SUMMIT COUNTY
SCPH
PUBLIC HEALTH

EVERY ONE
BETTER BIRTH OUTCOMES
SUMMIT COUNTY
OEI PARTNER

**Annual Report**
Maternal Child Health

Prepared by: Ndidi Larberg, MPH, RRT

# TABLE OF CONTENTS

# TABLE OF FIGURES AND TABLES

# INTRODUCTION

Infant mortality (IM) is defined as any death before a child's first birthday. Infant mortality rate (IMR) measures this occurrence per 1,000 live births[1]. The majority of child deaths on average occur during the first year of life. Infant mortality rate has been found to be the most sensitive indicator of societal health as well as being a key marker of maternal and child health[1]. It can serve as a crude indicator of the overall health of a community, health disparities existing in a community, and availability and access to health care[1,2].

The mission of Summit County Public Health (SCPH) is to protect and advance the health of the entire community through its policies, programs and activities that protect the safety, health and well-being of the people in Summit County.

This annual report provides current data trends and previous yearly averages in infant mortality and selected birth outcomes in Summit County. The data used for this report was obtained from Ohio Department of Health (ODH) data warehouse, and more detailed information about infant mortality and birth data can be found in the technical notes section. Infant mortality rates are used to detect trends in infant mortality over time, and to compare the rate of infant deaths between different population subgroups. The year to date (YTD) IM rate is calculated by dividing the total number of infant deaths in a specific year by the number of live births in that same year, then multiplying by 1000.

**TABLE 1.** *NUMBER OF INFANT DEATHS, SUMMIT COUNTY BY MONTH, 2017-2018*

|  | 2017 | 2018 |
|---|---|---|
| January | 2 | 8 |
| February | 4 | 3 |
| March | 2 | 4 |
| April | 2 | 2 |
| May | 1 | 3 |
| June | 4 | 2 |
| July | 4 | 4 |
| August | 4 | 1 |
| September | 2 | 5 |
| October | 5 | 4 |
| November | 10 | 3 |
| December | 4 | 3 |
| Total | 44 | 42 |

# INFANT MORTALITY SURVEILLANCE

There were 42 infant deaths and 5,953 births in Summit County in 2018. The infant deaths experienced in 2018 is less than the previous year (Table 1). Based on the 2018 data, the infant mortality rate in Summit County is trending even closer the Healthy People 2020 goal of 6.0 infant deaths per 1,000 live births.

**Neonatal deaths**

Neonatal infant deaths occur in newborn infants that are less than 28 days old, and nearly 60% of infant deaths occur during the first month of life. As seen below in Figure 1, the neonatal infant mortality rates (NIMR) from 2014 to 2018 exhibit similar trends as were seen in all Summit County infant deaths. The Healthy People 2020 goal for NIMR is 4.1 deaths per 1,000 live births. Summit County met this goal in 2013, however the NIMR for 2018 is 4.8 per 1,000, which is lower than the previous year.

**FIGURE 1.** *NEONATAL INFANT MORTALITY RATE BY MONTH 2014 – 2018*
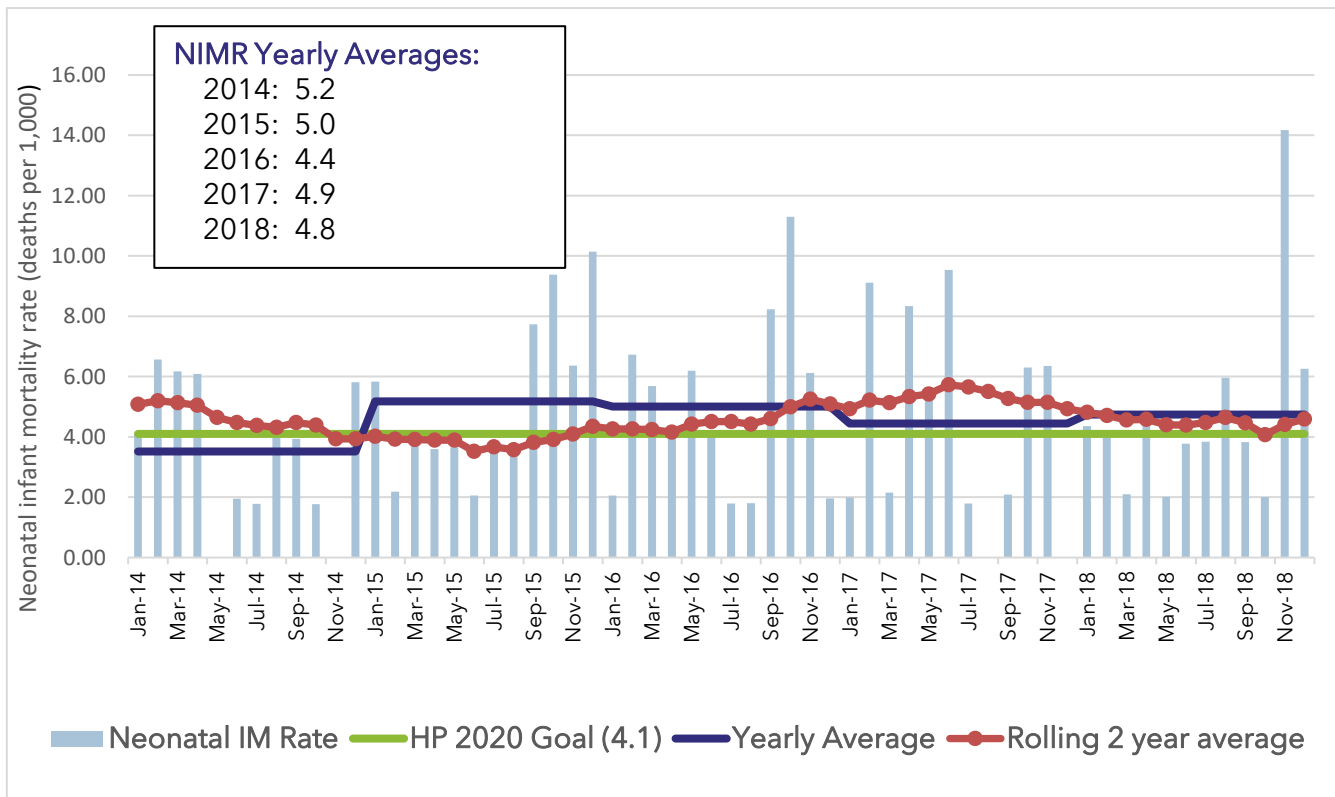
## Racial disparities in infant mortality

Racial disparities in infant mortality rates continue to persist in Summit County, as indicated in Figure 2. The average IMR for the past five years (2014-2018) in Summit County was 7.31 deaths per 1,000 live births with 2018's IMR being 7.06 per 1,000.  IMR's below the county average were seen in the non-Hispanic (NH) white, NH Asian, and Hispanic populations, but the NH African American rate was twice the county average, and was 3 times higher than the NH white rate.  In 2018, the IMR disparity between white and African American infants decreased from previous years, with the NH black IMR being 2.8 times higher than the NH white rate compared to  3.2 times higher than the NH white rate in 2017. The trend line graph below indicates that the IMR in the NH African American community has a larger increasing trend than what was seen in the NH white community or the county IMR from 2014 to 2018.

**FIGURE 2.** *TREND LINE GRAPH FOR ANNUAL INFANT MORTALITY FOR SUMMIT COUNTY BY RACE, 2014-2018*
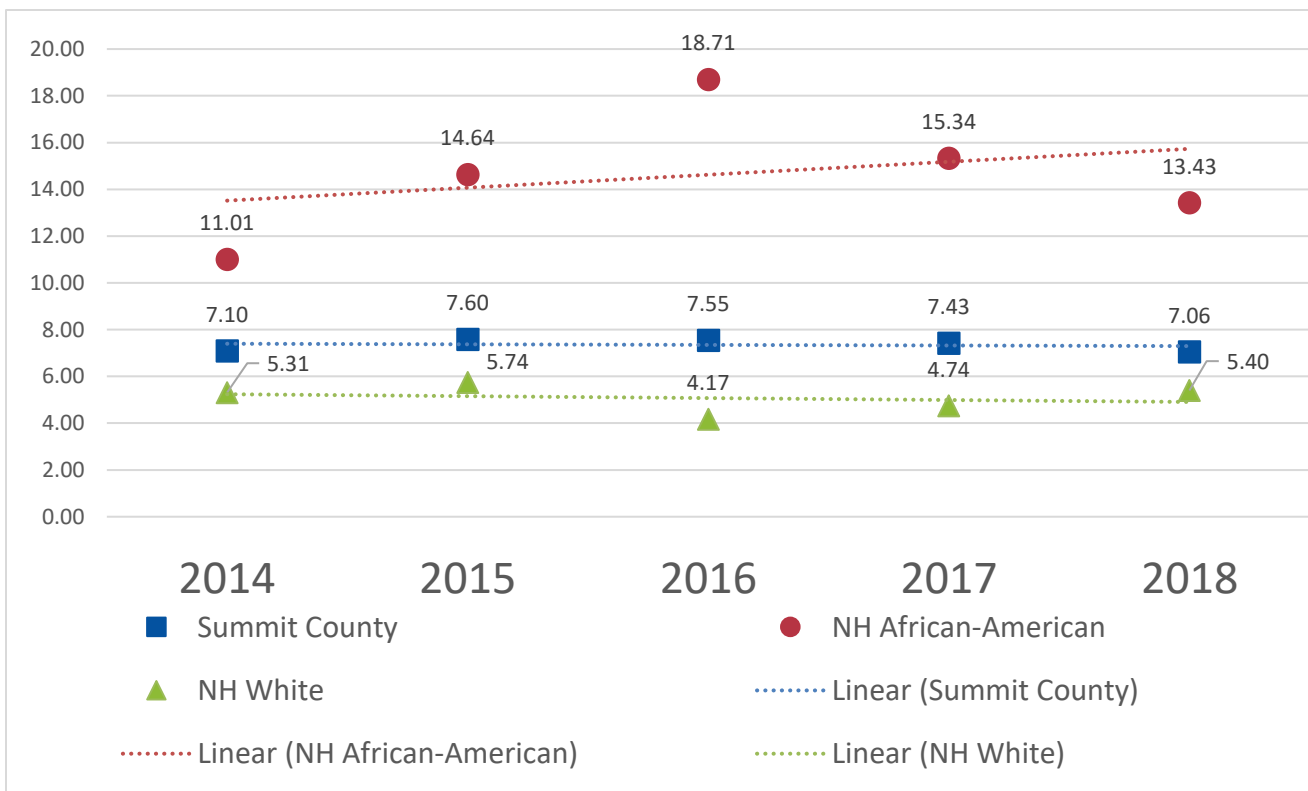


## Preterm birth rates

A birth is considered to be premature when it occurs before 37 weeks of gestation. Prematurity is a leading cause of infant death (especially during the first month). It increases the odds of having a chronic health condition and/or developmental delay. Therefore it's essential to ensure that as many pregnancies as possible deliver at 37

weeks gestation or later[5, 6]. Summit County's preterm birth rate went up from 9.2% in 2017 to 10% in 2018.

**FIGURE 3.** *PREMATURE BIRTH RATE (< 37 WEEKS GESTATION) BY MONTH: JAN 2014 TO DEC 2018*



**Preterm birth rate yearly averages:**
2014: 10.4%
2015: 11.1%
2016: 11.8%
2017: 9.2%
2018: 10.0 %

Legend: % <37 Weeks Gestation — HP 2020 Goal (9.4%) — Yearly Average — Rolling 2 yr Average
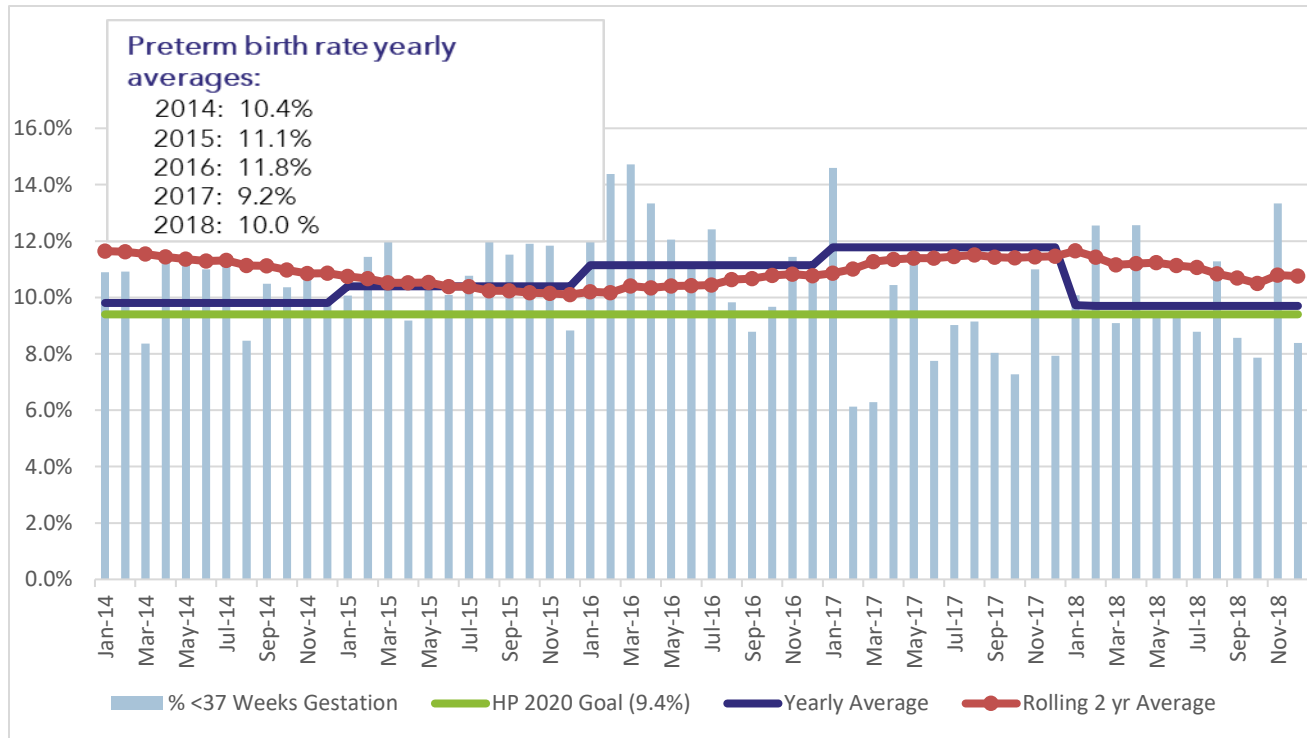
## Low birthweight rates

Infants that weigh less than 2500 grams (about 5.5 pounds) at birth are considered to be low birth weight.  Although low birth weight is usually associated with premature birth, other factors may negatively affect fetal growth and development. Factors that impact development, include congenital defects, maternal complications, and unhealthy maternal behaviors (such as poor nutrition, smoking and/or substance misuse)[7]. An infant having low birthweight, especially those with very low birth weight (less than 1500 grams), is a major factor of the magnitude of infant mortality[8]. Differences in low birthweight rates account for the higher neonatal mortality rates observed in groups characterized by socioeconomic disadvantages[8]. Low birthweight rates are correlated with preterm birth rates, and the preterm birthweight for Summit County increased from 2017 to 2018. Summit County saw an increase in low birthweight rates from 8.5% in 2017 to 9.0% in 2018 (figure 4).

**FIGURE 4.** *LOW BIRTH WEIGHT (< 2500 GRAMS) BIRTH RATE BY MONTH: JAN 2014 TO DEC 2018*



Low birth weight birth rate yearly averages:
- 2014: 9.1%
- 2015: 9.6%
- 2016: 9.9%
- 2017: 8.5%
- 2018: 9.0%

Legend:
- % Low Birth (<2500 g) Weight Birth
- HP 2020 Goal (7.8%)
- Yearly Average
- Rolling 2 yr Average
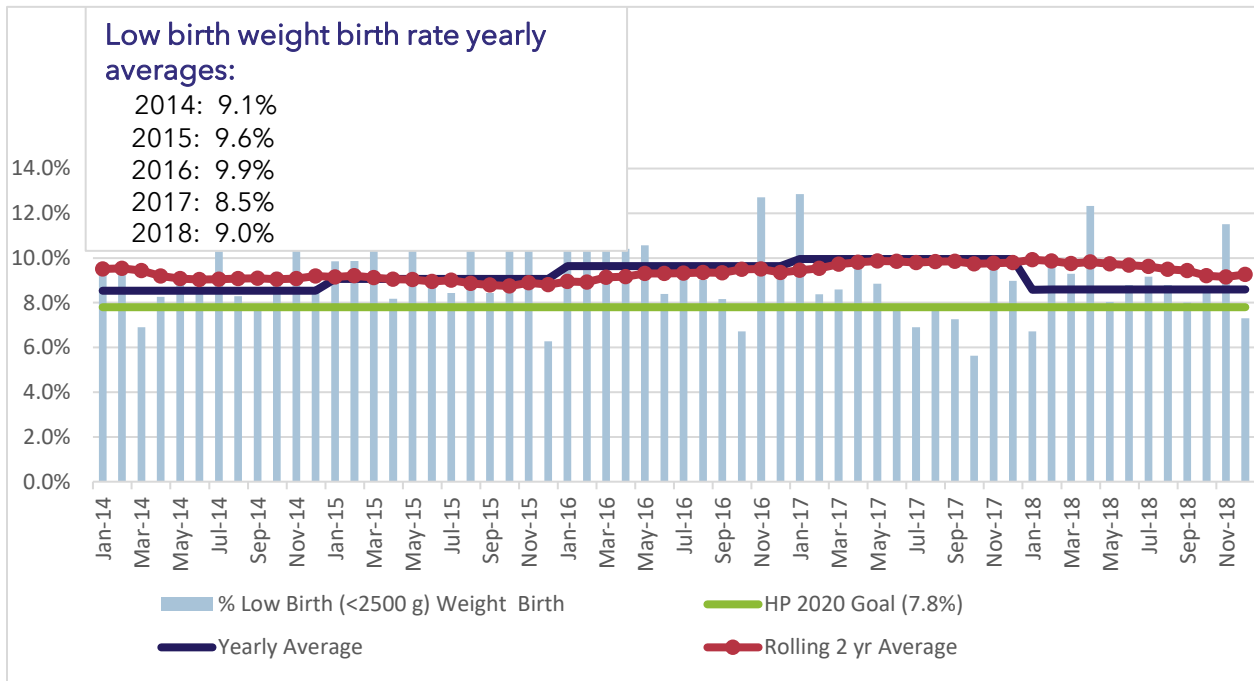
## Breastfeeding

Summit County has been seeing an overall decrease in breastfeeding rates, with 2018 being the lowest we have seen since 2009 (70%). To combat this trend, Full Term First Birthday (an initiative established by City of Akron Mayor Daniel Horrigan and Mrs. Tamiyka Rose) sent 4 individuals from different agencies to become certified lactation consultants. It is our hope that by adding these licensed consultants, more women can be educated in the benefits of breastfeeding and our county rates will improve.

**FIGURE 5.** *5 YEAR MATERNAL BREASTFEEDING AT DISCHARGE RATES*



Data points: 2014: 78.4%, 2015: 77.7%, 2016: 80.0%, 2017: 74.7%, 2018: 70.8%
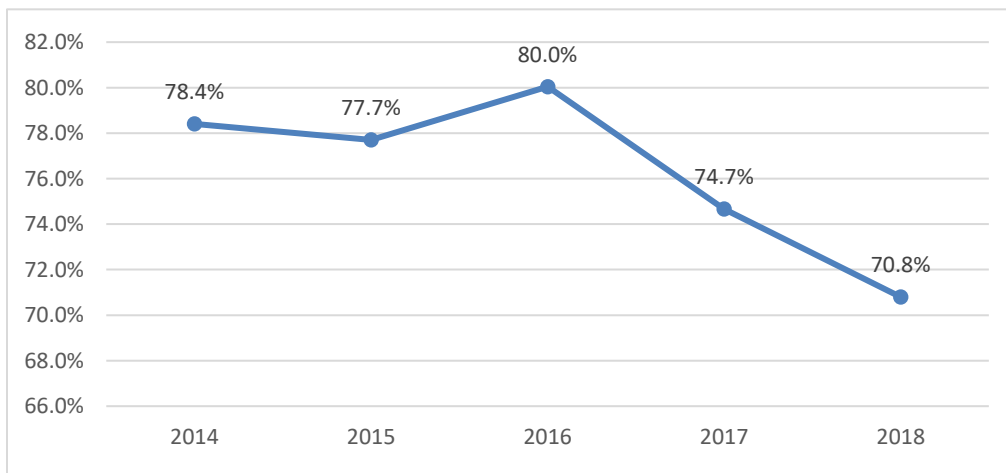
## Maternal smoking

Smoking during pregnancy has been associated with poor birth outcomes, especially low birth weight and prematurity[16]. According to the Centers for Disease Control and Prevention, smoking can make it more difficult for a woman to get pregnant, increases the chances of miscarriages, can cause problems with the placenta, can cause premature births, and subsequently cause a baby to be born with a low birth weight, it can also increase the chances of sudden infant death syndrome (SIDS) and can cause birth defects[16]. In Summit County, mothers who reported smoking during their second and third trimesters had higher rates of prematurity and low birth weight babies when compared to mothers who have never smoked. Additionally, mothers who were able to quit smoking at the beginning of their pregnancy had prematurity and low birth weight rates that were comparable to non-smoking mothers[16]. Summit County has been seeing a steady decline in maternal smoking rates since 2012.

**FIGURE 6.**  *5-YEAR SMOKING RATES IN THE SECOND OR THIRD TRIMESTER FOR SUMMIT COUNTY BY RACE*
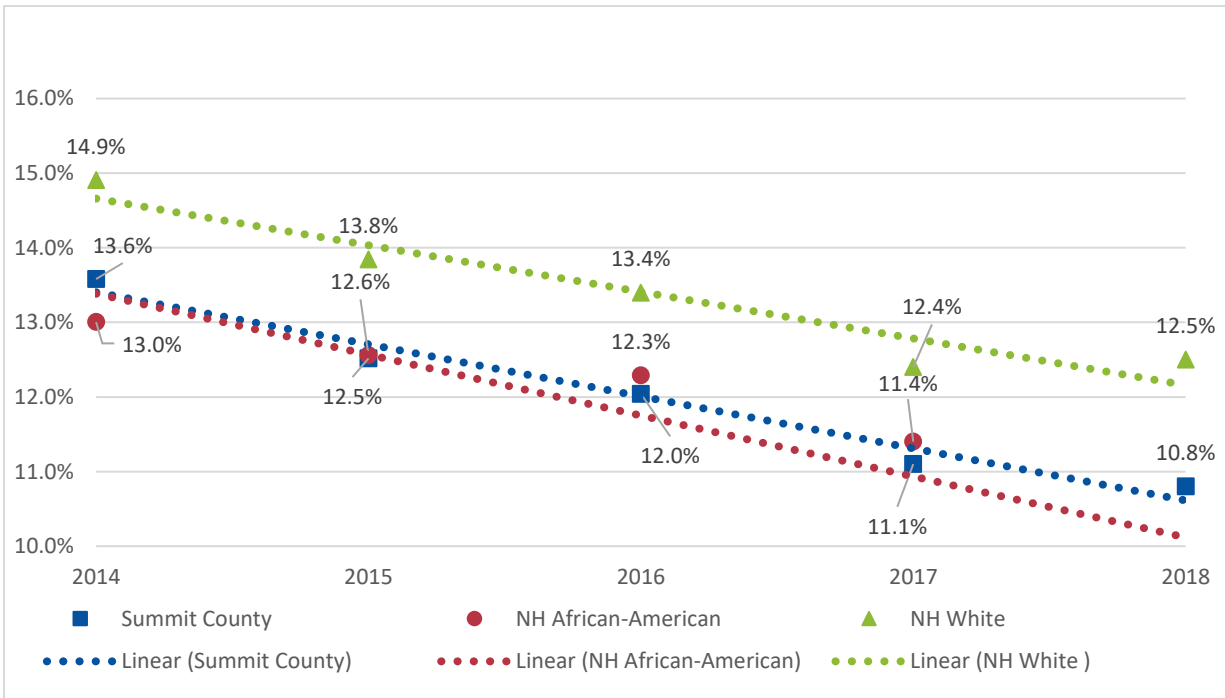
## Birth spacing

Allowing for 18 months or more between a previous birth and conception lets a mother's body fully recover from birth and prepare for the next pregnancy[12]. Research suggests that having a pregnancy within six months of a previous live birth is associated with an increased risk of premature birth, low birth weight, congenital disorders and placental abruption[13]. The pregnancy interval rate indicates the percentage of singleton births that were not spaced 18 months between a prior birth and conception.

**FIGURE 7.** *PERCENT LESS THAN 18 MONTHS BIRTH TO CONCEPTION INTERVAL RATES BY RACE 2014 – 2018 AVERAGES*
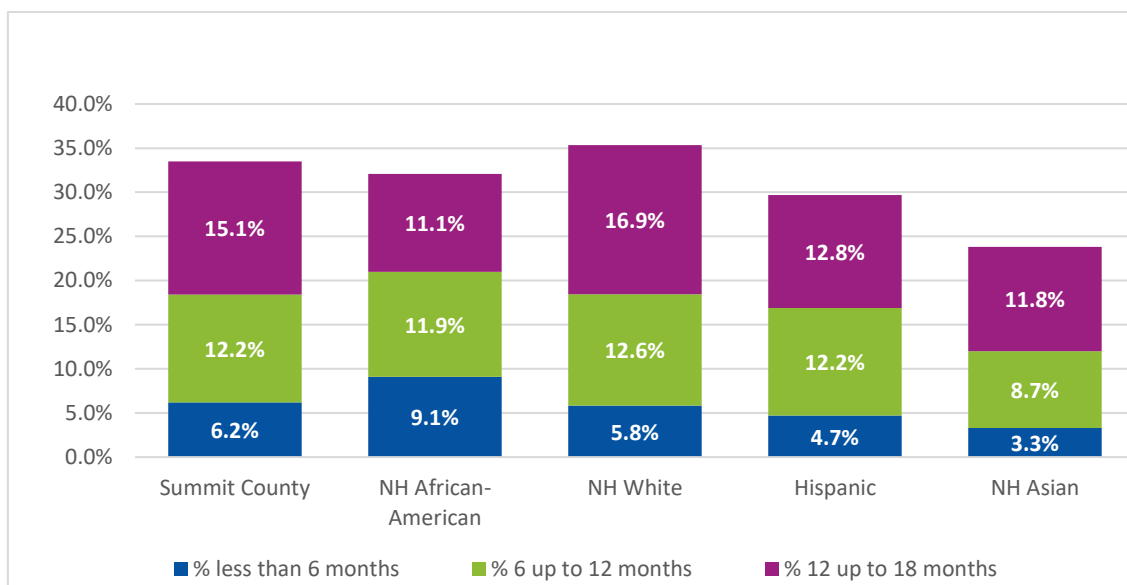


## Prenatal care

Prenatal care is the medical care a mother receives during pregnancy. Initiation of prenatal care during the first trimester of pregnancy is important in establishing healthy maternal habits, screening for and addressing potential health issues in the mother and fetus, and improving birth outcomes. With regular prenatal care women can reduce the risk of pregnancy complications, reduce the fetus' and infant's risk for complications, and help control existing conditions such as high blood pressure/diabetes to promote better birth outcomes[9]. Summit County continues to remain below the HP 2020 goal of 77.9% see figure 8.

**FIGURE 8.** *PRENATAL CARE INITIATED IN THE FIRST TRIMESTER 2014 – 2018 YEARLY AVERAGES*



Prenatal care initiated in the first trimester yearly averages:
2014: 73.3%
2015: 71.2%
2016: 69.8%
2017: 70.9%
2018: 71.4%

Legend: % Prenatal Care in 1st Trimester — HP 2020 Goal (77.9%) — Yearly Average — Moving 2 year average
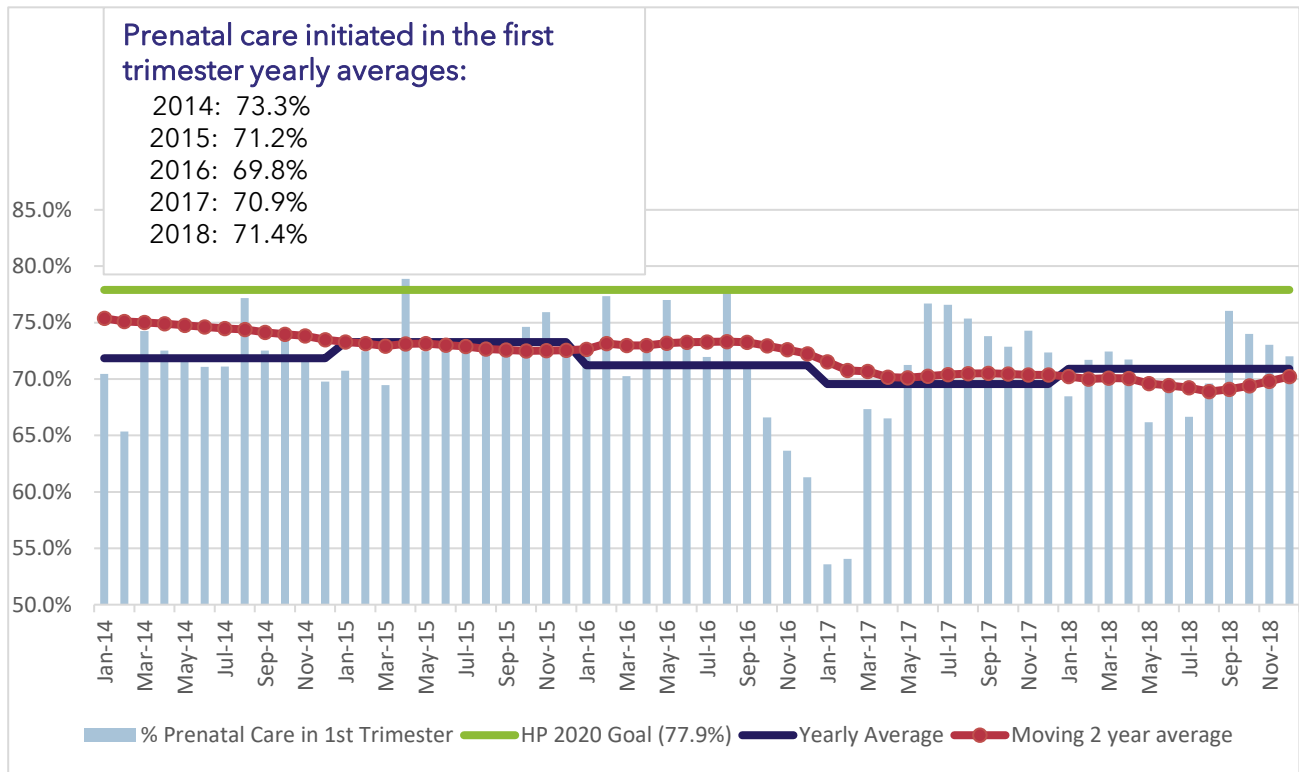
# OHIO EQUITY INSTITUTE 2.0

- OEI 2.0 components
- Upstream and downstream approach
- Historical context of OEI within Summit County

In 2013, the Ohio Department of Health (ODH) created the Ohio Equity Institute (OEI), a partnership between ODH, CityMatch, and nine Ohio counties to improve birth outcomes and infant health, reduce infant mortality, and eliminate racial disparities in maternal and child health indicators. The original structure of OEI was based on: 1) Race, racism and inequities in birth outcomes, 2) Epidemiology of birth outcomes, 3) Evidence-based interventions for vulnerable populations, 4) Leadership, 5) Evaluation. Through the combination of evidence-based strategies shown to improve birth outcomes, birth spacing, safe sleep, etc.) and data-driven decisions specific to target populations in participating communities, each OEI team was tasked with assessing local capacity and examining data to inform the design, implementation, and evaluation of a project. Summit County is one of the OEI communities; in 2016, the nine OEI counties accounted for 59% of all infant deaths and 86% of African American infant deaths[3].

The three leading causes of infant deaths in Ohio are prematurity/pre-term births, sleep-related deaths and birth defects. To improve maternal and infant health, Ohio communities must eliminate disparities in perinatal infant and maternal health by implementing proven and effective evidence-based strategies. Goals of OEI 2.0 include the reduction of low birth weight, very low birth weight, preterm birth and very preterm birth among women served in targeted counties.

- Achieve 7.8% low birth weight and 1.4% very low birth weight among women served by OEI Neighborhood Navigators. (Healthy People 2020 Objectives)
- Achieve 9.4% preterm birth and 1.5% very preterm birth among women served by OEI Neighborhood Navigators. (Healthy People 2020 Objectives)

These goals will be accomplished by:

- Understanding the local community and target population through data analysis;
- Connecting at-risk women prenatally to compressive clinical care and other needed services by facilitating access to services by acting as a liaison between health and social services and the community; and
- Addressing and mitigating the social determinants of health that impact pregnant women through the adoption or improvement of policies and/or practices at the local level.

- o  Reducing barriers for high-risk, pregnant women to access clinical and social services by improving the quality, availability and cultural competence of service delivery.
- o  Working with local leadership and partners who can directly address identified barriers

## *Identifying Target Areas*

Target at risk population for Summit County were based on ODH program eligibility. At-risk African American women living within the hot spot zip codes will be priority, with a goal of reaching a minimum of 80%. Summit County zip code hotspots are 44306, 44307, and 44320. The populations of the at risk zip codes in 2016 are 21,581 for 44306, 19,049 for 44320 and 6,987 for 44307. Nearly 80% of Summit County residents are NH white, 14.8% African American, 2.7% Asian, and 1.9% Hispanic. In the 44306 zip code (located in southeast Akron), 51.5% of the population is NH white, 39.5% NH African American, 2.3% Asian, and 2.7% is Hispanic. In the 44307 zip code (located in Akron West), 9.6% of the population is NH white, 84.2% NH African American, 0.04% Asian, and 1.1% Hispanic. In the 44320 zip code (located in Akron Southwest), 23.0% of the population is NH white, 71.7% NH African American, 0.70% Asian, and 1.2% Hispanic. At-risk African American women living within the hot spot zip codes will be priority, with a goal of reaching a minimum of 80%.

The zip codes of the women serviced are collected and monitored regularly to ensure that the most at risk areas are being reached. Most of the women that have been connected to resources by the Navigator live in the 44306, 44307, 44310, 44203, and 44320 zip codes. The zip codes that have the highest African American population are 44302, 44306, 44307, 44311 and 44320. These zip codes will remain our target areas for OEI2.0 fiscal year 2020 along with 44203 (Barberton) due to this zip code having the highest prevalence of AMHA housing.

Zip codes that demonstrate the most need were based on the number of women who were Non-Hispanic (NH) African American women who gave birth in 2017 and had one or more of the following:  Medicaid paid birth, recent preterm birth, recent birth with low birth weight, smoked during their third trimester of their most recent pregnancy, are under the age of 25, diabetes prior to recent pregnancy, hypertension prior to recent pregnancy, gestational diabetes during most recent pregnancy, preeclampsia during most recent pregnancy, and a previous preterm birth.

# Neighborhood Navigation

**Outreach**

The majority of referrals made to our Navigator come from our partnership with Women, Infants and Children (WIC) (66%). The partnership was established during second quarter of OEI 2.0 FY19 and has proven to be very meaningful in that it has provided a link to underserved women. Due to this partnership with WIC, through canvassing, and partnerships with other community organizations, most of our target number of women served have been met. We will continue this outreach plan for fiscal year 2020.

Our navigators were able to create a resource guild that is utilized to help navigate women and families to areas of service.

### TABLE 2. NEIGHBORHOOD NAVIGATOR OUTCOMES

| | White | Black | Other | Total |
|---|---|---|---|---|
| Total number of women screened for program eligibility* (count) | 119 | 163 | 24 | 306 |
| Total number of eligible* women identified (count) | 114 | 108 | 20 | 242 |
| Total number of eligible* women served (count) | 114 | 108 | 20 | 242 |
| Total number of needs identified (count) | 549 | 724 | 94 | 1367 |
| Total number of referrals made (count) | 548 | 723 | 94 | 1365 |
| **% of needs addressed by referral** | **99.8%** | **99.9%** | **100.0%** | **99.9%** |
| Total number of referrals utilized (count, self-reported by mom) | 421 | 533 | 85 | 1039 |
| **Total referrals utilized/Total referrals made (percentage, self-reported by mom)** | **76.8%** | **73.7%** | **90.4%** | **76.1%** |

### FIGURE 9. SERVED WOMEN CLIENT ELIGIBILITY CRITERIA
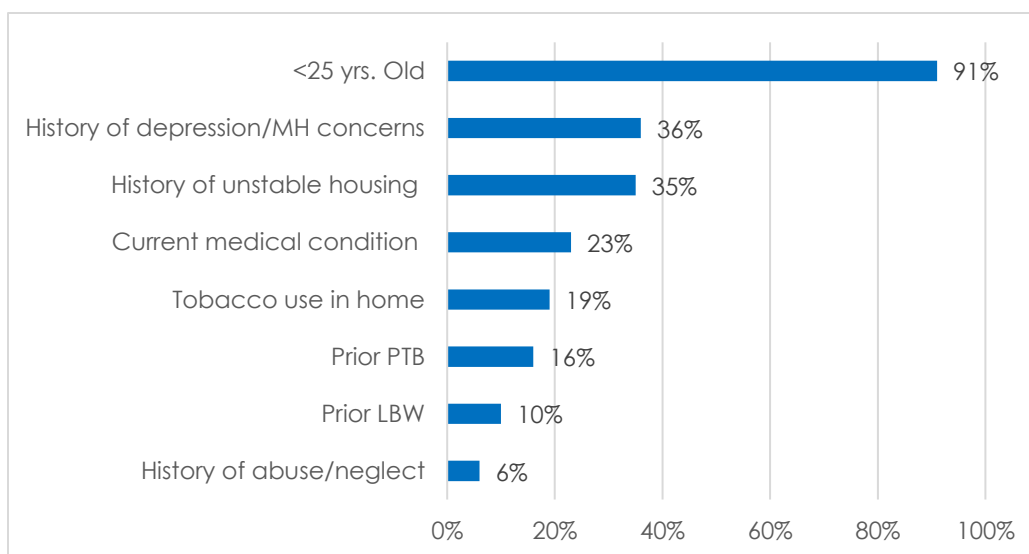
**TABLE 3.** *NEIGHBORHOOD NAVIGATOR PARTICIPATION: CLIENT DEMOGRAPHIC CHARACTERISTICS*

| Screened Women | 32 | 108 | 87 | 79 | 306 |
|---|---|---|---|---|---|
| **Race, Ethnicity** | | | | | |
| White, non-Hispanic | 29% | 45% | 36% | 38% | 39% |
| Black, non-Hispanic | 61% | 47% | 55% | 57% | 53% |
| Other, non-Hispanic | 10% | 8% | 9% | 5% | 8% |
| **Age** | | | | | |
| <18 yrs. | 16% | 5% | 4% | 6% | 5% |
| 18 to 24yrs. | 48% | 46% | 41% | 41% | 44% |
| 25 to 34yrs. | 35% | 43% | 44% | 44% | 43% |
| 35yrs.< | 3% | 6% | 10% | 9% | 7% |
| **Education** | | | | | |
| Less than HS | 19% | 19% | 23% | 21% | 21% |
| HS degree/GED | 74% | 56% | 56% | 53% | 57% |
| Some college/Associate's | 3% | 20% | 15% | 19% | 18% |
| Bachelor's degree or more | 3% | 4% | 6% | 6% | 4% |
| **Insurance Type** | | | | | |
| Private | 3% | 11% | 9% | 5% | 8% |
| Medicaid | 94% | 84% | 85% | 93% | 88% |
| Uninsured | 3% | 6% | 3% | 2% | 4% |

**FIGURE 10.** *SELF REPORTED STRESSORS*



| | |
|---|---|
| Pregnancy side-effects (physical) | 19% |
| Everything/life | 19% |
| Financial concerns | 18% |
| Homelessness/housing issues | 17% |
| Not listed | 8% |
| Lack of support from father/others | 7% |
| Anxiety/Depression | 5% |
| Preparation for child/child birth | 5% |
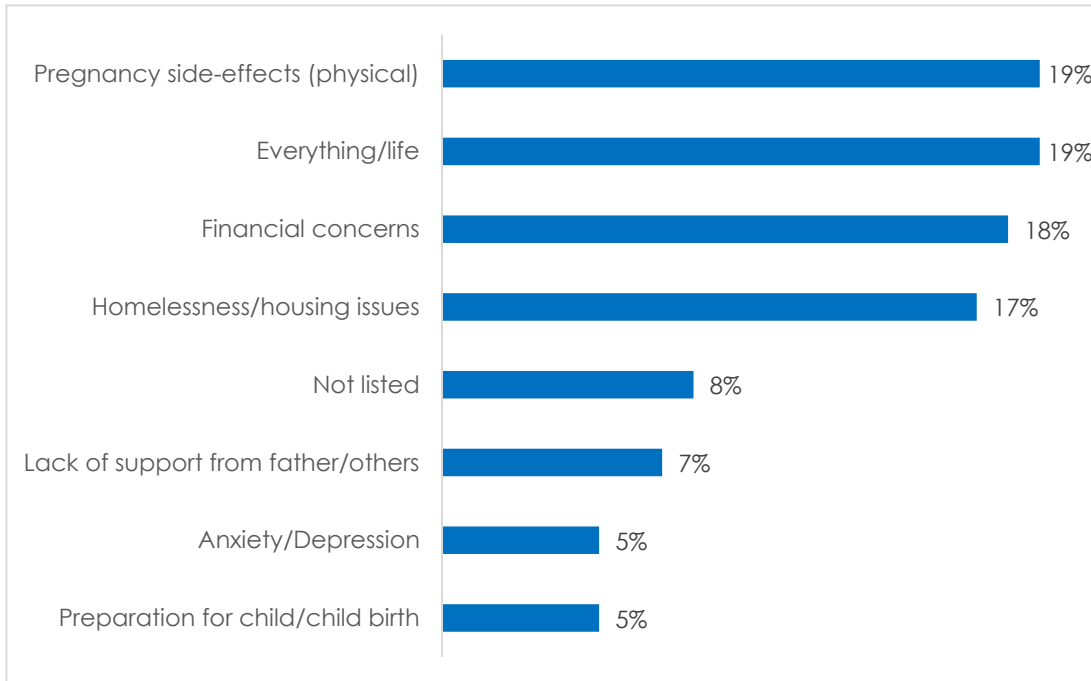
TABLE 4. *QUARTERLY BIRTH OUTCOMES*

| | Q1 | Q2 | Q3 | Q4 | Total |
|---|---|---|---|---|---|
| Deliveries | 15 | 26 | 56 | 124 | 238 |
| **Birth outcome** | | | | | |
| **Normal birth** | 73% | 79% | 89% | 83% | 83% |
| **Preterm birth** | 13% | 4% | 7% | 10% | 8% |
| **Low birthweight** | 27% | 7% | 5% | 15% | 11% |
| **Fetal death** | 0% | 8% | 2% | 0% | 1% |
| **Infant Death** | 0% | 4% | 0% | 0% | 0.04% |
| **Delivery type** | | | | | |
| **Vaginal** | 67% | 69% | 62% | 66% | 62% |
| **Cesarean** | 33% | 31% | 38% | 33% | 36% |
| **Breastfed** | | | | | |
| **Yes** | 67% | 75% | 55% | 66% | 63% |
| **No** | 33% | 17% | 45% | 31% | 34% |
| **Infant sex** | | | | | |
| **Male** | 47% | 50% | 50% | 56% | 53% |
| **Female** | 53% | 50% | 50% | 44% | 45% |

## Challenges and Future Plans

It was found that there were needs that were not being captured due to being categorized as 'other' when being documented based on the nature of the Redcap. Baby items, community health workers, and baby agencies were found to be among the highest needs not being captured. Because of this, the tool was adjusted so that for fiscal year 2020, these needs can be better captured. We also plan to ask the women we serve how we are doing as an agency connecting them to services.

FIGURE 11. *REFERRALS BY TYPE: OTHER*
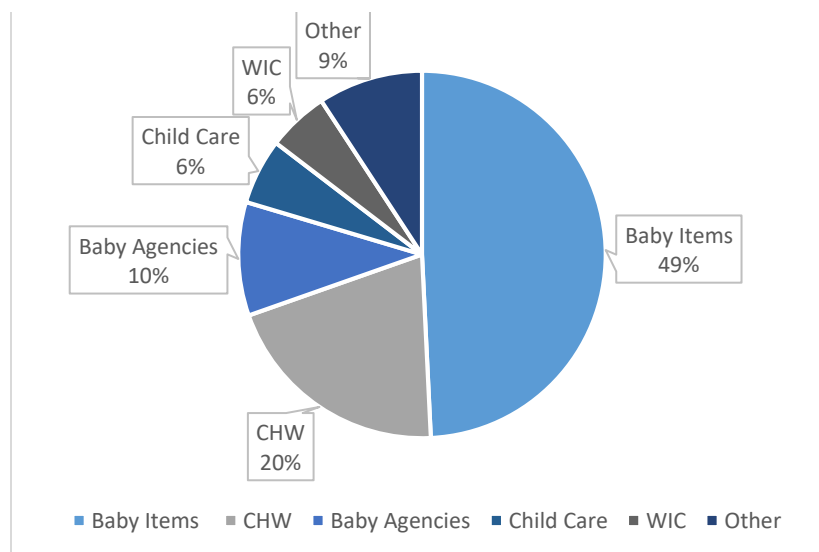
## Success stories

**Neighborhood Block Party**

A Rock the Block party was put on by Summit County Public Health in conjunction with Full Term First Birthday in one of Summit County's hot spot zip codes that experiences one of the highest infant mortality rates. This block party was a success and saw over 200 community members that day. Services aimed to help pregnant women were provided that day, infant vitality promotion as well as neighborhood navigation referrals. Next year, the Rock the Block party will be hosted in two locations (North Akron and South Akron) in order to reach more community members.
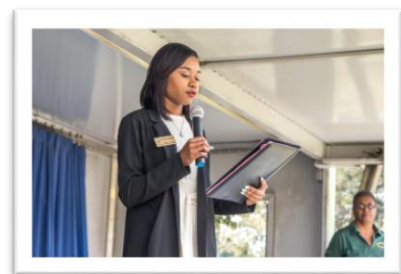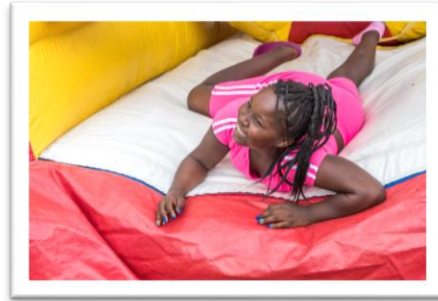
**Neighborhood Navigator Appreciation**

Our Neighborhood Navigator has been very instrumental in reaching, and connecting women to services needed to ensure an optimal birth outcome. She is a community health worker who comes from the community she serves. She has a kind and generous nature that makes it very easy for the women she connects with open up and establish a trust between our organization and the community we serve. Here are a couple of appreciation letters sent to our Navigator.

1867 W Market St.
Akron, OH 44313-6901
scph.org/nfp

P: (330) 923-4841
F: (330) 923-7558

P: (330) 926-5780
F: (234) 200-4610

Dear Carmen,

I wanted to let you know that during the 9/24/2019 Nurse-Family Partnership meeting we were discussing what is going well and what can be improved. Your name was mentioned a few times and I wanted to let you know what staff said. It is listed below.

- "Carmen is like butter, she is so smooth and natural with clients"
- "Carmen goes over and beyond with the clients. She is an expert in resources"
- "Whatever she tells clients, we should bottle it because she has a way with clients"

The NFP staff recognizes your kind and passionate nature and sees you as invaluable. Thank you for your hard work with our clients.

Sincerely,

Patrice Simmons, MPH, BSN, RN
Home Visiting Manager

To Carmen

A real awesome woman that God allowed me do met. I can only say Girl your the Bomb Awesome in every way thank You, thank You Thank You for being more than a blessing I love your wisdom & motivation you really inspired me more than you know God Bless you with every blessing & love that he has for you Please keep in touch

y. Shellman

You were our #1 referrer for March! January thru March

Carmen,
Thank you so much for your hard work with referring women to NFP. You are making a difference for generations to come.
Thank you from the NFP team

# PERINATAL PERIODS OF RISK

*Introduction*

The Perinatal Periods of Risk (PPOR) was developed by Dr. Brian McCarthy from the World Health Organization (WHO) Perinatal Collaborative Center at the Centers for Disease Control (CDC). This approach is used in developing countries to investigate feto-infant mortality problems, and has been recently used in the U.S. and urban settings. It identifies periods of risk with excess mortality within populations and helps to mobilize communities to focus preventive efforts on priority periods of risk.

This PPOR analysis provides data from Infant births, fetal and infant deaths from the years 2012 to 2016 in Summit County. The data used for this report was obtained from the Ohio Department of Health. Phase 1 analysis of PPOR looks at the feto-infant mortality map and gaps. Rates for feto-infant mortality are calculated and compared to the reference population. Excess mortality is calculated in order to identify opportunity gaps. PPOR identifies populations and periods of risk with the largest excess mortality, to focus preventive community efforts. Resident births, fetal deaths, and linked birth-infant death files from the Ohio Department of Health Vital Statistics are used to determine age at death and birthweight and calculate excess mortality.

At least 60 deaths overall and ten deaths in each periods of risk is needed to complete phase 1 of analysis. For this report, five years of feto-infant deaths were needed to complete the first phase of analysis. PPOR map is used to categorize the feto-infant deaths. There are three categories for age at death, fetal deaths with a gestational age of 24 weeks or more, neonatal deaths (first days of life), and post neonatal (rest of the first year of life). The four periods are defined by two determinants: birthweight and age at death. Birthweight is divided into two categories, less than 1,500 grams (very low birth weight), and greater than 1,500 grams. Live births, fetal and infant deaths under 500 grams were excluded. Each period of risk has a mortality rate per 1,000 live births.

The PPOR map is used to divide the overall feto-infant mortality into their respective periods of risk. This map is constructed based on age at death and birthweight. Age at death is separated into three categories: fetal death ($\geq$ 24 weeks gestation), neonatal death (died less than 28 days), and post neonatal death (28 – 364 days). Each feto-infant death is placed into one of the four categories based on birthweight and age at death. Because PPOR maps can be calculated for different subpopulations and geographical areas, comparisons can be made that highlight disparities that may exist by comparing subpopulation PPOR maps to a reference group that has been established to have the best birthing outcomes.

# PPOR Map

**FIGURE 12.** *PPOR MAP OF FETAL AND INFANT DEATHS*



Age at Death

Birthweight

|  | Fetal Deaths > 24 wks. | Neonatal Deaths | Post - neonatal Deaths |
|---|---|---|---|
| 500 g - 1499 g | Maternal Health/Prematurity | | |
| 1500+g | Maternal Care | Newborn Care | Infant Health |
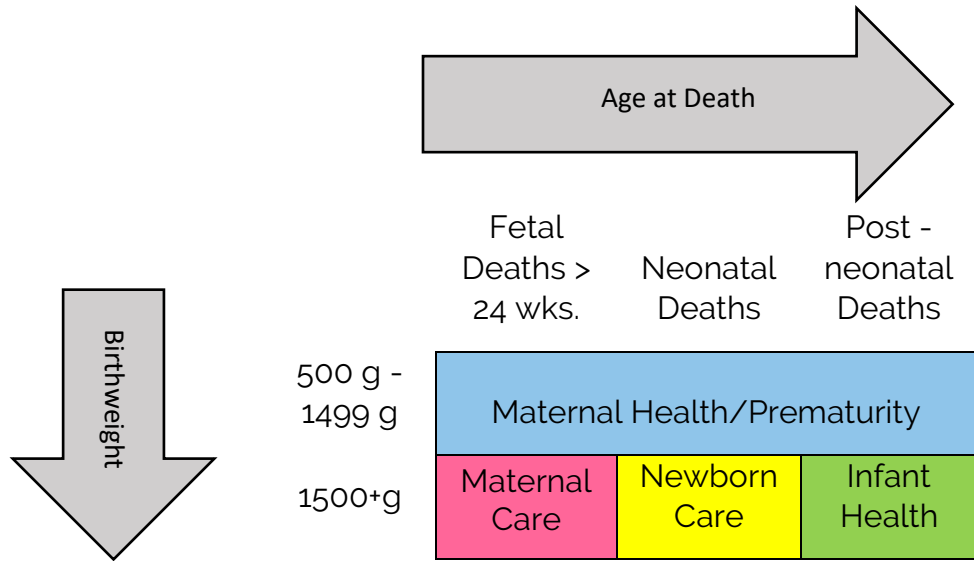
**FIGURE 13.** *EACH PERIOD OF RISK AND THE PREVENTIVE ACTIONS ASSOCIATED*



| Maternal Health / Prematurity | → | Preconception health<br>Health Behaviors<br>Perinatal Care |
|---|---|---|
| Maternal Care | → | Prenatal Care<br>High Risk Referral<br>Special Obstetric Care |
| Newborn Care | → | Perinatal Management<br>Neonatal Care<br>Pediatric Surgery |
| Infant Health | → | Sleep related Deaths<br>Injuries<br>Infections |
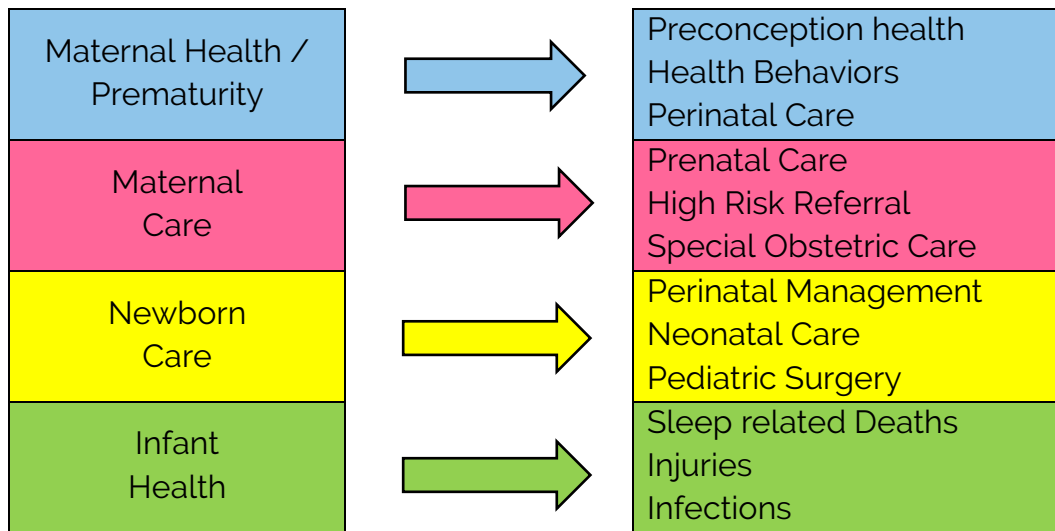
Each period of risk has preventive actions associated. For Maternal health and prematurity, preventive actions may need to focus on preconception health, health behaviors such as smoking, alcohol use, and perinatal care. For the maternal care period of risk, preventive actions should focus on prenatal care, especially in the first trimester, high risk referral, and special obstetric care. For the newborn care period of risk, preventive actions may need to focus on advanced neonatal care, perinatal management, and pediatric surgery. For infant health, preventive actions should focus on sleep related death preventions, decreasing co-sleeping situations, and increasing access to medical home and injury prevention.

## PPOR PHASE 1

The study population for this analysis are infants and fetal deaths within Summit County. Birth and death records were obtain from ODH vital statistics. Infant births, infant deaths, and fetal deaths that had birthweights less than 500 grams were excluded. Fetal deaths that occurred less than 24 weeks of gestation were excluded as well. If gestational age or birthweight was missing from birth and fetal death data, then those were excluded. There were a total of 30,482 births and fetal deaths included in this analysis from 2012 to 2016.

**FIGURE 14.** *PPOR MAP FOR SUMMIT COUNTY (2012 – 2016)*

2012-2016 Rate - 9.06

Maternal Health/Prematurity

| | | | |
|---|---|---|---|
| 500-1499g | 3.1 | | |
| 1500+g | 3.2 | 1.2 | 1.6 |
| | Maternal Care | Newborn Care | Infant Health |
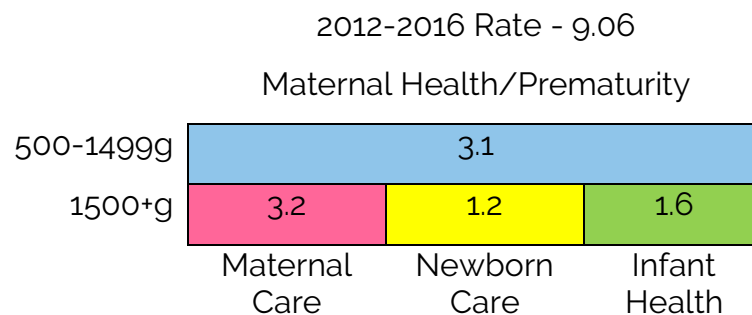
**FIGURE 15.** *PPOR MAP FOR THE REFERENCE GROUP (2012 – 2016)*

Reference Group - 5.9

Maternal Health/Prematurity

| 500-1499g | 1.4 | | |
|---|---|---|---|
| 1500+g | 2.7 | 1.2 | 0.6 |
| | Maternal Care | Newborn Care | Infant Health |
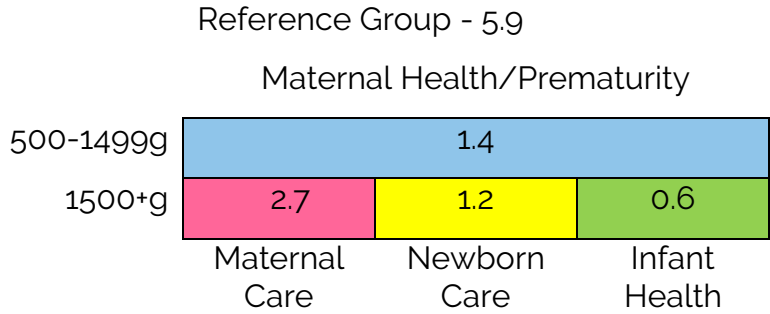
The reference group is the group that represents the best birth outcomes in Summit County. The reference group used in this analysis consists of infants and fetuses born to Non-Hispanic white mothers who were Summit County residents at the time of birth, who were 20 years of age or older, and having at least some college education from 2012 to 2016. There were a total of 15,367 infant births, and fetal deaths to NH white women who were 20 years or older and had a college education.

**FIGURE 16.** *FETO-INFANT MORTALITY GAP FOR SUMMIT COUNTY*

| | Maternal Health/ Prematurity | Maternal Care | Newborn Care | Infant Health | Feto-Infant Mortality Rate |
|---|---|---|---|---|---|
| Summit County | 3.1 | 3.2 | 1.2 | 1.6 | 9.06 |
| Reference Group | 1.4 | 2.7 | 1.2 | 0.6 | 5.9 |
| Excess Mortality | 1.7 | 0.5 | 0.0 | 1.0 | 3.2 |
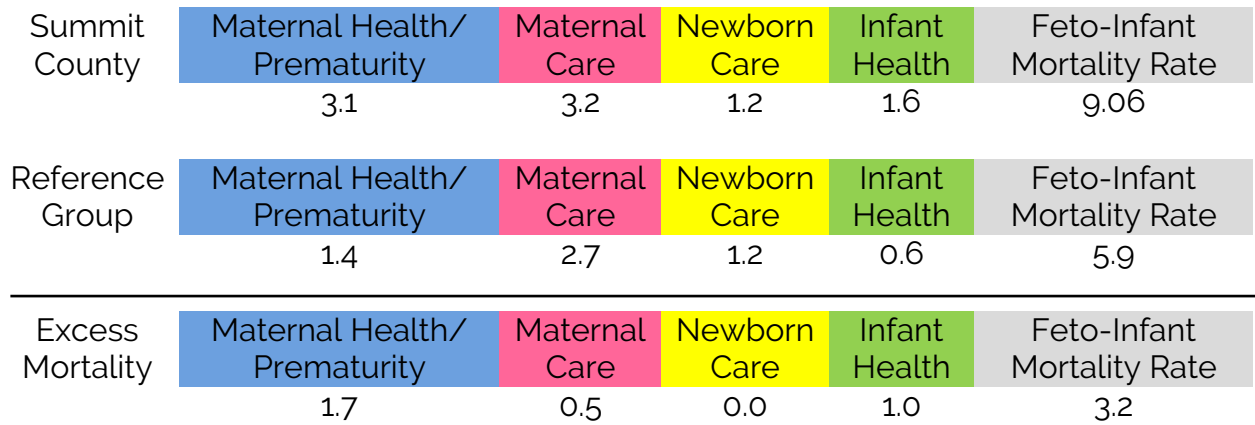
There were a total of 97 excess deaths making the excess rate 3.2 per 1000 live births and fetal deaths from 2012 to 2016 within Summit County. Maternal health/ Prematurity and Infant Health stand out as the periods of risk that need to be targeted for Summit County (Figure 16). For these periods of risk, factors that relate to

preconception health, perinatal care, sleep related deaths, injuries and infections should be further investigated to determine the cause of mortality and risk.

**FIGURE 17.** *FETO-INFANT MORTALITY GAP FOR SUMMIT COUNTY NH AFRICAN AMERICANS*

| | Maternal Health/Prematurity | Maternal Care | Newborn Care | Infant Health | Feto-Infant Mortality Rate |
|---|---|---|---|---|---|
| African American | 6.1 | 4.0 | 1.5 | 2.8 | 14.4 |
| Reference Group | Maternal Health/Prematurity | Maternal Care | Newborn Care | Infant Health | Feto-Infant Mortality Rate |
| | 1.4 | 2.7 | 1.2 | 0.6 | 5.9 |
| Excess Mortality | Maternal Health/Prematurity | Maternal Care | Newborn Care | Infant Health | Feto-Infant Mortality Rate |
| | 4.7 | 1.3 | 0.3 | 2.2 | 8.5 |

There were 55 excess deaths from 2012 to 2016 to African American mothers. The target periods of risk for African American mothers are Maternal Health/ Prematurity, Maternal Care, and Infant Health with Maternal Health/Prematurity being most important. There were 31 excess deaths in the Maternal Health/Prematurity period of risk for African Americans. Of those excess deaths, 24 were infant deaths that were born prematurely.

**FIGURE 18.** *FETO-INFANT MORTALITY GAP FOR SUMMIT COUNTY NH WHITES*

| | Maternal Health/Prematurity | Maternal Care | Newborn Care | Infant Health | Feto-Infant Mortality Rate |
|---|---|---|---|---|---|
| White | 2.3 | 3.0 | 1.2 | 1.3 | 7.8 |
| Reference Group | Maternal Health/Prematurity | Maternal Care | Newborn Care | Infant Health | Feto-Infant Mortality Rate |
| | 1.4 | 2.7 | 1.2 | 0.6 | 5.9 |
| Excess Mortality | Maternal Health/Prematurity | Maternal Care | Newborn Care | Infant Health | Feto-Infant Mortality Rate |
| | 0.9 | 0.3 | 0.0 | 0.7 | 1.9 |

There were 39 excess deaths from 2012 to 2016 to white mothers in Summit County. Maternal Health/Prematurity and Infant Health should be considered as a period of risk for white mothers due to the excess mortality rate being close to having an

excess rate of 1.0 feto-infant deaths per 1,000 births. Any excess death is a death too many and preventive actions should be considered. Most of the excess deaths occurred in the Maternal Health/Prematurity period of risk and all of the infant deaths in this period of risk were born prematurely.

## PPOR PHASE 2

Summit County continues to see disparities with infant and fetal mortality between NH African Americans and NH whites. Maternal health/prematurity is the greatest period of risk for Summit County, with NH African Americans making up a majority of the excess mortality in this period. Infant health is the second greatest period of risk seen in Summit County with NH African Americans having the highest excess feto-infant mortality rate.

The Kitagawa analysis done for Summit County focuses on the two pathways to excess morality of very low birthweight (VLBW) or less than 1499 grams. These contributions could be found by summing up all numbers contributing to each pathway for only the birthweight categories between 500 and 1,500 grams.

**TABLE 5.** *MATERNAL HEALTH AND PREMATURITY RISK PERIOD GAP*

| Study Population | Contribution to difference (VLBW) | Birthweight Distribution (VLBW) | Specific Mortality (VLBW) | VLBW Total |
|---|---|---|---|---|
| Summit County | Actual | 1.359 | 0.166 | 1.524 |
| | Percent | **89.1%** | **10.9%** | 100.0% |
| African American | Actual | 4.643 | -0.077 | 4.567 |
| | Percent | **101.7%** | **-1.7%** | 100.0% |
| Whites | Actual | 0.376 | 0.313 | 0.690 |
| | Percent | **54.6%** | **45.4%** | 100.0% |

The Kitagawa analysis found that for Summit County, Birthweight Distribution is the majority contributing factor for excess mortality for the maternal health and prematurity period of risk at 89%. This was also seen in the African American and white populations as well.

Infant health was determined to be the next period of risk with excess mortality that needed to be addressed from phase 1 of PPOR for both Summit County and African Americans. The goal for infant health in phase 2 is to explore the reasons for the excess mortality in this period of risk. For this period of risk, infants weighing more than 1500 grams and died after 27 days and before one year of life were included. Racial breakdown analysis was completed however, due to having less than 20 deaths in each category, information found while doing the analysis for racial subgroups were not significant and not reliable.
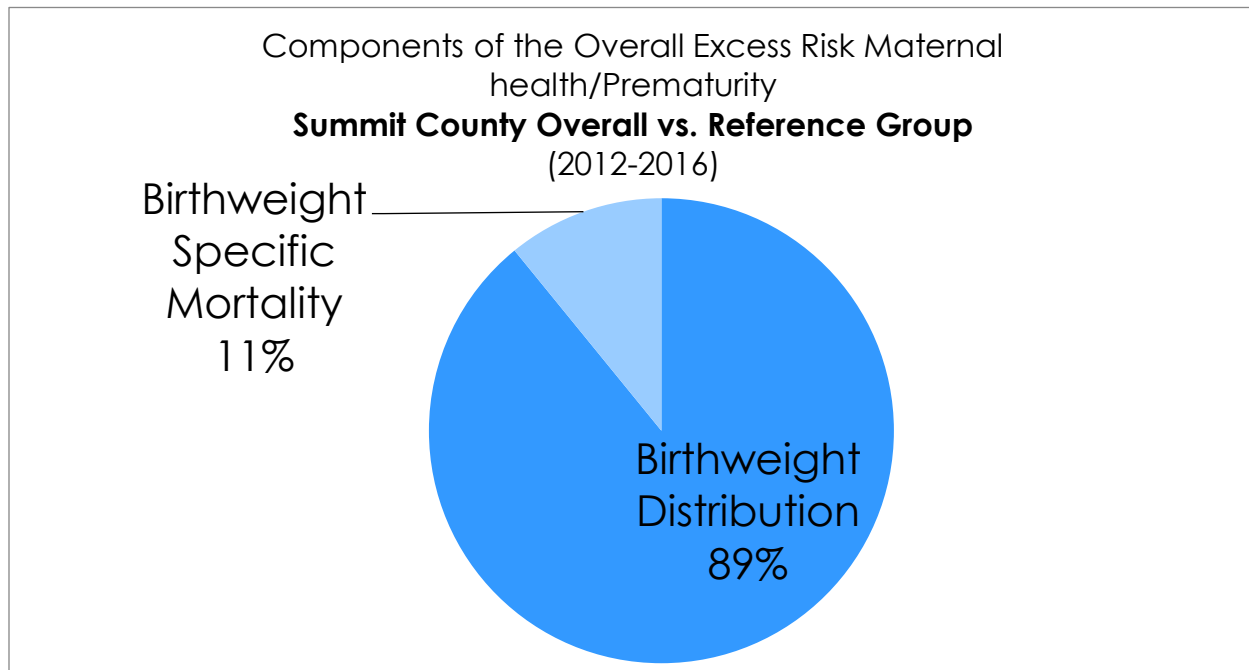
**FIGURE 19.** *COMPONENTS OF THE OVERALL EXCESS RISK*



Components of the Overall Excess Risk Maternal health/Prematurity
**Summit County Overall vs. Reference Group**
(2012-2016)

Birthweight Specific Mortality 11%

Birthweight Distribution 89%

**TABLE 6.** *EXCESS MORTALITY CAUSE, SUMMIT COUNTY*

| ***Report Excess Mortality*** | |
|---|---|
| **Excess Mortality from SUID** | 0.81 |
| **Excess Mortality from Other** | 0.18 |
| **Total Excess Mortality (IH Period)** | **0.99** |
| **82% of excess mortality in the green box is due to sleep-related death.** | |

**TABLE 7.** *EXCESS MORTALITY CAUSE, AFRICAN AMERICAN*

| ***Report Excess Mortality*** | |
|---|---|
| **Excess Mortality from SUID** | 1.75 |
| **Excess Mortality from Other** | 0.38 |
| **Total Excess Mortality (IH Period)** | **2.13** |
| **82% of excess mortality in the green box is due to sleep-related death.** | |

For both Summit County as a whole, and African Americans, Sudden unexpected infant death syndrome (SUIDS) was the leading cause of excess mortality for infant

health. The infant health period of risk numbers are small for both African Americans and Summit County as a whole, analysis of the risk factors chosen are not considered reliable.

The African American population within Summit County is the only study group in phase one that had excess mortality in the maternal care period of risk. Currently, there is no analysis associated with this period of risk to address the risk factors associated. Also, with the African American sample being small in this study, results from an analysis would be unreliable.

**TABLE 8.** *POPULATION ATTRIBUTABLE RISK FOR VERY LOW BIRTH WEIGHT (<1,500 GMS) FOR SUMMIT COUNTY 2012-2016 (N = 30482)*

| Risk Factor | PAR | 95% CI | Relative Risk |
|---|---|---|---|
| **Race (African American)** | **20.7%** | **17 – 24.3** | **2.2** |
| Education (less than bachelor's degree) | -17.3% | -13.7 – -21.9 | 0.6 |
| **Marital status (No)** | **23.2%** | **18.4 – 28.8** | **1.7** |
| Teen mother (Yes) | 0.7% | 0.2 – 2.7 | 1.4 |
| **Medicaid (Yes)** | **21.8%** | **16.9 – 27.7** | **1.6** |
| **Plurality (>1)** | **21.6%** | **19.1 – 24.4** | **8.3** |
| First Trimester Care | 7.0% | 3.8 – 12.5 | 1.3 |
| Previous Preterm Birth (Yes) | 11.1% | 9.1 – 13.5 | 4.3 |
| Smoking (Yes) | 4.7% | 2.4 - 9 | 1.3 |
| Congenital Anomalies (Yes) | 0.5% | 0.1 – 1.5 | 2.4 |
| Sexually Transmitted Disease (Yes) | 2.1% | 0.9 – 4.9 | 1.3 |
| BMI (Obese) | 10.1% | 6.8 – 14.8 | 1.4 |
| WIC participation (Yes) | 5.9% | 2.6 – 12.6 | 1.2 |

*Bold =highest PAR, PAR = Population Attributable Risk, SUIDS = Sudden Unexpected Infant Death, CI = Confidence Interval

**TABLE 9.** *POPULATION ATTRIBUTABLE RISK FOR SUIDS FOR SUMMIT COUNTY 2012-2016 (N = 30369)*

| Risk Factor | PAR | 95% CI | Relative Risk |
|---|---|---|---|
| Race (African American) | **25.1%** | **9.9 – 50.7** | **2.6** |
| Education (less than bachelor's degree | **83.3%** | **49.9 – 96.2** | **8.7** |
| Marital status (No) | **43.6%** | **20.3 – 70.2** | **2.8** |
| Teen mother (Yes) | 1.2% | 0 - 61 | 1.7 |
| Medicaid (Yes) | **68.6%** | **43.2 – 86.3** | **6.0** |

*Bold =highest PAR, PAR = Population Attributable Risk, SUIDS = Sudden Unexpected Infant Death, CI = Confidence Interval

The Kitagawa analysis was used to determine how much of the excess deaths that occurred in the maternal health and prematurity period of risk were due to birthweight distribution or birthweight specific mortality, and the risk factors within those categories were further analyzed. Because most of the deaths in that period of risk were due to birthweight distribution for both Summit County and African Americans, very low birthweight was used as the outcome when assessing attributable risk and relative risk. It was found that being African American, having a plurality of greater than 1, being on Medicaid, and being single had the largest PAR, meaning they accounted for the majority of the VLBW births for Summit County (Table 8).

For the infant health period of risk, both Summit County and African Americans had the same excess death due to SUIDS at 82% (tables 6 and 7). When looking at the risk factors associated, having an education lower than a Bachelor's degree and being on Medicaid, attributed most to the excess death (table 9).

*Summit County's PPOR report provides more information on the analysis looking into the risk factors associated with each period of risk that were found in phase 1

# FIMR

## *Executive Summary*

The Summit County Public Health (SCPH) Fetal Infant Mortality Review (FIMR) program is a subcommittee under the Child Fatality Review Board (CFRB). In 2016 the FIMR program began taking shape with a new FIMR Coordinator and a consistent Case Review Team (CRT). The FIMR process has become more stable while it continues to grow and develop. Currently, the role of the FIMR Coordinator involves many responsibilities including: writing and mailing letters of condolence to families experiencing a fetal loss, requesting records from various healthcare providers and systems,  abstracting data from medical records, creating case summaries using de-identified information, conducting voluntary consented maternal interviews, convening quarterly CRT meetings, maintaining CRT meeting minutes and a balanced CRT of community representatives when members resign. At this time case review criteria for fetal deaths are prioritized by maternal in-county residency, a maternal interview with a gestation of 20 weeks or more, or 24 weeks gestation with no maternal interview.

The CRT consists of 18 members from various community agencies within the county. A future goal for 2019 is to create a Community Action Team (CAT) that will examine trends and recommendations from the CRT to consider possible community interventions to improve services and resources for families. Early in 2018 the FIMR Coordinator participated in training webinars for the launching of the National Fatality Case Review (NFRC) System which now includes tracking of fetal deaths and maternal interviews. The FIMR Coordinator began utilizing the NFCR System in May 2018 to track cases from that time moving forward.  The FIMR Coordinator continues to track and report fetal deaths to the Ohio Department of Health (ODH) on a quarterly basis to document SCPH's FIMR process.

This report marks the first of many that SCPH FIMR will publish to share with the community its findings and recommendations.  The FIMR CRT reviewed eight cases and the FIRM Coordinator conducted 6 maternal interviews.  Only data for fetal deaths of Summit County residents was included. The graphs depict an unknown category for answers or responses left blank.

## *FIMR Model*

SCPH's FIMR program is modeled from the National Fetal Infant Mortality Review Program (NFIMR) which is an evidence-based model. The NFIMR Program was a collaborative effort between the American College of Obstetricians and Gynecologists (ACOG) and the Maternal and Child Health Bureau (MCHB) in 1990 to address the rate of infant and fetal deaths.  FIMR is a community-based, action-oriented process to improve service systems of care and resources for infants, women and families.   This process examines fetal and infant deaths, determines

preventability and engages communities to take action. Once cases are identified for review, the following steps are taken:

Data Abstraction - Information is collected from a variety of sources which may include physician, hospital, and community program records, as well as fetal and infant death certificates.  All information is then de-identified as the case summaries are written.

Maternal/Family Interviews - Interviews obtain unique information not typically available from vital statistics or medical records.  This provides an opportunity for the mother and/or family to provide their perspective as consumers on the healthcare and social services utilized in their community.

Case Review Team - The CRT is a multidisciplinary team of providers, institutions, advocates, professional organizations and public and private agencies that provide services and resources for women, infants and families.  The CRT reviews case summaries from de-identified fetal & infant deaths.  The case summaries include maternal interviews whenever possible.  The team makes recommendations for system changes.

Community Action Team - The CAT is composed of community leaders that possess political will and fiscal resources to create large scale system change and have the community perspective to best create the desired change.
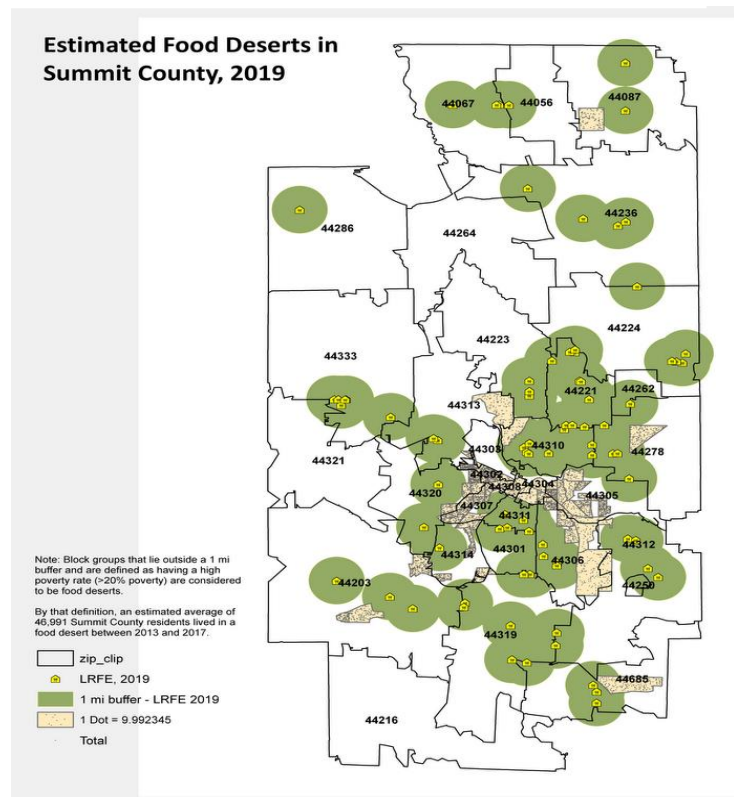
# *Social Determinants of Health*

Social determinants of health (SDOH) are the conditions in which people are born, grow, work, live, worship and age, and the wider set of institutionalized forces, systems, and social interactions that affect a wide range of health, functioning, and quality of life outcomes and risks.[1] The relationship between a populations experience within the social determinants of health and its impact on said population's health is fundamental in the fight against infant and fetal mortality as well as maternal child health. Examples of the social determinants of health that affect Summit County residents include: poverty, access to housing, access to transportation, access to health care services, and access to healthy options in food. Healthy People 2020 highlights the importance of addressing the social determinants of health by creating social and physical environments that promote good health for all.[2]

**FIGURE 20.** *ESTIMATED FOOD DESERTS IN SUMMIT COUNTY, 2019*



Most of the fetal deaths in 2018 occurred in the 44310 zip code. According to the American fact finder census data, 21% of the population live below the poverty level, and 41% that live below the poverty level (43% male, and 39% female) were unemployed in 2017. The zip code 44301 experienced the second highest fetal deaths, followed by the 44306 zip code. Those living below the poverty level in these areas are 22.3% and 33.8% in 2017 respectively. In the 44301 zip code, 44% live below the poverty level and are unemployed. The racial disparity in the social determinants of health can be seen in access to transportation; the differences in those that utilize public transportation versus those that do not. In the 44306 and 44301 zip codes, 13% and 11.9% of African Americans utilized public transportation to get to work versus 2% and 1% of whites respectively. In the zip code that experienced the most fetal deaths, 4% of African Americans and whites used public transportation to get to work. Figure 20 depicts the estimated food deserts in Summit County for 2019 by zip code. Large retail food establishments (LFRE) are shown as yellow buildings on the map. A one mile radius of the LFRE are depicted in green, while the tan shaded areas represent

the estimated food deserts. The white areas do not meet the criteria of being a food desert as they are more affluent (greater than 20%) and most likely have access to a vehicle to travel to an LFRE.

It is important to understand the relationship between how a population experiences social determinants of health and its effects on the population's health outcomes. By working to establish policies that have a positive influence on the social determinants of health affecting the Summit County community, improvements can be made on the health and birth outcomes of community members that can be sustainable over time.

## Summit County 2018 Statistics

There were 5,953 live births in Summit County in 2018. There were 41 infant deaths and 44 fetal deaths. Fetal deaths decreased from 57 in 2017 to 44 in 2018.  Mothers age 27 experienced the most fetal deaths, followed by mothers age 31. Fetal deaths to white mothers decreased by 15% (26 to 22), while fetal deaths to African American mothers decreased by 36% (25 to 16) from 2017 to 2018. Most of the fetal deaths in 2018 (n = 25) were under 29 weeks gestation, compared to 2017 where most fetal deaths (n = 29) were under 25 weeks gestation. Zip codes 44310, 44306 and 44301 experienced the most fetal deaths in 2018. For the fetal deaths in 2018, 41% of women reported being married. This is similar to the marital status rate for mothers who experienced a fetal death in 2017. For mothers who gave birth, 59% were married and 44% were unmarried.

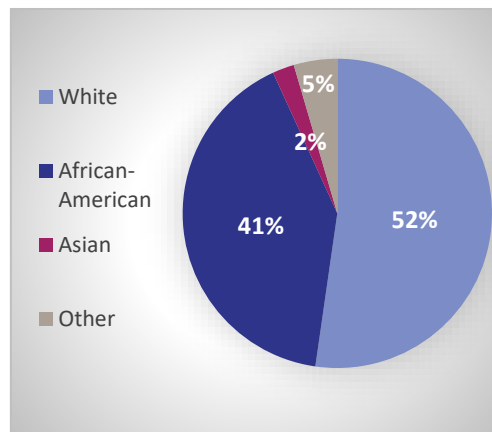**FIGURE 21.** *MOTHER'S RACE WHO HAD A FETAL DEATH IN 2018*



Figure 25. This figure represents the percentage distribution of mother's race for Summit County residents who had fetal deaths in 2018. The "Other" category included blank responses, and responses coded as 999. White (n = 23), African American (n = 18) Asian (n = 1), Other (n = 2). Racial disparity is apparent in fetal deaths although 52% of fetal deaths were to white mothers, the percentage of African American fetal deaths is disproportionately high given that African Americans make up about 14.5% of the Summit County population.

**FIGURE 22.** *GESTATIONAL AGE OF FETAL DEATHS IN 2018*
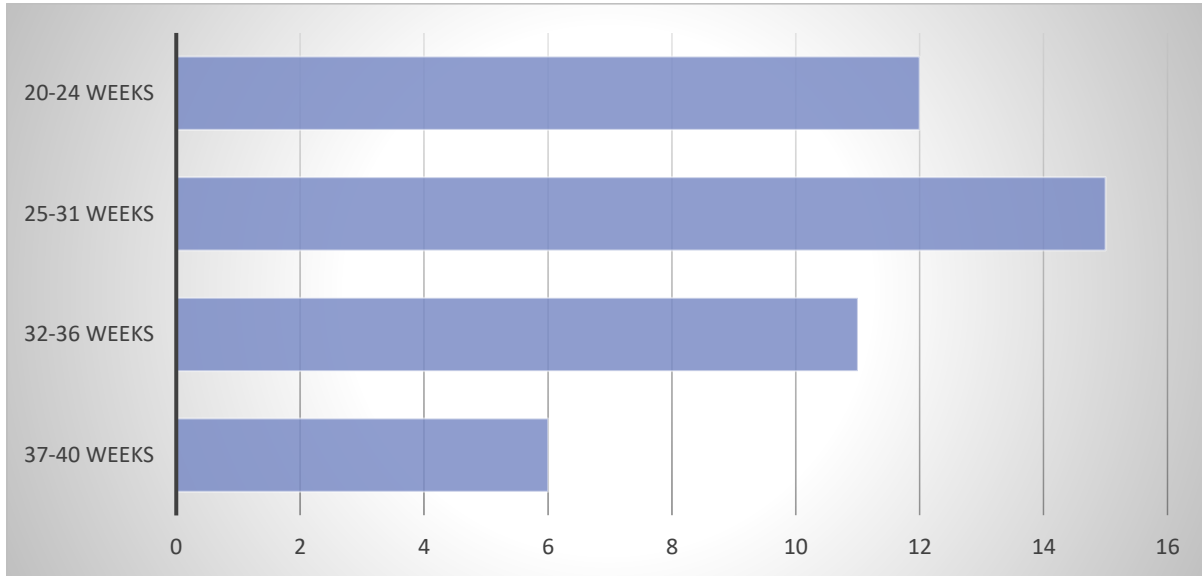


The majority of fetal deaths (35%) occurred during the gestational age period that is considered very premature at 25 to 31 weeks, followed by extremely premature at 20 to 24 weeks Figure 22. The gestational age of the majority of the fetal deaths in 2018 is higher than 2017 with the majority having a gestational age of less than 25 weeks. When examined by race, most of the fetal deaths to non-Hispanic white mothers occurred between 25 to 31 weeks gestation while most of the fetal deaths to non-Hispanic black occurred between 32 to 36 weeks gestation.

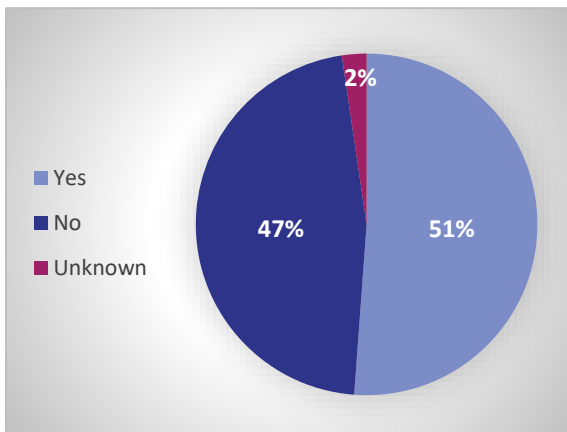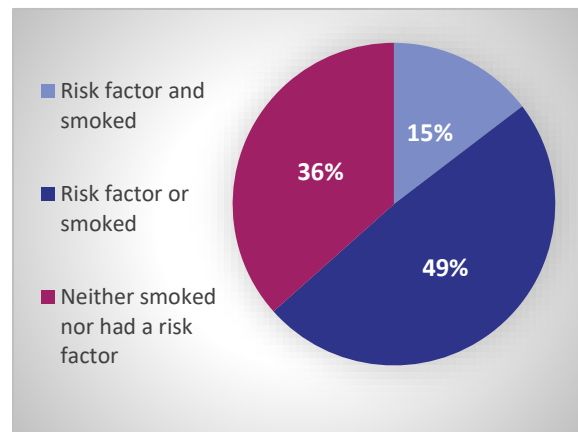**FIGURE 23.** *RISK FACTORS PRESENT IN MOTHERS WHO HAD A FETAL DEATH IN 2018*

**FIGURE 24.** *RISK FACTORS AND SMOKING PRESENT IN MOTHERS WHO HAD A FETAL DEATH IN 2018*

Figures 23 and 24 depicts that almost 50% of women who had a fetal death in 2018 either smoked or had a risk factor associated at the time of death. Only 36% of women who had a fetal death neither smoked or had a risk factor present.

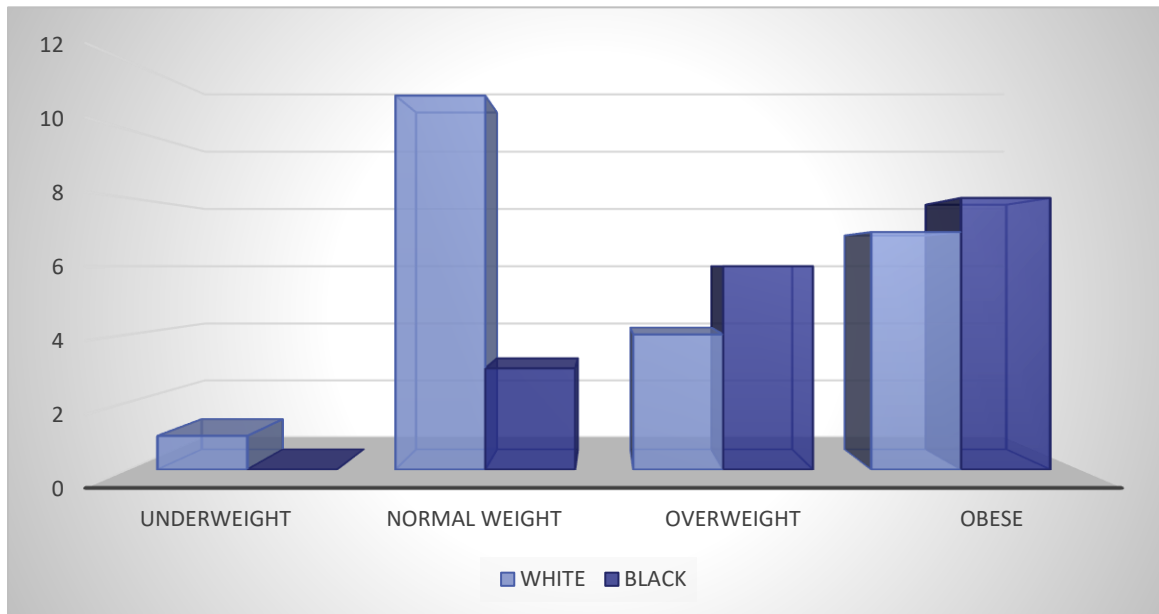**FIGURE 25.** *BMI FOR MOTHERS WHO HAD A FETAL DEATH BY RACE IN 2018*



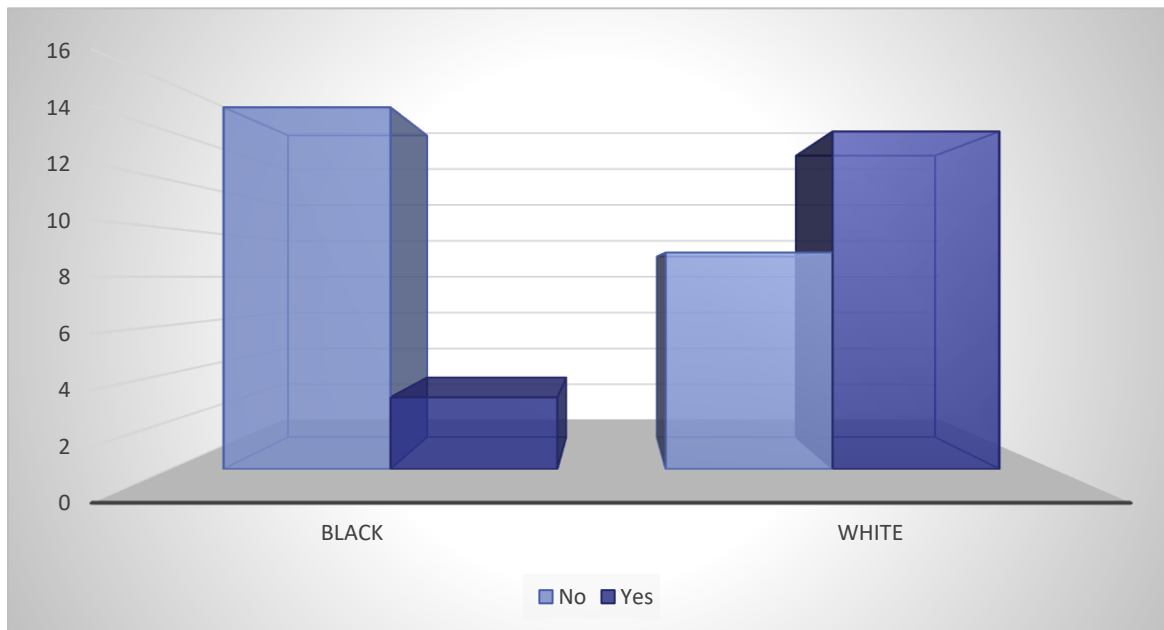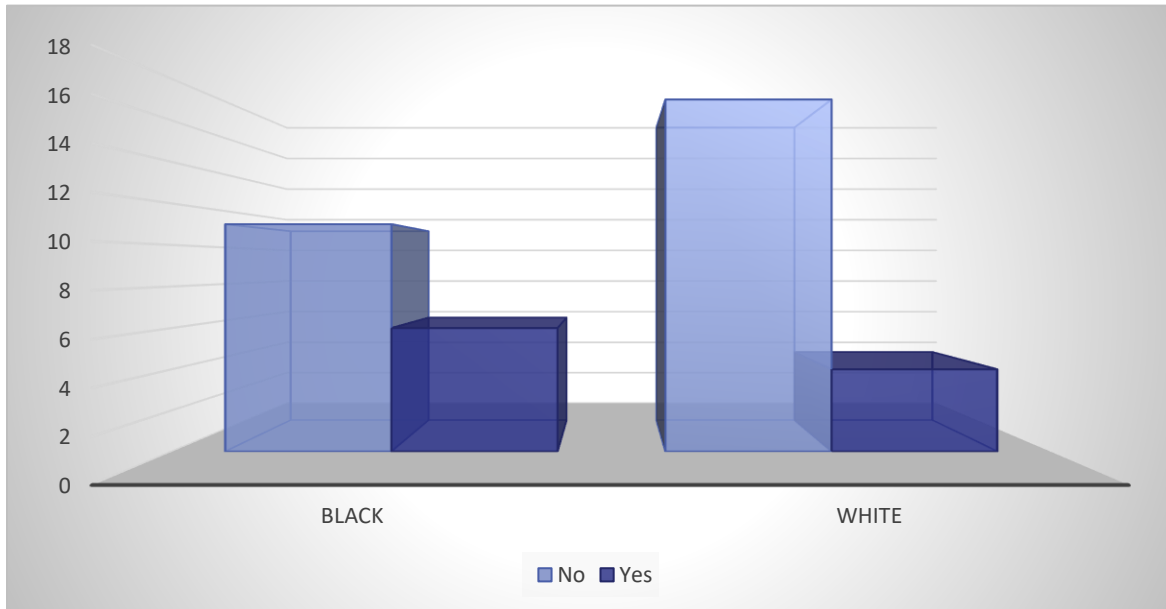**FIGURE 26.** *MARITAL STATUS FOR MOTHERS WHO HAD A FETAL DEATH IN 2018*

**FIGURE 27.** *WIC STATUS FOR MOTHERS WHO HAD A FETAL DEATH BY RACE IN 2018*



The graphs continue to depict a disparity present in fetal deaths for Summit County. More African American mothers than white mothers weren't married, had higher BMI's and less educational attainment (figures 25, 26 and 27). Fetal death records do not indicate a mother's Medicaid status, therefore poverty rates are not easily ascertained. Of the mothers who experienced a fetal death and had risk factors present 54% were African American and 45% were white. However, more than half of the mothers in each racial group had risk factors present.

Future goals-

SCPH FIMR will continue to grow and refine the process by:

- Creating data use agreements with community partners to access medical records for data abstraction
- Recruiting community agencies and organizations to become members for the CRT & CAT when members resign or don't consistently participate

- Creating paper & electronic surveys for maternal interviews to reduce barriers of time, travel or those not feeling comfortable discussing their story in person

- Include maternal interviews of mothers who have suffered an infant loss

- Streamline and standardize annual FIMR reports

# Technical Notes

**Data Sources:** The Summit County Public Health Epidemiology/Biostatistics Unit completed all analysis.

1. **Infant Mortality:** ODH data from birth and death certificates were used to count infant deaths and calculate the infant mortality rate. Data from 2018 and earlier are finalized.
2. **Birth Indicators:** ODH Birth certificate data
3. **Cause and Manner of Child Death:** Sleep-related death information was provided by the Summit County Child Fatality Review Board.
4. Fetal deaths: Fetal death certificate data is provided by ODH vital statistics. Deaths from 2018.

**Data limitations:** It is important to note that large annual changes in birth rates, especially for specific racial or ethnic groups, may be due to small overall numbers of births within that population. Caution is warranted in interpreting these findings across subpopulations within the County.

**Racial demographics:** To determine whether racial disparities exist in Summit County in either infant deaths or birth outcomes, infant death and birth data is also stratified by race and ethnicity. These groups are divided following practice by the federal government and the race categories in the ODH birth data: Non-Hispanic White, Non-Hispanic African American, Hispanic, and Non-Hispanic Asian. Although smaller in size, the Hispanic and Asian communities are significant, especially in certain areas throughout Summit County. For this report, the graphs will include data from 2013, which was the first year of organized infant mortality efforts through the formation of the Ohio Equity Institute (OEI) and Summit County Better Birth Outcomes (SCBBO).

**Special notes on reporting by race/ethnicity:** The information on race and ethnicity is based on self-reported data provided by the mothers about themselves; the race/ethnicity of children may be different from those of their mothers. The mothers who identify their ethnicity as Hispanic or Latino may belong to any racial group. The rates reported for black or African American mothers combines members from both the U.S.-born and African immigrant communities. Rates would be expected to be notably different for these two subgroups. The number of births and the overall rate reported for Hennepin County includes a small number of births to mothers whose race/ethnicity was not identified.

**Summit County Census Tract Clusters:** Based on census tracts from the 2010 census, twenty Summit County clusters were developed to standardize data reporting within Summit County Public Health. The clusters are groupings of census tracts with similar demographic characteristics.

# REFERENCES

1. Centers for Disease Control and Prevention (CDC). Preterm Birth. Retrieved November 8, 2017 from: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm
2. March of Dimes. Premature Babies. Retrieved November 8, 2017 from: https://www.marchofdimes.org/complications/premature-babies.aspx
3. Centers for Disease Control and Prevention (CDC). Preterm Birth. Retrieved November 8, 2017 from: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm
4. March of Dimes. Premature Babies. Retrieved November 8, 2017 from: https://www.marchofdimes.org/complications/premature-babies.aspx
5. March of Dimes. Low birthweight. Retrieved November 16, 2017 from: https://www.marchofdimes.org/complications/low-birthweight.aspx
6. The Contribution of Low Birth Weight to Infant Mortality and Childhood Morbidity. Retrieved July 5 2018 from: https://www.ncbi.nlm.nih.gov/pubmed/3880598
7. What is prenatal care and why is it important? Retrieved June 25, 2018 from: https://www.nichd.nih.gov/health/topics/pregnancy/conditioninfo/prenatal-care
8. The impact of prenatal care in the United States on preterm births in the presence and absence of antenatal high-risk conditions. Retrieved June 26, 2018 from: https://www.ajog.org/article/S0002-9378(02)00404-0/abstract
9. The impact of prenatal care in different social groups. Retrieved June 26, 2018 from: https://www.ajog.org/article/0002-9378(83)90681-6/abstract?code=ymob-site
10. Centers for Disease Control and Prevention (CDC). Maternal and Infant Health. Retrieved November 8, 2017 from: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/index.html
11. March of Dimes. (2015). Birth Spacing and Birth Outcomes. Retrieved November 30, 2017 from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=0ahUKEwim-t7xpoLYAhUm5YMKHZUwCJEQFgg9MAM&url=https%3A%2F%2Fwww.marchofdimes.org%2FMOD-Birth-Spacing-Factsheet-November-2015.pdf&usg=AOvVaw3E6F0dgzk6ZQZBe1M7cOB0
12. Family planning: Get the facts about pregnancy spacing. Retrieved June 26, 2018 from: https://www.mayoclinic.org/healthy-lifestyle/getting-pregnant/in-depth/family-planning/art-20044072
13. Short Interpregnancy Intervals in 2014: Differences by Maternal Demographic Characteristics. Retrieved June 26, 2018 from: https://www.cdc.gov/nchs/products/databriefs/db240.htm
14. Centers for Disease Control and Prevention (CDC). Tobacco Use and Pregnancy. Retrieved November 16 from: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/tobaccousepregnancy/index.htm

15. Ohio Department of Health (ODH).  (2017). Infant Safe Sleep.  Retrieved 12/5/2017 from:  https://www.odh.ohio.gov/safesleep/

16. State Infant Mortality Collaborative: Infant Mortality Toolkit. State Infant Mortality (SIM) Toolkit: A Standardized Approach for Examining Infant Mortality. N.p., 01 Nov 2013. Web. <http://www.amchp.org/programsandtopics/data-assessment/InfantMortalityToolkit/Pages/default.aspx>.

17. Reidpath, D.D., & Allotey, P.  (2003). Infant mortality rate as an indicator of population health.  Journal of Epidemiology and Community Health, 57(5): 344-346. Doi:10.1136/jech.57.5.344.

18. CDC: Ohio's Infant Mortality Rate Remains One of the Highest in US. http://www.ideastream.org/news/cdc-ohios-infant-mortality-rate-remains-one-of-the-highest-in-us

19. Centers for Disease Control and Prevention (CDC).  Preterm Birth.  Retrieved November 8, 2017 from: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm

20. NCHHSTP Social Determinants of Health. https://www.cdc.gov/nchhstp/socialdeterminants/index.html

21. Healthy People 2020: An Opportunity to Address Societal Determinants of Health in the United States. https://www.healthypeople.gov/2010/hp2020/advisory/SocietalDeterminantsHealth.htm

22. Social Determinants of Health: Know What Affects Health. https://www.cdc.gov/socialdeterminants/

23. Social Determinants of Health. https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health

Summit County Public Health