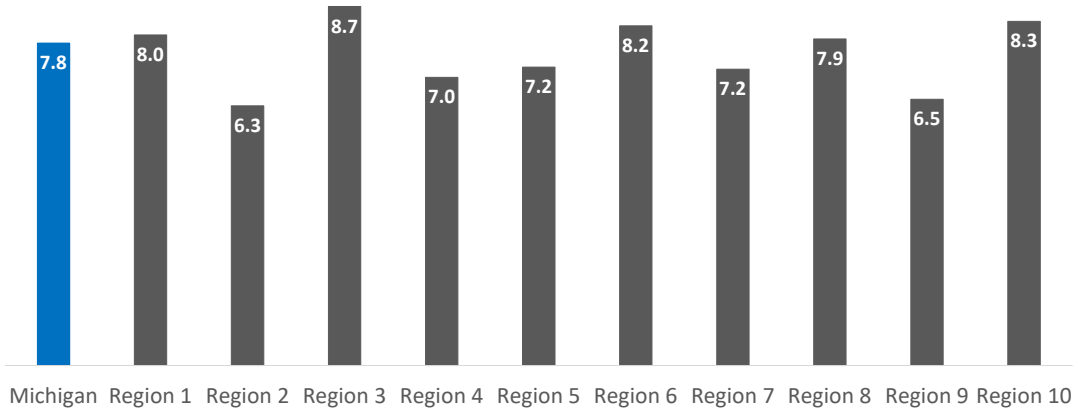
2015-2019

Phase 1

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

The following slides includes PPOR Phase 1 results by region during 2015-2019. The data was aggregated over 5 years in order to have a sufficient sample size.

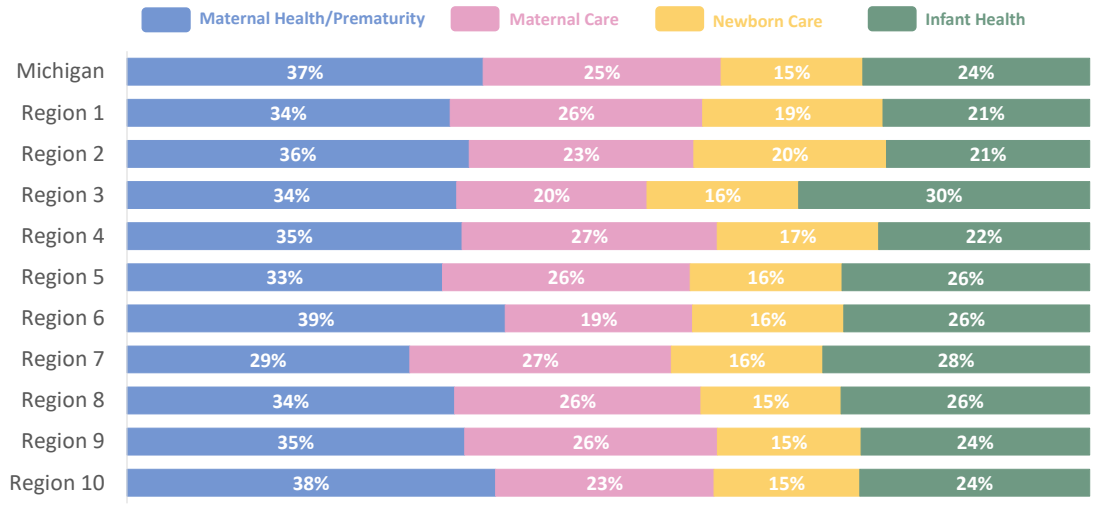
Feto-Infant Mortality Rate by Prosperity Region



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the feto-infant mortality rate by region (2015-2019), compared to Michigan (2017-2019). The feto-infant mortality rate is highest in region 3 at 8.7 deaths per 1,000 live births + fetal deaths. Region 2 has the lowest feto-infant mortality rate at 6.3 deaths per 1,000 live births + fetal deaths.

Feto-Infant Mortality Burden by Prosperity Region



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the proportion of feto-infant deaths in each period of risk by prosperity region.

Maternal Health + Prematurity: At least a 1/3 of the fetal + infants in each region are within the maternal health + prematurity period of risk.

Maternal Care: 1 out of 4 fetal + infant deaths statewide fall into the maternal care period of risk. Approximately 1 out of 5 fetal + infant deaths in region 3 and 6 fall into the maternal care period of risk.

Newborn Care: Statewide, 15% of fetal-infant deaths fall into the newborn care period of risk. This is consistent with most regions.

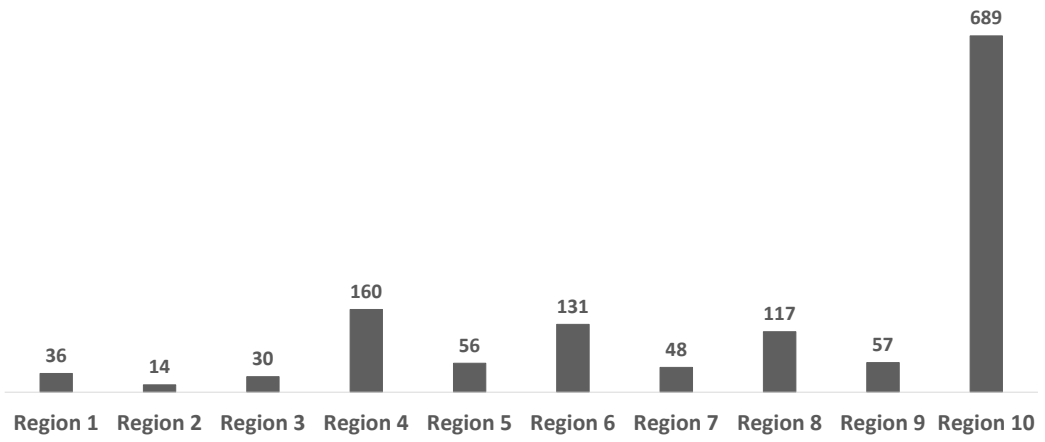
Infant Health: Statewide, almost a quarter (24%) of the fetal + infant deaths during 2015-2019 fall into the infant care period of risk. The infant care period accounts for 1 out of 3 fetal + infant deaths in region 3.

Study Group	Reference Group
• Resident of region X • Gave birth 2015-2019	• Michigan resident • White, non-Hispanic mother • 20-39 years old • More than 12 years of education *or* intention to use private insurance at delivery • Gave birth during 2015-2019

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

Deaths in each region (study group) were compared with a reference group to calculate excess deaths.

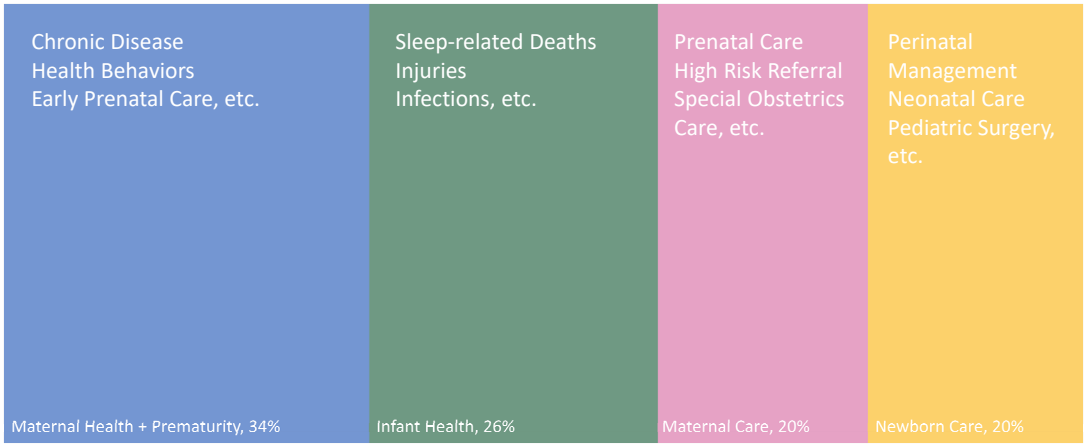
Number of Excess Deaths by Prosperity Region, 2015-2019



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

Region 10 has the highest number of excess deaths (n = 689). There were more than 100 excess deaths in regions 4, 6 and 8 during 2015-2019.

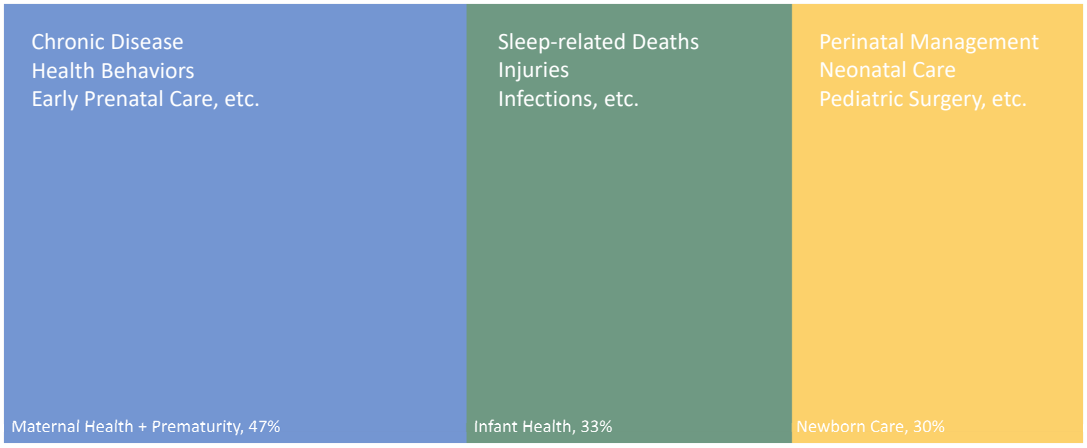
Percent Excess Mortality: **Region 1**



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

The next 10 slides show the burden of excess deaths as a proportion by perinatal period of risk for each region. More than 1/3 of the excess deaths in region 1 are within the maternal health + prematurity risk period. More than a ¼ of the excess deaths in region1 are in the infant health risk period. An equal proportion (20%) are within the maternal + newborn care risk period.

Percent Excess Mortality: **Region 2**

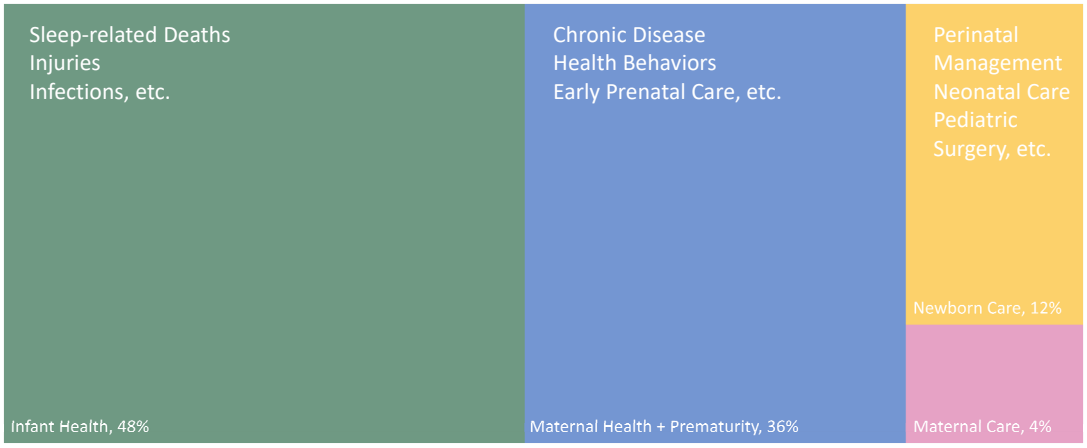


Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk in region 2. Almost half (47%) of the excess deaths in region 2 are within the maternal health + prematurity risk group.

Maternal care risk period is not included on this slide because the feto-infant mortality rate within the maternal care risk period is lower in the study group (i.e. region 2) compared to the reference group. This results in a negative excess rate, and the proportions adding up to more than 100%.

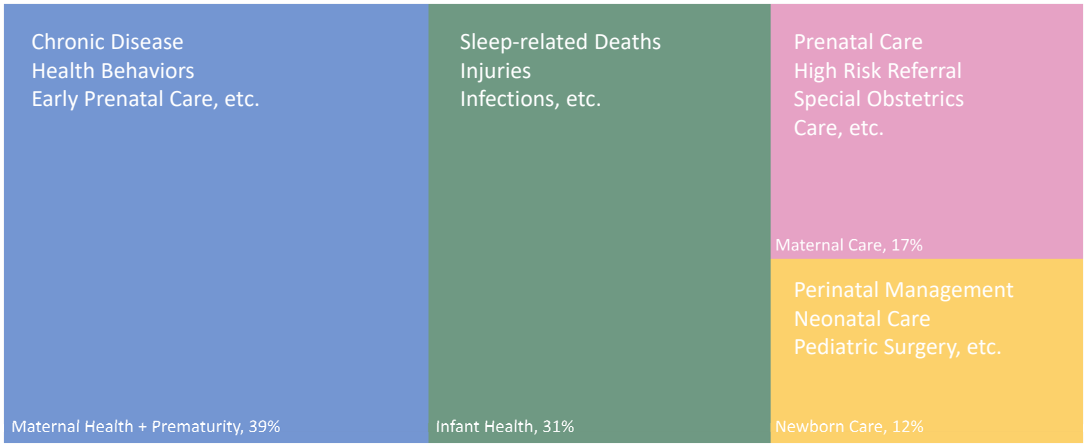
Percent Excess Mortality: **Region 3**



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk in region 3. The infant health risk period makes up almost half (48%) of the excess feto-infant deaths in region 3. 36% of the excess deaths are within the maternal health + prematurity risk period.

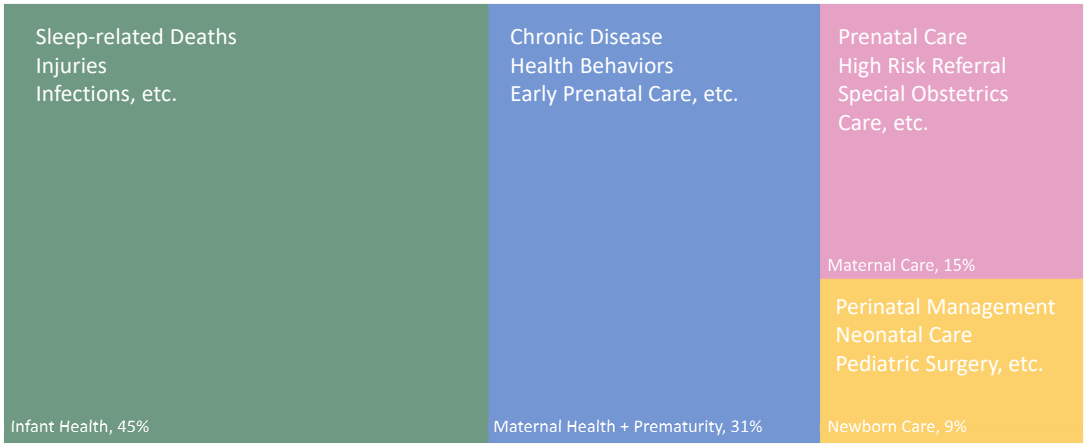
Percent Excess Mortality: **Region 4**



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk as a proportion in region 4. Almost 40% of the excess feto-infant deaths in region 4 fall into the maternal health + prematurity risk group. Approximately 1/3 of the excess deaths fall into the infant health risk group.

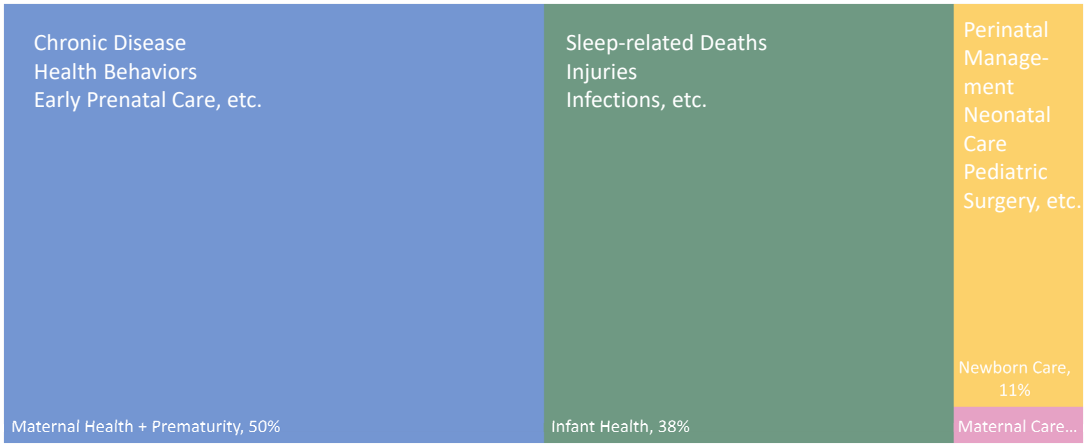
Percent Excess Mortality: **Region 5**



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk as a proportion in region 5. Almost half (45%) of the excess deaths in the region are within the infant health risk period. About 1/3 of the excess deaths are within the maternal health + prematurity risk period.

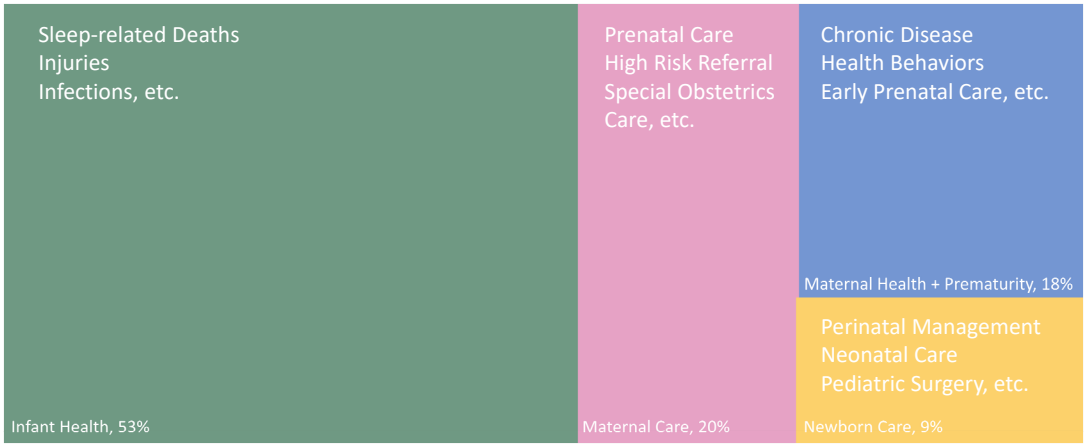
Percent Excess Mortality: **Region 6**



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk in region 6. Exactly half (50%) of the excess deaths fall within the maternal health + prematurity risk group. Almost 40% of the excess deaths in the region fall within the infant health risk period.

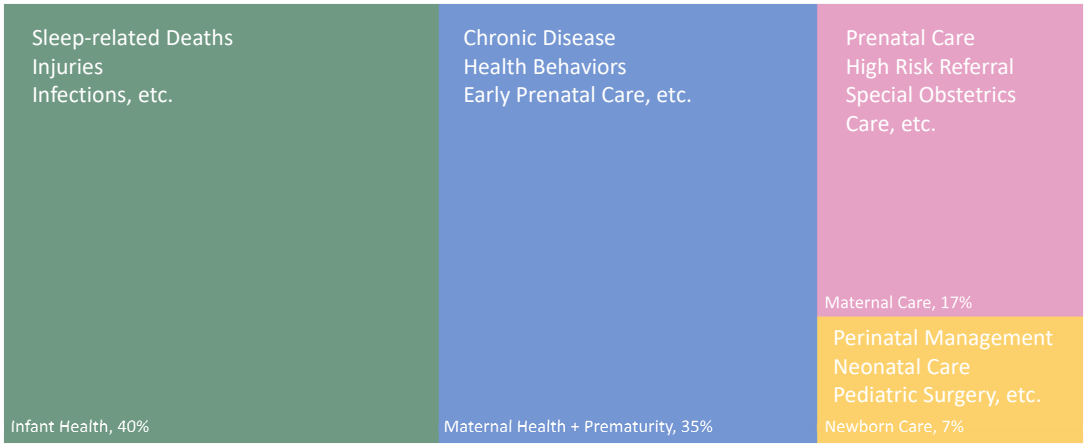
Percent Excess Mortality: **Region 7**



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk in region 7. More than half (53%) of the excess deaths in region 7 are within the infant health risk period. One out of five of the excess deaths are within the maternal care risk period. 18% are within the maternal health + prematurity risk period.

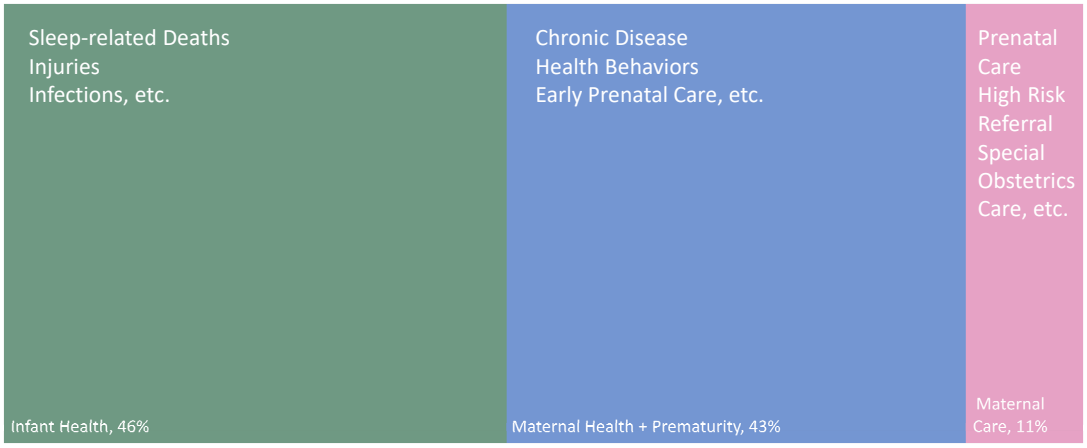
Percent Excess Mortality: **Region 8**



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk in region 8. 40% of the excess deaths in region 8 are within the infant health risk period. 35% of the excess deaths in the region are within the maternal health + prematurity risk period.

Percent Excess Mortality: **Region 9**

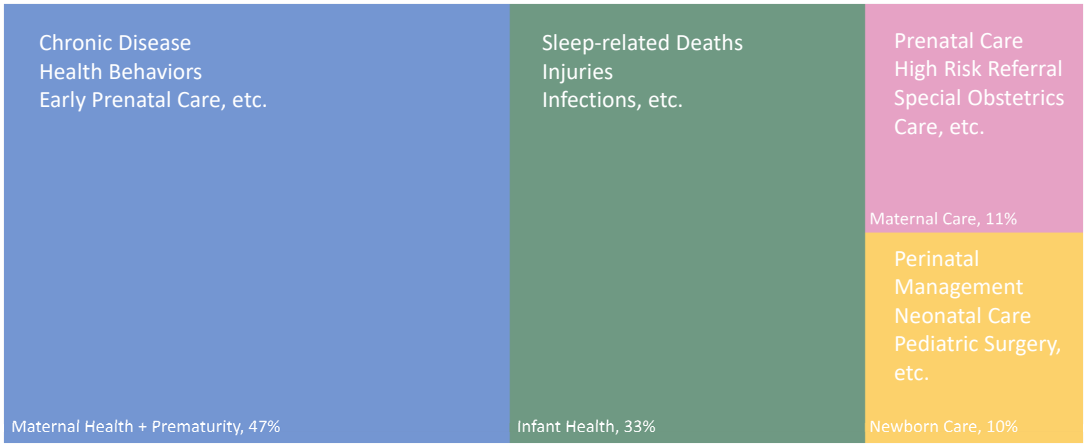


Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk in region 9. Almost half (46%) of the excess deaths in region 9 are within the infant health period. 43% of the excess deaths in the region are within the maternal health + prematurity risk period.

The Newborn care risk period is not included on this slide because the feto-infant mortality rate within the newborn care risk period is lower in the study group (i.e. region 9) compared to the reference group. This results in a negative excess rate, and the proportions adding up to more than 100%.)

Percent Excess Mortality: **Region 10**



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk in region 10. Almost half (47%) of the excess deaths in region 10 are within the maternal health + prematurity risk period. More than 1/3 of the excess deaths in the region are within the infant health risk period, at 33%. Maternal care and newborn care make about equal proportion of the excess deaths around 10-11%.

RESULTS | CITY

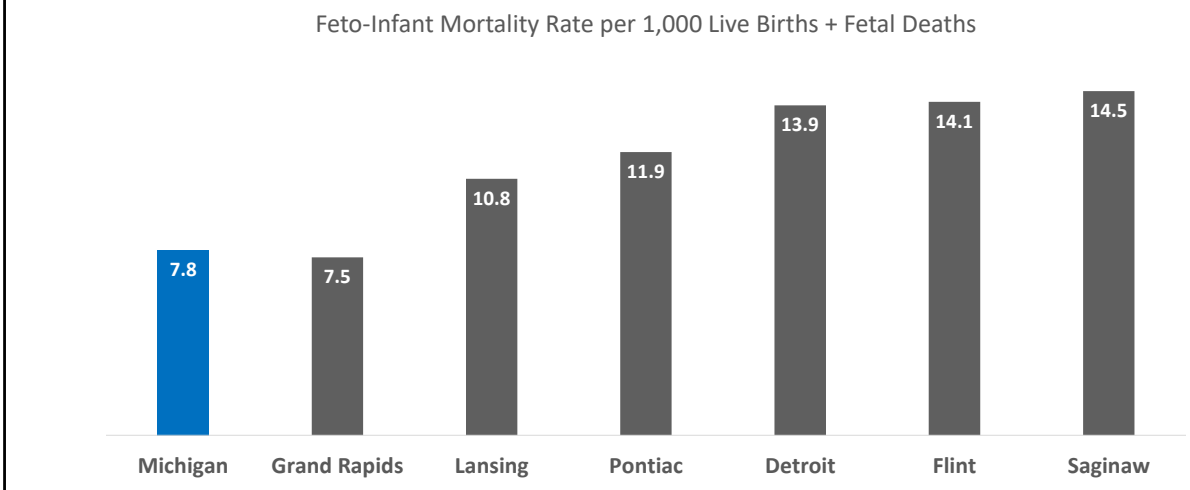
2015-2019

Phase 1

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

The following slides includes PPOR Phase 1 results by mother's city of residence during 2015-2019. The data was aggregated over 5 years in order to have a sufficient sample size.

Feto-Infant Mortality Rate by City, 2015-2019

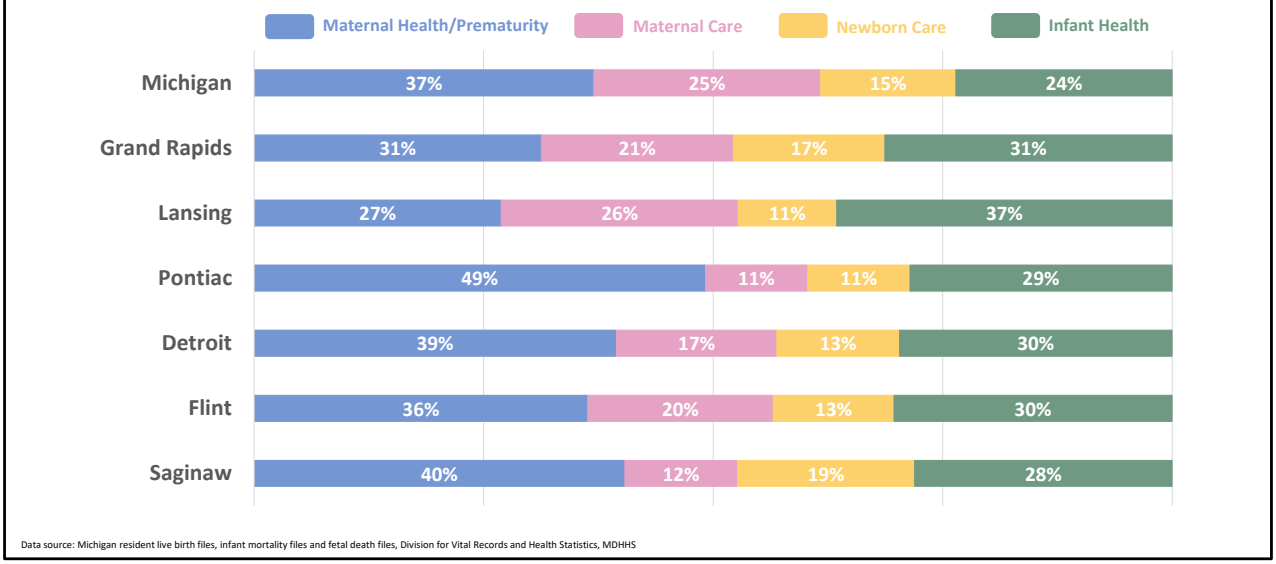


Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the feto-infant mortality by the mother's city of residence during 2015-2019 from low to high. The feto-infant mortality rate is highest in Detroit, Flint and Saginaw. The rate is lowest in Grand Rapids during this time.

Note: The Michigan feto-infant mortality rate is during 2017-2019. Cities that did not meet the minimum sample size necessary to complete phase 1 of the analysis were excluded.

Feto-Infant Mortality Burden by City



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the period of risk the fetal and infant deaths in each city are concentrated it in, as a proportion.

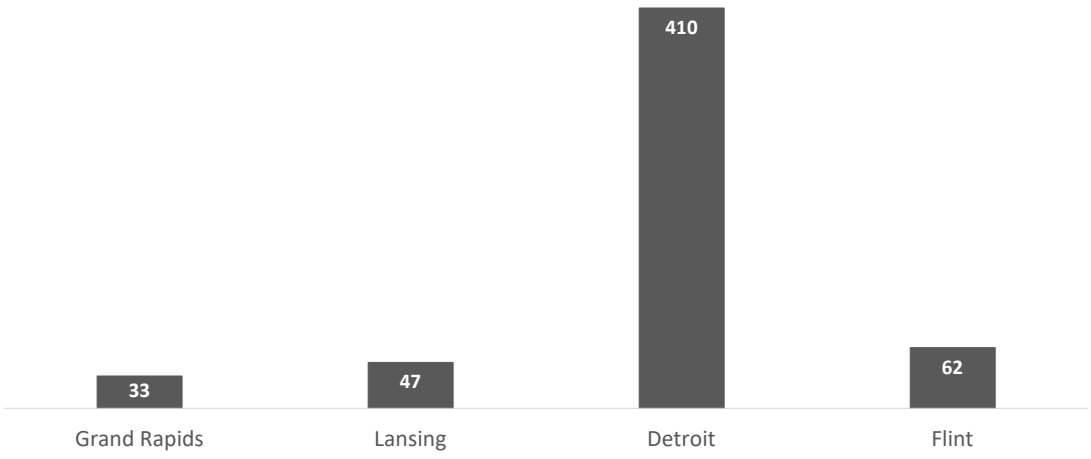
Maternal Health + Prematurity: Grand Rapids (31%) and Lansing (27%) have a lower proportion of maternal health + prematurity deaths. This period makes up almost half (49%) of the feto-infant deaths in Pontiac.

Maternal Care: This risk period makes up a lower proportion of feto-infant deaths in Pontiac and Saginaw, around 11-12%.

Newborn Care: Newborn care makes up a relatively greater proportion of feto-infant deaths in Saginaw, at 19%. They make up a smaller proportion of feto-infant deaths in Lansing and Pontiac, at 11%.

Infant Health: The infant health risk period makes up a relatively large proportion of feto-infant deaths in Lansing, at about 37%.

Number of Excess Deaths by City, 2015-2019



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the total count of excess deaths by city of residence. Excess mortality is calculated by comparing the 2015-2019 feto-infant mortality rate in each city with that of the reference group during the same period. Detroit city has by far the greatest number of excess deaths at 410 during 2015-2019.

Note: Cities that did not meet the minimum sample size necessary to complete phase 1 of the analysis were excluded.

Excess Feto-Infant Mortality by City

	Maternal Health + Prematurity (VLBW + small fetal deaths)	Infant Health (Large Post-Neonatal Deaths)	Maternal Care (Large fetal deaths)	Newborn Care (Large neonatal deaths)
Michigan	44%	33%	16%	7%
Grand Rapids	26%	62%	0%	12%
Lansing	21%	54%	22%	4%
Detroit	43%	36%	10%	10%
Flint	38%	37%	15%	10%

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality as a proportion by period of risk for each city. Excess mortality is calculated by comparing the 2015-2019 feto-infant mortality rate in each city with that of the reference group during the same period.

In Michigan, 44% of the excess feto-infant deaths are in the maternal health + prematurity risk period. More than 1/3 (33%) are within the infant health period of risk.

In Grand Rapids, more than 60% of the excess feto-infant deaths are within the infant health risk period. More than a quarter (26%) of the excess deaths are within the maternal health + prematurity risk period.

In Lansing, more than half (54%) of the excess feto-infant deaths are within the infant health risk period. Roughly, an equal proportion of excess deaths are within the maternal care (22%) and maternal health + prematurity (21%) risk period.

In Detroit, 43% of the excess feto-infant deaths are within the maternal health + prematurity risk period. More than a 1/3 (36%) are within the infant health risk period.

In Flint, about an equal proportion of the excess feto-infant deaths are within the maternal health + prematurity (38%) and the infant health (37%) risk period.

RESULTS | COUNTY

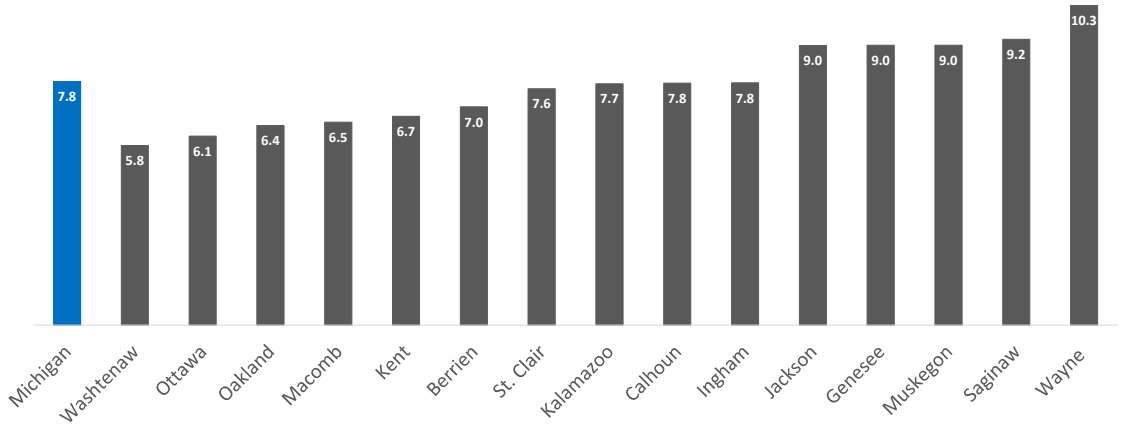
2015-2019

Phase 1

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

The following slides includes PPOR Phase 1 results by county during 2015-2019. The data was aggregated over 5 years in order to have a sufficient sample size.

Feto-Infant Mortality Rate by County



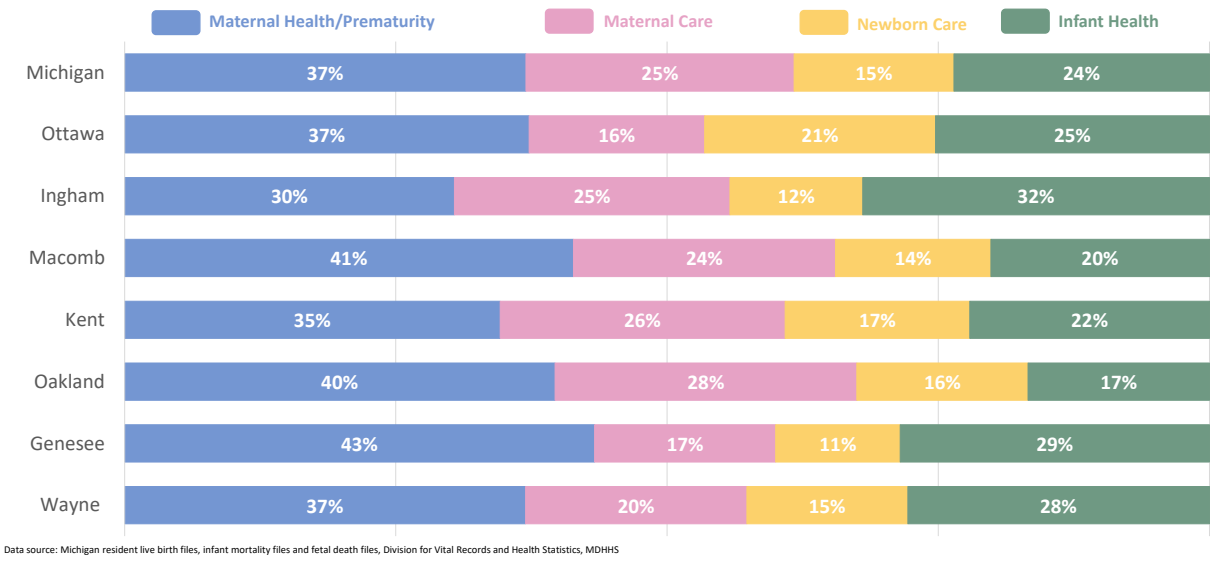
Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the feto-infant mortality rate per 1,000 live births + fetal deaths by county during 2015-2019.

The feto-infant mortality rate is highest in Wayne County (inclusive of city of Detroit) at 10.3 deaths per 1,000 live births + fetal deaths. The feto-infant mortality rate is lowest in Washtenaw county at 5.8 deaths per 1,000 live births + fetal deaths, which is lower than the state average.

Note: The Michigan feto-infant mortality rate is during 2017-2019. Counties that did not meet the minimum sample size necessary to complete phase 1 of the analysis were excluded.

Feto-Infant Mortality Burden by County



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the period of risk the fetal-and infant deaths are concentrated within each county, as a proportion.

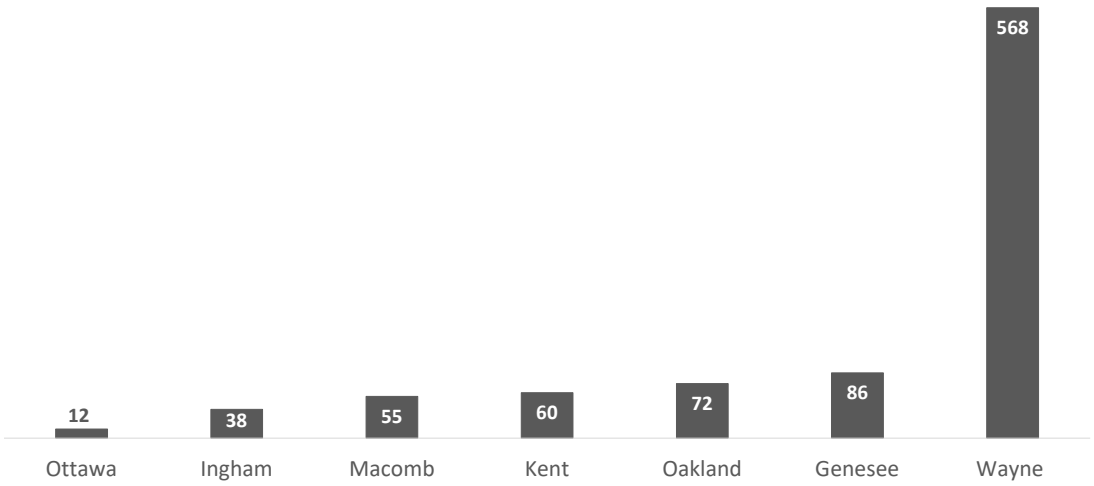
Maternal Health + Prematurity: A smaller (30%) proportion of feto-infant deaths in Ingham county fall within the maternal health + prematurity period of risk.

Maternal Care: This period of risk makes up a smaller proportion of feto-infant deaths in Ottawa (16%) and Genesee (17%) county.

Newborn Care: Newborn care deaths make up a larger proportion of feto-infant deaths in Ottawa (21%) county.

Infant Health: More than 1/3 (32%) of feto-infant deaths in Ingham County fall within the infant health period of risk.

Number of Excess Deaths by County, 2015-2019



Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows the total count of excess deaths by county. Excess mortality is calculated by comparing the 2015-2019 feto-infant mortality rate in each county with that of the reference group during the same period. Wayne County has by far the greatest number of excess deaths during this 5 year period at 568 deaths

Note: Counties that did not meet the minimum sample size necessary to complete phase 1 of the analysis were excluded.

Excess Feto-Infant Mortality by County

	Maternal Health + Prematurity (VLBW + small fetal deaths)	**Infant Health** (Large Post-Neonatal Deaths)	**Maternal Care** (Large fetal deaths)	**Newborn Care** (Large neonatal deaths)
Michigan	44%	33%	16%	7%
Ottawa*	65%	70%	-80%	43%
Oakland	70%	6%	19%	4%
Macomb	77%	25%	0%	-3%
Kent	39%	34%	14%	12%
Ingham	24%	60%	16%	-1%
Genesee	58%	42%	-2%	2%
Wayne	41%	37%	11%	11%

Data source: Michigan resident live birth files, infant mortality files and fetal death files, Division for Vital Records and Health Statistics, MDHHS

This slide shows excess mortality by period of risk for each county, as a proportion. Excess mortality is calculated by comparing the 2015-2019 feto-infant mortality rate in each county with that of the reference group during the same period.

The majority (70%) of the excess feto-infant deaths in Oakland county are within the maternal health + prematurity risk period. Almost 1 in 5 (19%) of the excess feto-infant deaths in the county are within the maternal care risk period. In Macomb county, more than three quarters of the excess feto-infant deaths (77%) are within the maternal health + prematurity risk period. In Kent County, 39% of the excess feto-infant deaths are within the maternal health + prematurity risk period, and 34% are within the infant health period. In Ingham County, the majority (60%) of the excess feto infant deaths are within the infant health risk period. Almost a quarter (24%) of the excess deaths are within the maternal health + prematurity risk period. In Genesee county, more than half (58%) of the excess feto-infant deaths are within the maternal health + prematurity risk period. 42% of the excess deaths are within the infant health period. In Wayne County, the proportions are more evenly distributed between the maternal health + prematurity and the infant health risk period. 41% of the excess feto-infant deaths are within the maternal health + prematurity risk period. 37% of the excess feto-infant deaths are within the infant health risk period

* The percentages for Ottawa sum to more than 100%. This is because the feto-infant death rate in the maternal care period is lower in Ottawa than the reference group. This distorts the other proportions. As shown on the previous slide, there were a net 12 excess deaths in Ottawa county compared to the reference group. An equal number of excess deaths were in the infant health and maternal health + prematurity period of risk.