# *PERINATAL PERIODS OF RISK ANALYSIS, 2003-2012 Period*
# *Kalamazoo County Healthy Babies-Healthy Start*

PROJECT NAME: Kalamazoo County Healthy Babies-Healthy Start

TITLE OF REPORT: Perinatal Periods of Risk Analysis: 2003-2012 Period

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## Section I: Introduction

The purpose of Healthy Babies-Healthy Start (HBHS) in Kalamazoo, Michigan is to eliminate the racial disparities in perinatal health. One of the key indicators of perinatal health is fetal-infant mortality. Kalamazoo County has long had a history of high fetal-infant mortality, with black families bearing the brunt. Most recent figures show that Black infants are dying at 4.5 times the rate of white infants. The table below summarizes the last 20 years in Kalamazoo. Out of the 59 counties in Michigan with enough births to generate an annual infant mortality rate, Kalamazoo is ranked 34th.[1] While there have been ups and downs over the last decade shown below, the county as a whole has seen notable gains, and is close to meeting the Healthy People 2020 goal of 6.0 IMR per 1,000 births.

### Infant Mortality & Racial Disparities Trends, Kalamazoo County, 2003-2012

Infant Mortality Rates per 1,000 Live Births, Three-year moving Averages

| | 2002-2004 | 2003-2005 | 2004-2006 | 2005-2007 | 2006-2008 | 2007-2009 | 2008-2010 | 2009-2011 | 2010-2012 |
|---|---|---|---|---|---|---|---|---|---|
| KALAMAZOO COUNTY RATE | 8.8 | 7.3 | 6.4 | 7.2 | 7.1 | 8.4 | 8.6 | 7.6 | 6.4 |
| White | 6.4 | 5.2 | 4.6 | 5.0 | 4.8 | 5.5 | 5.7 | 4.8 | 3.9 |
| Black | 20.8 | 17.9 | 16.0 | 16.8 | 16.8 | 19.2 | 19.5 | 18.3 | 17.6 |
| DISPARITY: RATIO OF BLACK TO WHITE IMR | 3.3 | 3.4 | 3.5 | 3.4 | 3.5 | 3.5 | 3.4 | 3.8 | 4.5 |

Source: Michigan Department of Community Health, Division for Vital Records and Health Data Development. *Michigan Infant Death Statistics.* March, 2014.

There are many contributing factors to fetal-infant mortality and disparities in those rates. A community must assess these risk factors in order to develop a prevention strategy. The Perinatal Periods of Risk Analysis is a tool developed by the World Health Organization and adopted by the Center for Disease Control and Prevention to translate fetal-infant birth and death

[1] Michigan Department of Community Health, Division for Vital Records and Health Statistics. 2014. "Michigan Infant Death Statistics: January 1 through December 31, 2012.

data into prevention and intervention efforts. This local evaluation study will serve both *outcome* and *formative* purposes; monitoring the impact of perinatal health services and systems, of which Healthy Babies-Healthy Start is a part, and also guiding the Local Health Systems Action Plan and, more specifically, the program elements of Kalamazoo County Healthy Babies/Healthy Start Project.

Section II: Process

The World Health Organization, in collaboration with the Center for Disease Control, developed the Perinatal Periods of Risk Analysis (PPOR), based upon a strong conceptual prevention framework, and takes into account both fetal and infant mortality. It is a powerful mechanism for analyzing gaps at the community level and mapping them onto specific perinatal periods, each with specific problem areas and intervention foci:

-Maternal Health/Prematurity category (preconceptional health, health behaviors, perinatal care, etc)
-Maternal Care category (prenatal care, referral system, high-risk obstetric care, etc)
-Newborn Care category (perinatal management, perinatal system, pediatric surgery, etc)
-Infant Health category (sleep-related, injury prevention, breast-feeding, etc)

Key Questions:

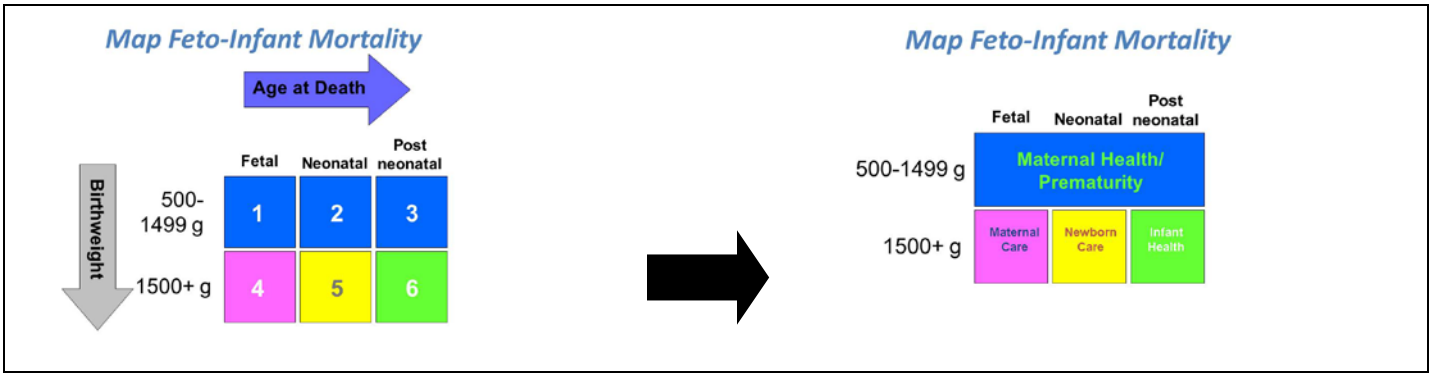
1) Compared to Kalamazoo County maternal reference group, for which perinatal periods are Black and poor women in Kalamazoo County at excess risk?
2) What are the temporal trends?

Methodology:

The Michigan Department of Community Health, Division of Vital Records and Health Data Development generated the following PPOR-specific annual counts for the years 1995 through 2012 for Kalamazoo County:

-Infant births
-Fetal deaths
-Neonatal infant deaths (within first 28 days)
-Post-neonatal infant deaths (between 28 days and 1 year)

In addition to total figures, aggregated counts were stratified into two birth weight groups: 500-1499 grams, and 1500+grams. The PPOR approach clusters these figures into four cells, the very low birth weight (500-1499 grams) group and three higher birth weight (1500+ grams) cells form the three remaining groups (see figure below).



For validity, the PPOR needs mortality figures of 60 or more; therefore, we collapsed 10 years of FIMR data (2003-2012) to calculate the most recent PPOR as well as the previous, comparison period (1997-2006).

Applying the PPOR algorithm, we produced the following series of PPOR maps for each period:

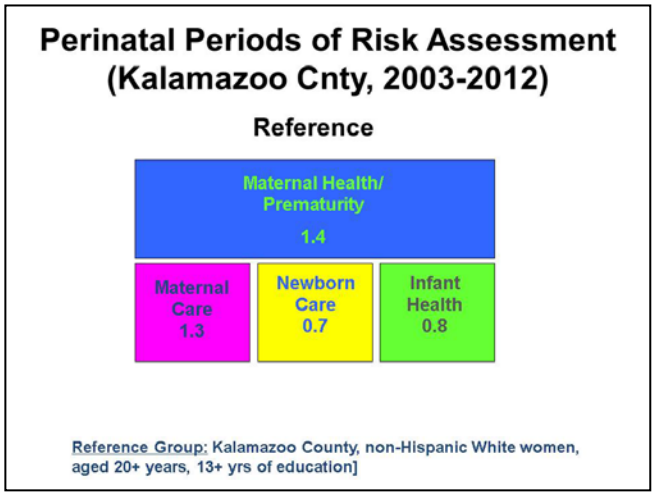
- Kalamazoo Reference group (defined as non-Hispanic White women, aged 20+ years with 13+ years of education)
- Black infants (defined by infant race, as recorded in death records)
- Poor infants (defined by Medicaid-paid delivery, as recorded in the birth records)

Next, "excess" deaths were calculated by subtracting PPOR-category rates:
Excess Black deaths = [Black PPOR] minus [Reference PPOR]
Excess Poor deaths = [Poor PPOR] minus [Reference PPOR]
Changes over time = [2003-2012 PPOR] minus [1997-2006 PPOR]
Race only deaths = [Black PPOR] minus [Poor PPOR]

Section III: Findings

*Kalamazoo County PPOR*

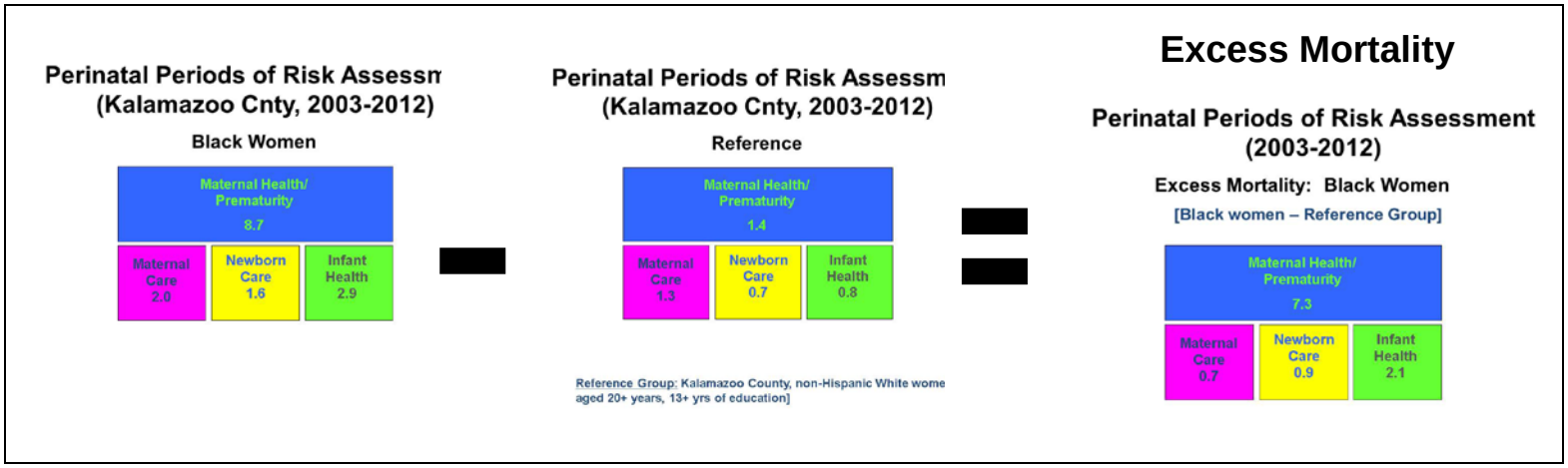
Among the gold standard reference group in Kalamazoo County, the totaled infant mortality rate is 4.2 per 1000 births for this, most recent period. The maternal health category and maternal care category each account for roughly a third, while the newborn care and the infant health categories, combined, account for the remaining third.



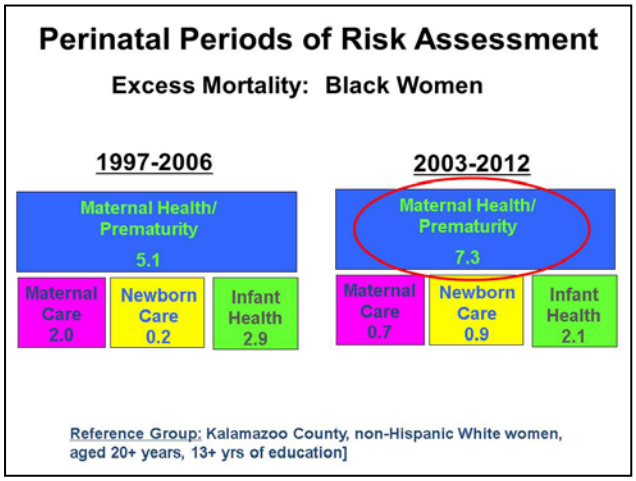
## *PERINATAL PERIODS OF RISK ANALYSIS, 2003-2012 Period*
## *Kalamazoo County Healthy Babies-Healthy Start*

*Excess Mortality among Black Women*

Compared to the reference group, Black women have excess mortality totaling 11.0 per 1000 births. Most of the excess is in the category of Maternal Health. At 7.3, the excess in this category alone is nearly double the total infant mortality rate of the reference group (4.2). There is also notable excess in the category of Infant Health.




Compared to the 1997-2006 period, the excess mortality in the Maternal Health category has increased by over 40%, from a rate of 5.1 to 7.3 in 2003-2012. Less marked, but noteworthy nonetheless, is the reduction in excess mortality within the Maternal Care category, from 2.0 in the earlier period to 0.7 in the more recent period. Excess mortality in the two infant categories have also changed – in opposite directions: Newborn care has gotten moderately worse and Infant Health has gotten moderately better.



## *PERINATAL PERIODS OF RISK ANALYSIS, 2003-2012 Period*
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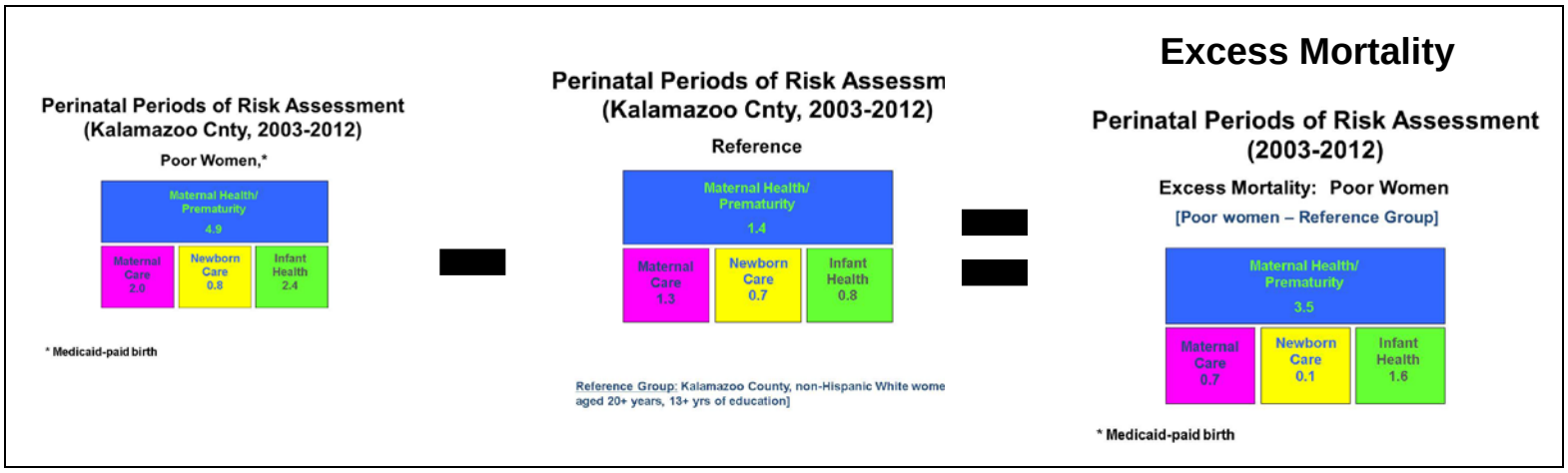
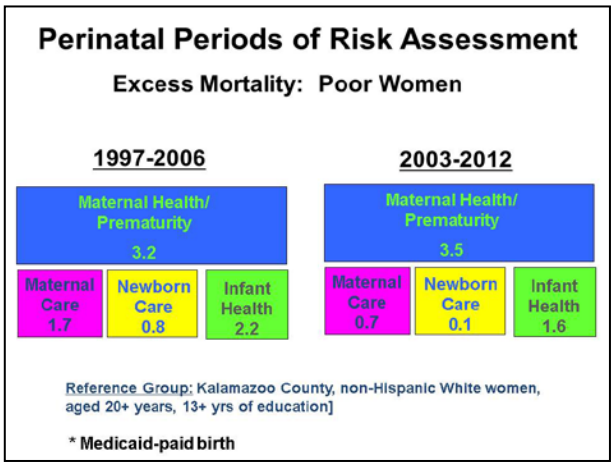
*Excess Mortality among Poor Women*

Similar to Black women, when compared to the reference group, poor women have most of their excess mortality in the category of Maternal Health. Unlike Black women, the excess mortality of poor women is much lower (total excess of 5.9 compared to total excess of 11.0 among Black women). Here too, there is also notable excess in the category of Infant Health.




Compared to the1997-2006 period, excess mortality among poor women has seen improvements in Maternal Care, Newborn Care and Infant Health. Excess mortality due to Maternal Health, on the other hand, has moved in the opposite direction, and gotten slightly worse.



## *PERINATAL PERIODS OF RISK ANALYSIS, 2003-2012 Period*
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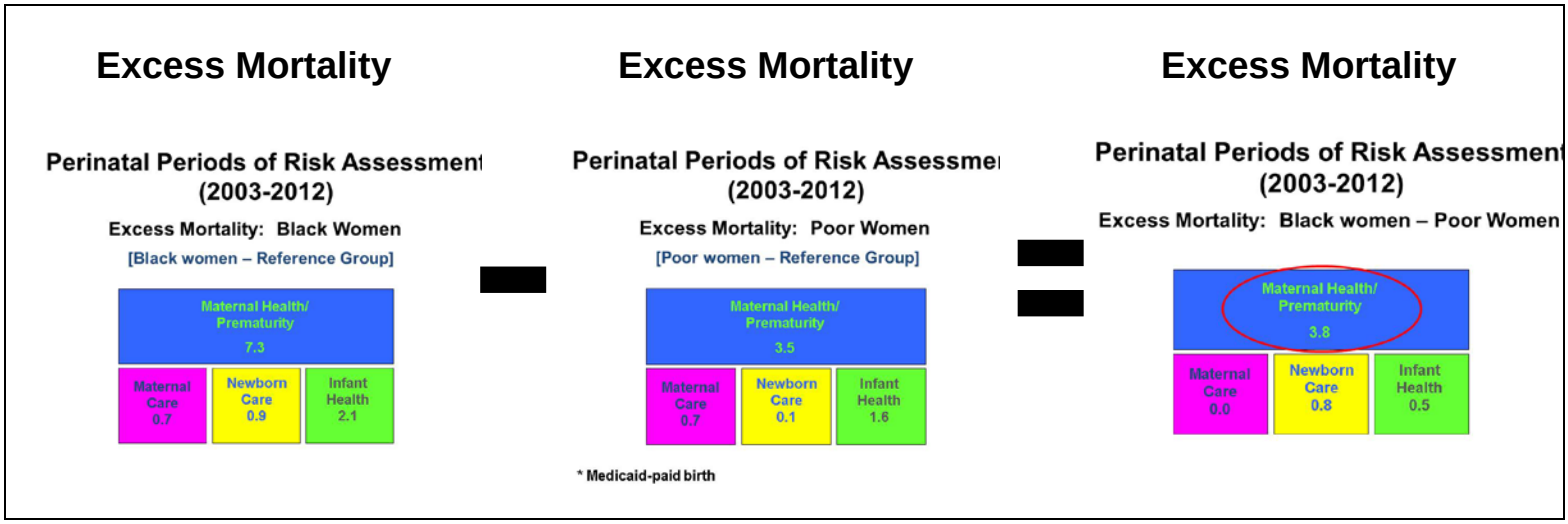
*Isolating the Excess Mortality associated with Black Race*

Being Black and being poor are strongly related: 85.4% of Black women giving birth in Kalamazoo County in 2010 were poor, compared to 38.6% of White women. This fact, itself, is a marker of racial disparity. Additionally, it also makes it difficult to separate the effects of being Black from the effects of being poor upon birth outcomes and infant mortality. One way to accomplish this is to compare excess PPOR maps. Subtracting the excess-PPOR of poor women from the excess-PPOR of Black women, seen in the following figure, reveals that, after accounting for poverty, Black women in Kalamazoo have substantial excess mortality in the category of Maternal Health; the very category that accounts for the majority of Black women's IMR risk, and one that has gotten worse over time, similar to the racial disparity trend. It is also notable that the Newborn Care and Infant Health categories have excess risk that is specific to being Black, above and beyond being poor.




Section IV: Conclusions & Recommendations

*Conclusions*

While there is a great deal of overlap between being Black and being poor, each brings its own set of vulnerabilities and risk related to infant mortality:

- Being Black, regardless of income status, brings risk associated with maternal health and well-being, from before pregnancy as well as during pregnancy. These health risks are resulting in Black babies being born too early and too small.
    - Additionally, Black infants are not being as well-served by the perinatal system in Kalamazoo, as indicated by their excess risk in Newborn Care; excess risk that has grown in recent years.
- Being poor carries its own risk, primarily in Maternal Health also, pointing to problems in the areas of preconceptional health, health behaviors and perinatal care.
- While moderate gains have been seen over the last decades, deaths falling into the Infant Health category are still the second leading type of mortality. Excess death here are tied

primarily to poverty (excess 1.6), but there is added risk among Black families (excess beyond poverty 0.5).

*Recommendations*

1. Conduct a Phase II Perinatal Periods of Risk Analysis for excess Maternal Health mortality:
    a. Conduct a Kitgawa Analysis to identify whether the cause of excess Maternal Health mortality is due to more VLBW births or more to Perinatal Care or to both equally. Conduct sub-analyses for Black births and poor births.
    b. Analyze population-based birth and death records for trends associated with race and with poverty that predict VLBW (prematurity and birth weight), and that predict death among VLBW births.
    c. Conduct a FIMR summary study that focuses upon the fetal deaths and infant births weighing in between 500 and 1500 grams (the "Maternal Health" PPOR cells). Stratify this analysis by race (Black women versus White women and other races), and by poverty (poor women versus higher-income women). Note the social, behavioral and medical risk factors identified as well as the interventions (public health and medical) delivered, especially those not included in the vital records analysis above.

2. Conduct a Phase II Perinatal Periods of Risk Analysis for excess Infant Health mortality:
    a. For all deaths falling into the Infant Health cell (birthweight 1500 grams or more, death at age 28 - 364 days), identify predominant cause-specific death through categorization of underlying cause of death, both broad and detailed groupings, as defined by *CDC Postneonatal Mortality Surveillance System (MMWR Vol. 47, No. SS-2, Pages 29-30),* see Appendices:
        i. SUIDS / Sleep-related
        ii. Congenital anomalies / birth defects (cardiovascular, central nervous system, musculoskeletal, respiratory, gastrointestinal, chromosomal, other)
        iii. Infections (respiratory, central nervous system, septicemia, gastrointestinal, other)
        iv. Injuries (motor vehicle crash, fire, drowning, falls, poisoning, homicide, other)
        v. Perinatal conditions
        vi. Ill-defined conditions
        vii. Other underlying causes of death

        -Stratify by race and by poverty
    b. Analyze population-based birth and death records for trends associated with race and with poverty that predict the predominant causes identified above and that predict death among those experiencing the cause.
        -Stratify by race and by poverty
    c. Conduct a FIMR summary study that focuses upon the infant deaths weighing 1500+ grams (the "Infant Health" PPOR cells), with a focus upon the predominant causes of death for Black infants and for poor infants. Note the social, behavioral and medical risk factors identified as well as the interventions (public health and medical) delivered, especially those not included in the vital records analysis above.
        i. Note the percentage of deaths that were autopsied: overall, by cause-of-death, by race and by poverty
    d.

3. Disseminate Healthy-Babies/Healthy-Start Evaluation Findings to local, state and national audiences
4. Develop a strategic plan for reducing identified risk factors, with specific and proportional attention paid to those factors affecting Black women and poor women.

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Appendix A: Underlying cause of death as defined by groupings of International Classification of Diseases (9th revision).

***Task:*** The first step is to examine the underlying cause of death using the cause of death categorization proposed by the CDC Postneonatal Mortality Surveillance System (MMWR Vol. 47, No. SS-2, Pages 29-30)[see below]. The mortality rates by underlying cause of death, both broad and detailed groupings, should be compared between the groups under study and the reference group. This examination may identify one or two categories contributing to the majority of the excess mortality rate. In this situation, further investigation of the excess mortality should undertake with a cause-specific focus because the risk factors for SIDS are different from the risk factors for congenital anomalies, infection, or injury. If the excess mortality is generally across all causes of death, a cause-specific approach is still needed. However, cross cutting themes should also be examined. For Table A-1, the groupings are defined by both ICD-9 and ICD-10 codes. Updates on Table A-2 for the ICD-10 codes are a work in progress. Please note that for this version of the guidelines, the ICD-10 coded groupings have not been clinically reviewed by experts, and have not been reviewed, approved or published by CDC.

TABLE A-1. Broad groupings of International Classification of Diseases (9/10th revisions).

| **Broad Grouping** | **ICD-9** | **ICD-10: Draft Version** |
|---|---|---|
| **Perinatal Conditions** | 760.0 - 779.9 | P00-P96,A33 |
| **Congenital Anomalies** | 740.0 - 759.9 | Q00-Q99 |
| **Infections** | 001.0–139.8<br>320–326<br>360.0–360.1, 372.0<br>373.1–373.2, 373.5–373.6<br>380.1–380.2<br>382.0–383.9<br>420.0–422.9<br>460.0–466.1<br>475.0<br>478.2, 478.7<br>480.0–487.9, 490.0<br>510.0–510.9<br>513.0–513.1<br>566.0–567.9<br>572.0–572.1<br>573.1–573.2, 577.0<br>590.0–590.9<br>595.0<br>680.0–686.9<br>711.0–711.9<br>728.0<br>730.0-730.9<br>790.7-790.8 | A00-A32,A34-B99<br>G00-G09<br>H44.0-H44.1, H10.0-H10.3<br>H00, H03<br>H60,H62.0-H62.4<br>H66-H67,H70,H95.0-H95.1<br>I30,I33,I40-I41<br>J00-J06,J20-J22<br>J36<br>J39.0-J39.1<br>J10-J18, J40<br>J86<br>J85<br>K61,K65,K67<br>K75.0-K75.1<br>K77.0, K85<br>N10-N12,N13.6,N15.1<br>N30.0<br>L01-L08, L98.0,L98.3<br>M00-M03<br>M60.0<br>M86,M90.0-M90.2<br>A49.9,B34.9 |
| **Injury** | E800.0-E969.9, E980.0-E989.9 | V01-Y34,Y40-Y88,Y89.9 |
| **SIDS** | 798.0 | R95 |
| **Ill-defined** | 780.0-797.9 | R00-R53,R55-R94,R96-R99 |
| **Other** | Remainder | Remainder |

TABLE A-2. Detailed groupings of International Classification of Diseases (9th revision).

| ***Injuries (E800.0–E969.9, E980.0–E989.9)*** | |
|---|---|
| **Unintentional** | |
| Motor vehicle | 810.0–825.9 |
| Poisoning | 850.0–869.9 |
| Falls | 880.0–888.9 |
| Fire | 890.0–899.9 |
| Drowning | 910.0–910.9 |
| Suffocation, obstructive | 911.0–912.9 |
| Suffocation, mechanical | 913.0–913.9 |
| Other unintentional | 800.0–807.9 |
| | 826.0–849.9 |
| | 870.0–879.9 |
| | 900.0–909.9 |
| | 914.0–949.9 |
| **Intentional** | |
| Homicide | 960.0–969.9 |
| **All Others** | 980.0–989.9 |
| . | |
| ***Birth defects (740.0–759.9)*** | |
| Central nervous system | 740.0–742.9 |
| Cardiovascular | 745.0–747.9 |
| Respiratory | 748.0–748.9 |
| Gastrointestinal | 749.0–751.9 |
| Genitourinary | 752.0–753.9 |
| Musculoskeletal | 754.0–756.9 |
| Chromosomal | 758.0–758.9 |
| Other anomalies | Remainder |

| ***Infections*** | |
|---|---|
| Central nervous system | 320.0–326.9 |
| | 013.0–013.9, 036.0–036.1 |
| | 045.0–049.9 |
| | 053.0–053.1 |
| | 054.3, 055.0, 056.0 |
| | 062.0–064.9 |
| | 072.1–072.2, 130.0 |
| Respiratory | 460.0–466.1 |
| | 478.2, 478.7 |
| | 480.0–487.9, 490.0-490.9 |
| | 510.0–510.9, 513.0-513.9 |
| | 010.0–012.9 |
| | 031.0, 033.0–033.9 |
| | 034.0,039.1, 055.1, 130.4 |
| Gastrointestinal | 566.0–567.9, 572.0-572.1 |
| | 573.1–573.2, 577.0 |
| | 001.0–009.9, 014.0, 039.2 |
| | 070.0–070.9, 127.0-127.9 |
| Septicemia | 038.0–038.9 |
| Other | 360.0–360.1 |
| | 372.0, 373.1-373.2 |
| | 380.1–380.2 |
| | 382.0–383.9 |
| | 420.0–422.9 |
| | 590.0–590.9 |
| | 595.0, 614.4 |
| | 680.0–686.9, 711.0-711.9 |

**Perinatal Periods of Risk: Phase II Analysis**
**Protocol for Excess Infant Health**

Appendix B: Potential Risk Factors and Interventions by Underlying Cause of Death

***Task:*** Assess the prevalence of known risk factors and interventions for Infant Health deaths by comparing the prevalences for the study population to the reference group. This should include information on the birth certificates as well as other information sources that may be readily available. In addition, significant risk factors and interventions that could not be measured in the community should also be noted. The prevalences of the risk factors will need to be examined differently for each cause of death.

| Underlying Cause of Death | Potential Factors and Interventions |
|---|---|
| SIDS--Sudden Infant Death Syndrome | Passive smoking (alternative-maternal smoking) |
| | Sleep position |
| | Breast-feeding |
| | Bedding |
| | Death scene investigation |
| | Maternal age |
| | Maternal education |
| | |
| Congenital Anomalies | Folic acid intake |
| | Genetic counseling |
| | Alpha-feto protein screen |
| | Ultrasound |
| | Delivery site |
| | Alcohol |
| | Drug abuse |
| | |
| Infection | Medical home/health home |
| | Immunization level |
| | Type of infection |
| | Maternal age |
| | Maternal education |
| | Breast-feeding |
| | Smoking |
| | Prenatal care participation |
| | |
| Injuries | Type of injury |
| | Bedding |
| | Co-sleep |
| | Death scene investigation |
| | Car seat use |
| | Abuse |
| | |
| Perinatal conditions | Type of condition |
| | Medical/health home |
| | Smoking |
| | High risk follow up |
| | |
| Ill-defined conditions | Autopsy rate |
| | Death scene investigation |
| | |
| Other | Specific cause of death |