This report presents Illinois data on infant mortality, including trends and at-risk populations. The purpose of this report is to inform prevention efforts and guide the development of strategies for infant mortality reduction.

**Major Findings**

- The infant mortality rate in Illinois has decreased over time to meet the *Healthy People 2020* objective of 6.0 deaths per 1,000 live births.
- However, major racial/ethnic disparities persist. The infant mortality rate for infants born to Non-Hispanic black women is consistently at least two to three times as high as the infant mortality rate of infants born to Non-Hispanic white women.
- Infants at higher risk for infant mortality include those born to: Non-Hispanic black women, younger mothers, unmarried women, women with a high school education or less, U.S.-born women (vs. foreign-born), women covered by Medicaid, women with three or more previous births, residents of the city of Chicago, women with pregnancy-related hypertension (high blood pressure) or eclampsia, or women who did not receive any prenatal care.
- The leading causes of infant deaths are prematurity, congenital anomalies (birth defects), and Sudden Unexplained Infant Deaths (SUID), which includes deaths related to accidental suffocation and Sudden Infant Death Syndrome (SIDS).
- Based on a special kind of analysis called “Perinatal Periods of Risk,” the feto-infant mortality rate for infants of non-Hispanic black women was nearly three times higher than that for infants born to the low-risk “reference” group (non-Hispanic white women at least 20 years of age and who had more than a high school education).
- The “excess” feto-infant mortality rate refers to the difference between the rates in the target (non-Hispanic black women) and reference populations. During 2014-2015, there was an excess of 7.98 deaths per 1,000 births in the target population compared to the reference population. This translates to 418 excess fetal and infant deaths among non-Hispanic black infants.
- Because most of the excess feto-infant deaths among non-Hispanic black infants occurred in the “Maternal Health/ Prematurity” and the “Infant Health” periods of risk, interventions could target preconception health, prenatal behaviors, perinatal care, social determinants, sleep position, postpartum behaviors, and injury prevention.
- More than half of the excess feto-infant mortality in the target population were related to prematurity, due to increased prematurity rates overall and lower survival rates for premature babies.
According to the Centers for Disease Control and Prevention (CDC), over 23,000 infants died in the United States in 2014. This national infant mortality rate is higher than that of any other developed country, and reduction of infant mortality has been a longstanding goal in the United States. Healthy People 2020 is a federal plan that provides national objectives for improving the health of Americans. One of the Healthy People 2020 objectives is an infant mortality rate of no more than 6.0 infant deaths per 1,000 live births by the year 2020.

As Illinois considers statewide strategies to reduce infant mortality, the data surrounding infant mortality rates, trends, and risk markers, including disparities between different populations of interest will inform prevention efforts. Stakeholders in Illinois can use this report to develop and target strategies for infant mortality reduction.

In 2014, Illinois ranked 36th out of 50 states and Washington D.C. in infant mortality, with a rate of 6.6 infant deaths per 1,000 live births. California had the lowest infant mortality rate of 4.3 per 1,000 live births, and Alabama had the highest rate of 8.7 per 1,000 live births. Twenty-six states had infant mortality rates lower than the Healthy People 2020 goal of 6.0 deaths per 1,000 births.
Data for this report came from birth, death, and fetal death certificates (IDPH Division of Vital Records). Analyses were limited to births and deaths of Illinois residents. The 2010-14 American Community Survey (ACS) provided the socioeconomic data by county.

**DATA SOURCE**

**DEFINITIONS**

- **Fetal Death**: Death of a fetus (≥ 20 weeks gestation) prior to delivery
- **Infant Death**: Death of an infant before first birthday
- **Neonatal Death**: Death during days 0-27 of life
- **Post-Neonatal Death**: Death during days 28-364 of life

**Term**: Gestational age ≥ 37 weeks
**Preterm**: Gestational age < 37 weeks
**Very Preterm**: Gestational age < 32 weeks

**RACE/ETHNICITY**

The race/ethnicity groups used are: Non-Hispanic White, Non-Hispanic Black, Hispanic, and Asian/Pacific Islander. All other groups were excluded due to small numbers.

**GEOGRAPHY**

Illinois was divided into five regions: Chicago, suburban Cook County, collar counties (Lake, McHenry, Kane, DuPage, and Will Counties), other urban counties (Winnebago, DeKalb, Kendall, Kankakee, Rock Island, Peoria, Tazewell, McLean, Champaign, Macon, Sangamon, Madison, and St. Clair Counties), and rural counties (all others).

**CAUSES OF DEATH**

International Classification of Disease (ICD) codes for underlying cause of death were classified into 30 categories of infant death, as defined by CDC. The top three causes that will be discussed in this report are: 1) disorders related to length of gestation and fetal malnutrition, 2) congenital malformations, deformations, and chromosomal abnormalities, and 3) symptoms, signs, findings not elsewhere classified. In this report, these categories are simplified to: 1) disorders related to prematurity, 2) congenital and chromosomal abnormalities, and 3) SIDS and other unknown causes.

**ANALYSIS**

Two different calculation methods were used to describe infant mortality:

- **Cross-sectional analyses** compare the number of infant deaths in a year to the number of babies born in that year. These analyses do not require a linkage between infants’ birth and death certificates. This method was used for the time trend analyses.

  - **Trend analysis**: Joinpoint regression was used to assess trends over time and to estimate the average annual percent change in infant mortality.

- **Cohort analyses** require matched infant birth and death records and provide more information about the difference between babies who died and those who did not die. This method was used to do in-depth analyses of the risk markers associated with infant mortality. Matched infant records were not available prior to 2014.
There are substantial differences in the infant mortality rates for Illinois babies of different racial/ethnic groups. The IMR for non-Hispanic Black infants is consistently more than double that of the other three racial/ethnic groups. On average, between 2000 and 2015, the infant mortality rate decreased about 1.9% per year for Non-Hispanic White infants, 1.6% per year for Non-Hispanic Black infants, and 0.8% per year for Hispanic infants, with no significant change over time for Asian infants. The significantly higher IM rate in Non-Hispanic Black infants highlights the need for targeted interventions.

The Illinois infant mortality rate decreased from 8.3 per 1,000 in 2000 to 6.0 per 1,000 in 2015 — a total average decrease of 28% and an average annual decrease of 1.6%. The neonatal mortality rate was 4.3 per 1,000 in 2015, with an average annual decrease of 1.3% since 2000. The post-neonatal mortality rate was 1.8 per 1,000 in 2015, with an average annual decrease of 2.3% since 2000.
On average, the infant mortality rates between 2000 and 2015 decreased 2.0% per year for Chicago residents, 1.9% per year for suburban Cook Co. residents, 1.3% per year for collar county residents, 1.9% per year for other urban county residents, and 0.9% per year for rural county residents.

The top three causes of infant mortality in Illinois between 2000 and 2015 were disorders related to prematurity, congenital and chromosomal abnormalities, and SIDS and other unknown causes. Together, these three causes accounted for about half of infant deaths. On average, the rate of deaths due to a congenital or chromosomal abnormality decreased 2% per year during 2000-2015. The rate of SIDS and other unknown deaths decreased an average 3% per year between 2000 and 2015. There was no significant change over time for the rate of deaths due to disorders related to prematurity. The rate of deaths due to all other causes decreased an average 1.7% per year between 2000 and 2015.
There are two specific causes of death that are of interest because they make up a large proportion of the overall infant deaths:

**Sudden Unexpected Infant Deaths (SUID)** and **Prematurity-Related Deaths**.

The rate of SUID is significantly higher in Non-Hispanic Black infants than in Non-Hispanic White or Hispanic infants. There was a significant decrease in SUID for non-Hispanic Black infants at an average of 1.5% per year during 2000-2015, but no significant change over time for Non-Hispanic White or Hispanic infants.

The rate of prematurity-related infant death is also significantly higher in Non-Hispanic Black infants than in Non-Hispanic White or Hispanic infants. On average, the rate of prematurity-related death for Non-Hispanic White infants decreased 2.2% per year, and the rate for Non-Hispanic Black infants decreased 1.1% per year between 2000 and 2015. There was no statistically significant change for Hispanic infants over time.

**Note:**
*Asian/Pacific Islander data are not presented because the numbers were too small to provide reliable estimates.*

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The following data are from a cohort of birth certificates for infants born in Illinois in 2014 or 2015. These births were linked to their corresponding death certificates, where infant mortality is defined as:

\[
\text{Infant Mortality Rate} = \frac{\text{number of infants born in year } A \text{ who died within 1 year}}{\text{total number of live births in year } A} \times 1,000
\]

By having the matched birth record for each of the death records, we can analyze more detailed maternal and infant characteristics associated with infant mortality.

The top three causes of infant deaths in Illinois account for a little more than 50% of all infant deaths. These are disorders related to prematurity, congenital and chromosomal abnormalities, and SIDS and other unknown causes. All other causes account for about 48% of all infant deaths.

Within each of the three leading causes of infant death in Illinois, infants of Non-Hispanic Black mothers have the highest infant mortality compared to other racial/ethnic groups. The widest disparities are seen with “disorders related to prematurity” and “SIDS and other unknown causes”; infants of Non-Hispanic Black mothers are more than three times as likely to die from these causes as infants of Non-Hispanic white mothers.
**RACE/ETHNICITY:** Infants born to Non-Hispanic Black women have the highest rate of infant mortality.

**AGE:** Infants born to younger women generally have higher infant mortality rates than those born to older women.

**MARITAL STATUS:** Infants born to unmarried women have a higher mortality rate than those born to married women.

**PLACE OF MOTHER’S BIRTH:** Infants of women who were born in the U.S. have an infant mortality rate twice as high as infants of foreign-born women.

**GEOGRAPHIC REGION:** Residents of Chicago have a higher infant mortality rate than other areas of the state.

**EDUCATION:** The rate of infant mortality generally decreases as the mother’s education increases.

**PAYER FOR DELIVERY:** Infants of privately-insured women have a lower infant mortality rate than infants of women covered by Medicaid or other types of insurance.

**PARITY:** Infants of women with three or more previous live births have higher infant mortality rates than infants of women with fewer previous live births.

**INFANT GENDER:** Male infants have a higher infant mortality rate than female infants.
**RESULTS: COHORT ANALYSIS**

ILLINOIS INFANT MORTALITY RATE BY MATERNAL AND INFANT MEDICAL AND HEALTHCARE FACTORS, 2014-2015

**DIABETES:** Infants born to women who had diabetes before pregnancy have a higher mortality rate than infants born to women who had diabetes during pregnancy or no diabetes.

**HYPERTENSION:** Infants born to women with eclampsia and gestational hypertension have higher infant mortality rates than infants of women with chronic hypertension or no hypertension at all.

**SMOKING:** Infants born to women who smoke during pregnancy have a higher mortality rate than infants born to women who do not smoke during pregnancy.

**PRENATAL CARE (PNC):** Infants of women with no prenatal care have higher rates of infant mortality than women with any prenatal care. Infants of women with “adequate plus” prenatal care have the second highest mortality rate — this group of women likely had higher-risk pregnancies that prompted them to receive more prenatal care than is typical.

**PLURALITY:** Twin births have an infant mortality rate more than four times that of singleton births.

*Prenatal care was measured on the Adequacy of Prenatal Care Utilization Index (“Kotelchuck” index), which classifies prenatal care utilization into adequacy categories based on the time of prenatal care initiation.
A Perinatal Periods of Risk (PPOR) approach identifies opportunities to reduce fetal and infant death. PPOR is an analytical framework developed by CityMatCH that was developed to investigate the disparity in fetal and infant death between a reference population and a target population. The “reference” population is typically the subgroup of women with the best birth outcomes, and the “target” population is typically the subgroup of women with the worst birth outcomes.
PPOR Analyses were limited to Illinois resident women, with an infant/fetus at least 24 weeks gestation and at least 500 grams at delivery.

**Reference Population** *(Low Infant Mortality)*
- Non-Hispanic white
- ≥ 20 years old
- Education ≥ 13 years

**Target Population** *(High Infant Mortality)*
- Non-Hispanic black

### RESULTS: PERINATAL PERIODS OF RISK

- 500—1499 g
  - (1 lb 1 oz—3 lbs 4 oz)
- ≥1500 g
  - (3 lbs 5 oz or more)

**Total mortality rate = 4.20 deaths per 1,000**

**Total mortality rate = 12.18 deaths per 1,000**

The “excess” feto-infant mortality rate refers to the difference between the rates in the target and reference populations.

<table>
<thead>
<tr>
<th>Period of Risk</th>
<th>Maternal Health / Prematurity</th>
<th>Maternal Care</th>
<th>Newborn Care</th>
<th>Infant Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Excess” Rate in Target Population</td>
<td>3.06 per 1,000</td>
<td>2.03 per 1,000</td>
<td>0.56 per 1,000</td>
<td>2.34 per 1,000</td>
</tr>
<tr>
<td>“Excess” # Deaths in Target Population</td>
<td>160</td>
<td>106</td>
<td>29</td>
<td>123</td>
</tr>
</tbody>
</table>

During 2014-2015, there was an excess of 7.98 deaths per 1,000 births in the target population compared to the reference population. This translates to 418 excess fetal and infant deaths that could have been prevented if the feto-infant mortality rate for the target population was the same as the rate for the reference population.
Of the 418 total number of excess deaths in the target population, about two-thirds occurred in the maternal health/prematurity and infant health periods of risk. Therefore, targets of action in Illinois could include preconception health, prenatal behaviors, perinatal care, and social determinants (to address the maternal health/prematurity period), or sleep position, postpartum behaviors, and injury prevention (to address the infant health period).

Examples of these factors are:

- **Preconception health**: maintenance of a healthy weight and diet before pregnancy
- **Prenatal behaviors**: alcohol, smoking, or drug use before delivery
- **Perinatal care**: receipt of care at appropriate facility
- **Social determinants**: income, education, neighborhood safety
- **Sleep position**: infants sleeping alone, on their backs, and in cribs
- **Postpartum behaviors**: breastfeeding, smoking in house with infant
- **Injury prevention**: cribs for safe sleep, car seats

### KITAGAWA ANALYSIS

Two possible explanations for the large number of excess deaths in the maternal health/prematurity period of risk may be: a **higher number of preterm live births and fetal deaths** (different gestational age distributions), or **lower survival rates regardless of gestational age distribution** **(higher birthweight-specific mortality rate)** in the target population. The Kitagawa approach allows us to determine the contribution of each explanation to the overall excess. The causes, risk factors, and interventions for preterm births are generally different than those for gestational age-specific mortality rate.

<table>
<thead>
<tr>
<th>Explanation</th>
<th>General Pathway for Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Preterm Births (gestational age distribution)</td>
<td>Behavioral, social, health, and economic disparities of the mothers</td>
</tr>
<tr>
<td>Lower Survival Rates (higher gestational age-specific mortality rate)</td>
<td>Perinatal care provided to the mother and infant</td>
</tr>
</tbody>
</table>
In Illinois between 2014-2015, 41.4% of the excess feto-infant mortality in the target population was attributable to the gestational age distribution, or the fact that more preterm births occur in the target population. The remaining 58.6% of the excess feto-infant mortality rate was attributable to lower gestational-age specific survival rates in the target population, with 16.9% of the excess due to lower survival rates for preterm babies and 41.7% of the excess due to lower survival rates for term babies.

About 60% of the excess feto-infant mortality in the target population was related to prematurity through the combination of increased prematurity and lower survival rates for premature babies.

To address prematurity, we examined risk factors and risk markers that may be associated with having a preterm baby.

⇒ Was the woman on MEDICAID during her pregnancy?
⇒ Did the woman have fewer than 13 years of EDUCATION during her pregnancy?
⇒ Did the woman have THREE OR MORE LIVE BIRTHS PRIOR to this pregnancy?
⇒ Did the woman enter PRENATAL CARE DURING HER 1ST TRIMESTER?
⇒ Did the woman SMOKE during her pregnancy?
⇒ Did the woman have HYPERTENSION before or during her pregnancy?

County-level data from the American Community Survey (ACS) provided an assessment of community economic factors that may be associated with having a preterm baby:

⇒ Did the woman live in a HIGH POVERTY county during pregnancy?
⇒ Did the woman live in a county with a HIGH UNEMPLOYMENT RATE during pregnancy?
RESULTS: RISK FACTORS FOR PRETERM BIRTH

If prematurity accounts for most of the difference in infant mortality, what social and medical factors influence prematurity?

<table>
<thead>
<tr>
<th>Social and Medical Factors</th>
<th>% Increase in Risk of Preterm Birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Medicaid (vs. Private Insurance)</td>
<td>11.7%</td>
</tr>
<tr>
<td>No education beyond high school</td>
<td>9.2%</td>
</tr>
<tr>
<td>Had 3 or more previous live births</td>
<td>44.1%</td>
</tr>
<tr>
<td>Did not enter prenatal care during 1st trimester</td>
<td>4.7%</td>
</tr>
<tr>
<td>Smoked during pregnancy</td>
<td>29.1%</td>
</tr>
<tr>
<td>Had hypertension before or during pregnancy</td>
<td>204.0%</td>
</tr>
<tr>
<td>High poverty in county of residence*</td>
<td>7.0%</td>
</tr>
<tr>
<td>High unemployment in county of residence*</td>
<td>6.1%</td>
</tr>
</tbody>
</table>

Each of the factors to the left were found to significantly increase the likelihood of preterm birth for Illinois women during 2014-2015.

For example, a woman covered by Medicaid was 11.7% more likely to have a preterm birth than a woman on private insurance.

We examined how these factors differed in the target (non-Hispanic black) and reference (low-risk non-Hispanic white) populations.

Each of the factors associated with preterm birth was significantly more common among non-Hispanic black women than the low-risk non-Hispanic white women. The factors that were the most different between the two populations were: Medicaid coverage, lower education levels, and living in areas with high poverty and high unemployment.

* Using data from the American Community Survey (ACS), Illinois counties were divided into four equal sizes groups (quartiles) based on their poverty level and unemployment rate in the civilian population above 16 years old.

Note: A map and list of the counties included in each category for poverty and unemployment can be found in the appendix.
OVERALL INFANT MORTALITY

The infant mortality rate in Illinois has decreased over time to meet the Healthy People 2020 goal. However, major racial/ethnic disparities persist. The infant mortality rate for infants born to Non-Hispanic black women is consistently at least two to three times as high as the infant mortality rate of infants born to Non-Hispanic white women.

CAUSES OF DEATH

The leading cause of infant death is any disorder related to prematurity, so if we can reduce the incidence of premature births, we can help to reduce infant mortality. Another leading cause of infant death is Sudden Unexplained Infant Deaths (SUID), which includes Sudden Infant Death Syndrome (SIDS) and other sleep-related deaths. Targeted interventions to address infant sleep patterns should also be a focus.

PERINATAL PERIODS OF RISK (PPOR) ANALYSIS

The feto-infant mortality rate for infants of non-Hispanic black women (the target population) was nearly three times higher than that for infants born to non-Hispanic white women at least 20 years of age and who had at least 13 years of education (the reference population). If the feto-infant mortality rate in the target population had been the same as that of the reference population, 418 deaths would have been prevented in 2014-2015. Most of the excess feto-infant deaths in the target population occurred in the “Maternal Health/ Prematurity” and the “Infant Health” periods of risk. These periods of risk suggest preconception health, prenatal behaviors, perinatal care, social determinants, sleep position, postpartum behaviors, and injury prevention as potential target for action.

More than half of the excess feto-infant mortality in the target population was related to prematurity through the combination of increased prematurity and lower survival rates for premature babies. Being on Medicaid, having fewer than 13 years of education, having three or more previous live births, not entering prenatal care during the 1st trimester, smoking during pregnancy, and having hypertension before or during pregnancy were all associated increased risk of prematurity. In addition, women who lived in counties with higher poverty and unemployment rates had higher risks of prematurity than those living in counties of low poverty and unemployment. All of these social and medical factors that were associated with prematurity were significantly more common among non-Hispanic black women than among low-risk non-Hispanic white women.

LOOKING FORWARD

Beyond the factors studied in this report, it would be useful to analyze factors associated with preterm birth further, such as those reported in the Pregnancy Risk Assessment Monitoring System (PRAMS) survey. Given that the PPOR analysis also showed a large excess mortality in the infant health period of risk, further analyses of infant sleep behaviors could inform efforts to reduce these deaths.
POVERTY Counties were divided into four quartiles based on ACS 2015 poverty estimates. The lowest poverty quartile was used as the reference group.

UNEMPLOYMENT Counties were divided into four quartiles based on ACS 2015 estimates of unemployment rate. The lowest unemployment quartile was used as the reference group.
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DATA SOURCES
American Community Survey (ACS) 5-Year Estimates (2015)

RESOURCES


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