Kansas Department of Health and Environment

Infant Mortality & Stillbirth Report: Kansas, 2018

Kansas Department of Health and Environment
Division of Public Health
Bureau of Epidemiology & Public Health Informatics
Curtis State Office Building – 1000 SW Jackson, Topeka, KS, 66612-1354
http://www.kdheks.gov/bephi/
August 2020

Errata: Corrections have been made to Tables 3 and 4, and Figure H. Textual changes have been made to Figure I and Technical Notes.

Research Summary Was Prepared On Behalf Of:

Lee A. Norman, MD, Secretary, Kansas Department of Health and Environment

Kay Haug, State Registrar and Director, Bureau of Epidemiology and Public Health Informatics

Report Prepared By:

Brandi Markert, MS, Epidemiologist, Bureau of Epidemiology and Public Health Informatics

Editors:

Greg Crawford, BA, Public Service Executive, Bureau of Epidemiology and Public Health Informatics

David Oakley, MA, Research Analyst, Bureau of Epidemiology and Public Health Informatics

Farah Ahmed, MPH, PhD, Environmental Health Officer and State Epidemiologist, Bureau of Epidemiology and Public Health Informatics

Data for This Report Were Collected By:

Kansas Department of Health and Environment, Office of Vital Statistics

OUR VISION

Healthy Kansans Living in Safe and Sustainable Environments

OUR MISSION

To Protect and Improve the Health and Environment of All Kansans

TABLE OF CONTENTS

TABLES AND FIGURES

Tables

Figures

Detailed Tables

EXECUTIVE SUMMARY

Infant mortality is an important indicator of community health. It is associated with a variety of factors such as economic development, general living conditions, social wellbeing where basic needs are met, illnesses such as diabetes and hypertension, and quality of the environment. This report provides a long-term assessment of progress on infant mortality.

Key findings include:

- The Kansas infant mortality rate **increased** from 2017 to 2018 (from 6.0 to 6.4 deaths per 1,000 live births). The increase was not statistically significant.
- The 2018 infant mortality rate **did not meet** the Healthy People 2020 objective of 6.0 deaths per 1,000 live births. The Non-Hispanic White population rate (4.8) met the objective, while the Hispanic rate (9.0) and the Non-Hispanic Black rate (10.0) did not.
- From 1999 to 2018, infant mortality **declined** among Non-Hispanic White and Non-Hispanic Black births. The same improvements were not seen among Hispanic births.
- The Non-Hispanic Black infant mortality rate has remained **at least double** that of the Non-Hispanic White rate for most of the last twenty years.
- During 2014-2018, the leading cause of infant mortality was **congenital anomalies** (23.5%), followed by sudden unexpected infant death (SUID) (18.1%), prematurity or low birth weight (17.9%), and maternal complications of pregnancy (6.0%).
- Approximately **one-third** of deaths in 2014-2018 that could be linked to a birth certificate (381 of 1,136 deaths, or 33.5%) were **preterm-related**, corresponding to a rate of 201.5 deaths per 100,000 births. The rate among Non-Hispanic Black births (560.4 deaths per 100,000 births) was higher than that among Non-Hispanic White or Hispanic births.
- More than **1 in 4 stillbirths** (28.0%) had an unspecified cause of death. The second leading cause of fetal death was complications of the placenta, umbilical cord, and membrane (26.8%).
- Perinatal deaths include stillbirths with a gestation period of at least 28 weeks, and hebdomadal deaths (less than seven days). The perinatal mortality rate **declined** from 1999 to 2018. In 2018, the perinatal mortality rate was 6.2 perinatal deaths, per 1,000 live births and stillbirths at 28 weeks or more gestation.

INTRODUCTION

An important indicator of the health of a community is infant mortality, the death of an infant before reaching one year of age. Infant deaths can stem from environmental, socioeconomic, biological, and lifestyle factors, which are often interconnected.[1] Many of these factors are associated with the health status of the whole population, such as general living conditions, social wellbeing where basic needs are met, chronic health conditions, and quality of the environment.[2,3]

Known risk factors for infant morbidity and mortality include:

- Being of Black, American Indian/Alaskan Native, Native Hawaiian, or other Paci c Islander background.[3,5]
- Family history of birth defects or genetic disorders.[4]
- Use of alcohol, nicotine products, other substances, or certain medications during pregnancy.[4-6]
- Advanced maternal age.[4,5]
- Teen pregnancy.[5]
- Pre-pregnancy underweight status or obesity.[4,5]
- Chronic health conditions, such as diabetes mellitus or hyptertension.[4,5,7]
- Short interval (less than 18 months) between pregnancies.[6]
- Infections during pregnancy.[4,7]
- Infant exposure to secondhand smoke.[8]
- Certain infant sleep habits (increase the risk for sleep-related deaths).[8,9]
  - Sleeping on the side or stomach, rather than on the back.
  - Sleeping on a soft surface, such as an adult mattress or couch.
  - Sleeping with loose bedding, toys, or other clutter.
  - Sharing a bed with another person.
- Lack of access to quality health care.[9,10]
- Maternal mental health conditions.[7,10]
- High levels of stress around the time of pregnancy.[11]

To help promote infant health and well-being, cross-sector collaboration is needed. Strategies include:

- ✓ Reduce healthcare provider bias,[10] as well as other systemic barriers which contribute to racial and socioeconomic disparities in birth outcomes.
- ✓ Increase access to timely health care services, including routine prenatal and postpartum visits, as well as dental healthcare, mental healthcare, family planning visits, and prenatal education classes.[9,10]
- ✓ Support and refer to services for tobacco cessation.[12,13]
- ✓ Support families in following infant safe sleep recommendations from the American Academy of Pediatrics.[8,9]
- ✓ Encourage folic acid supplementation, before, during, and between pregnancies.[4]
- ✓ Support families in achieving breastfeeding recommendations, which include breastfeeding infants exclusively for at least 6 months.[8,14,15]
- ✓ Complete comprehensive screenings during healthcare visits, to include pregnancy intention, sexually transmitted infections, tobacco use, substance use, immunization status, perinatal mood and anxiety disorders, social determinants of health, intimate partner violence, and other risk factors [7,10]. Provide brief interventions and referral to care, where applicable.
- ✓ Avoid early delivery before 39 weeks of gestation, unless medically indicated.[10]
- ✓ Assess clients' access to basic needs during healthcare visits, such as transportation, food, and shelter[10,16]. Make referrals and connection to services if applicable.

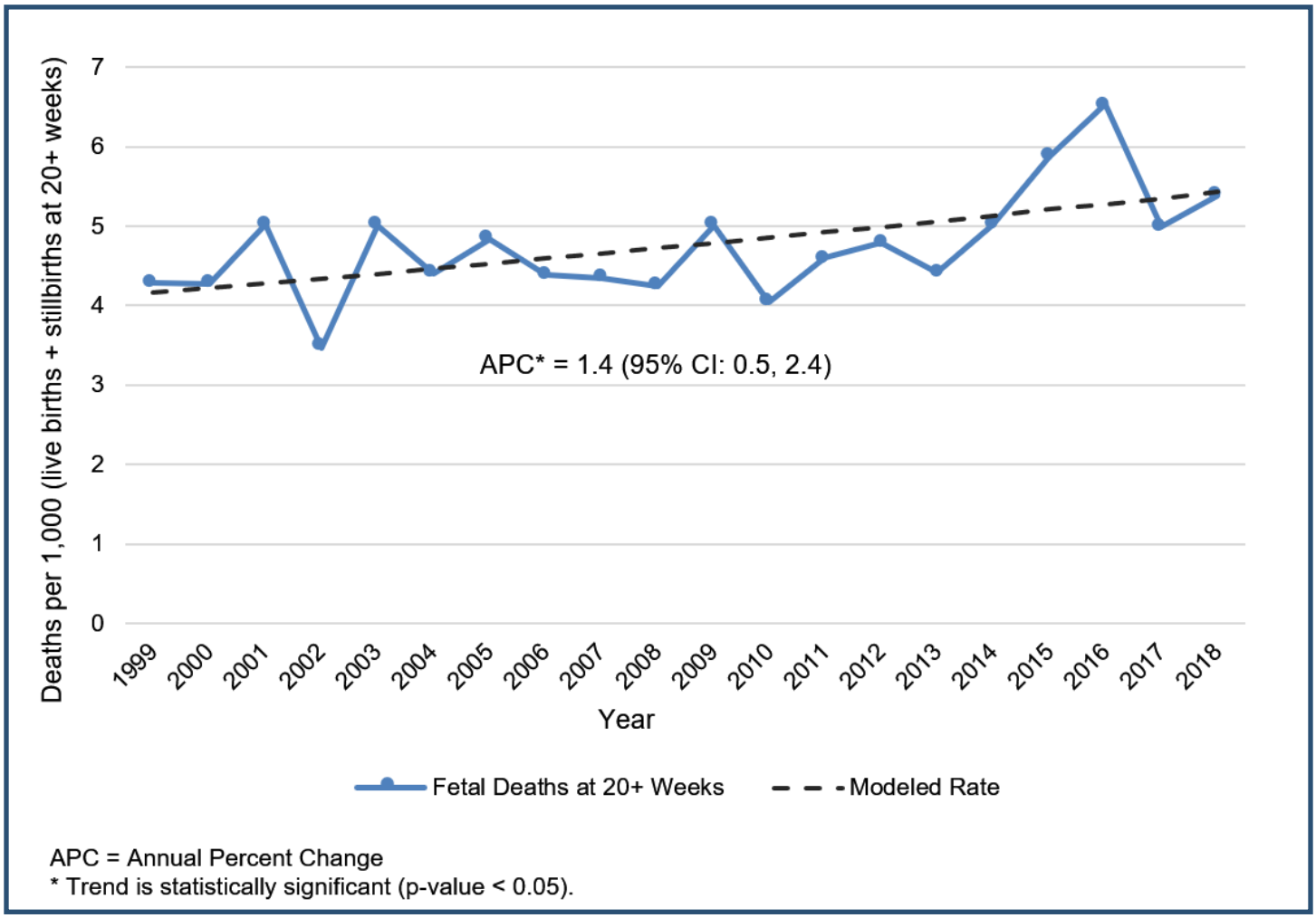
Healthy People 2020 provides national objectives for improving the health of all Americans, including infant mortality. The Healthy People 2020 target is 6.0 infant deaths per 1,000 live births.[16] In 2018, the nationwide infant mortality rate was 5.7 per 1,000 live births.[17]

The Kansas Department of Health and Environment's (KDHE) Bureau of Epidemiology and Public Health Informatics (BEPHI) monitors infant mortality and supports programs that promote access to health services for mothers and infants. This report builds on information in the *KDHE Annual Summary of Vital Statistics, 2018,*[17] with multi-year statistics and emphasis on trends, geographic distribution, and potential risk factors. Information on fetal mortality is also presented, as stillbirths and infant deaths may share similar risk factors.

FETAL & PERINATAL MORTALITY

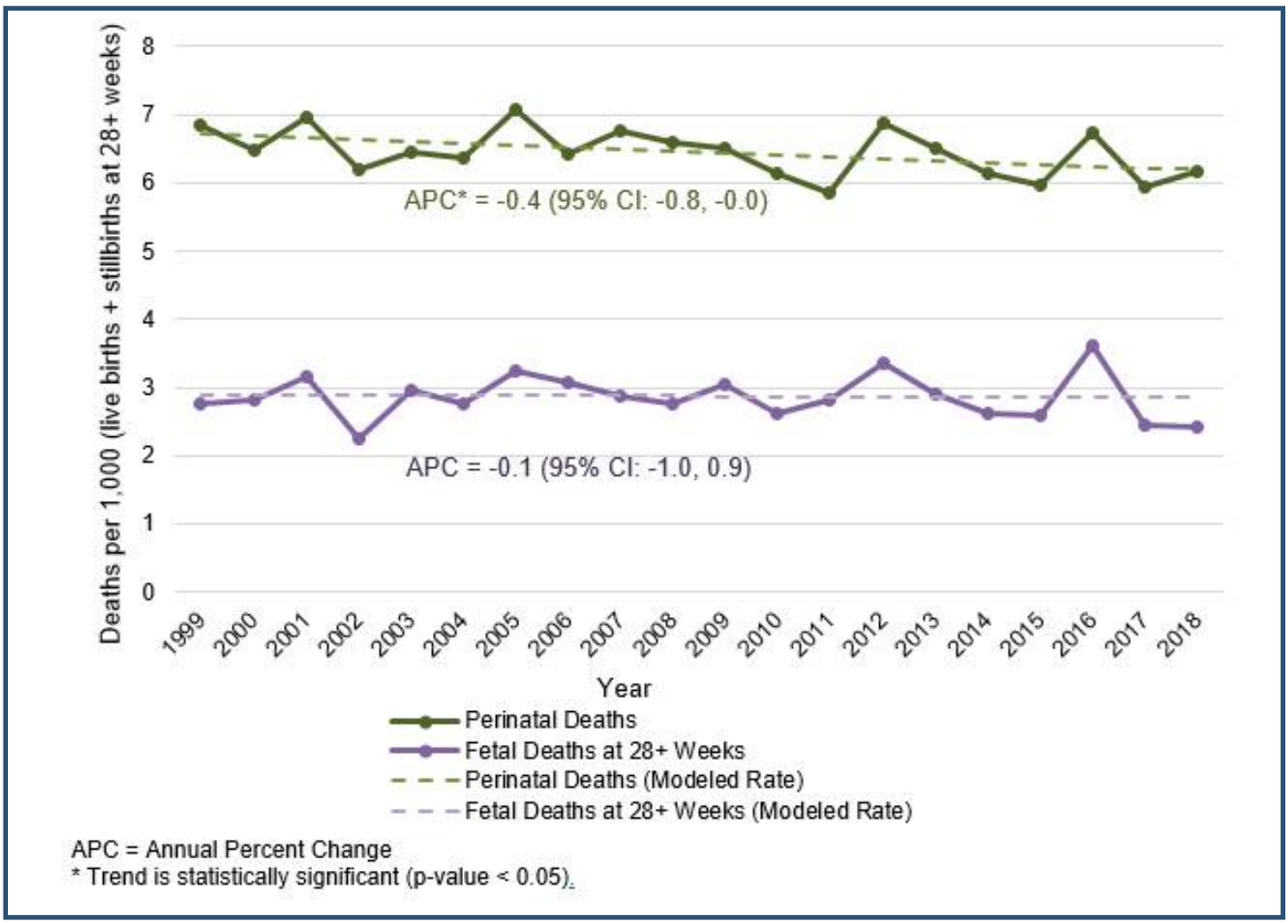
The stillbirth rate rose from 1999 to 2018 (Table 2, Figure A). The increase since 2013, particularly, may be partially due to a change in stillbirth reporting requirements in Kansas, which occurred in July 2014.[19] In 2018, there were 5.4 stillbirths at 20 weeks or more of gestation, per 1,000 live births plus stillbirths at 20 weeks or more of gestation (95% CI: 4.6, 6.1).

Figure A. Stillbirth Rates, Kansas, 1999-2018



Despite the increase in the number of stillbirths being reported, the rate of perinatal deaths dropped from 1999 to 2018 (Table 2, Figure B). Perinatal deaths include stillbirths at 28 weeks or more of gestation, as well as deaths to infants under 1 week old. In 2018, the perinatal mortality rate was 6.2 stillbirths at 28 weeks or more of gestation plus infant deaths occurring under 7 days, per 1,000 live births plus stillbirths at 28 weeks or more of gestation (95% CI: 5.4, 7.0). The rate of stillbirths occurring at 28 weeks or more of gestation did not change significantly over the twenty-year period.

Figure B. Five-Year Average Perinatal Mortality and Stillbirth Rates at 28+ Weeks of Gestation, Kansas,1999-2018



Among stillbirths at 20 weeks or more of gestation that occurred in 2014-2018, 28.0% of stillbirths were attributed to unspecified cause (Table 7). The second leading cause of fetal death was complications of the placenta, cord, and membranes (26.8%), followed by maternal complications of pregnancy (10.7%).

The stillbirth rate varied by race/ethnicity. In 2014-2018, there were 138 stillbirths to Non-Hispanic Black mothers (Table A), corresponding to a rate of 10.8 stillbirths at 20 weeks or more gestation, per 1,000 live births plus stillbirths at 20 weeks or more gestation (95% CI: 9.0, 12.6). This was more than twice the rate among the Non-Hispanic White population (4.8; 95% CI: 4.4, 5.1). Among the Hispanic population, there were 6.5 stillbirths at 20 weeks or more gestation, per 1,000 live births plus stillbirths at 20 weeks or more gestation (95% CI: 5.6, 7.4). Nearly one-third of Hispanic stillbirths were attributed to unspecified cause (Table A). Meanwhile, the leading cause of fetal death among the Non-Hispanic Black and Non-Hispanic White populations was complications of placenta, cord, and membranes.

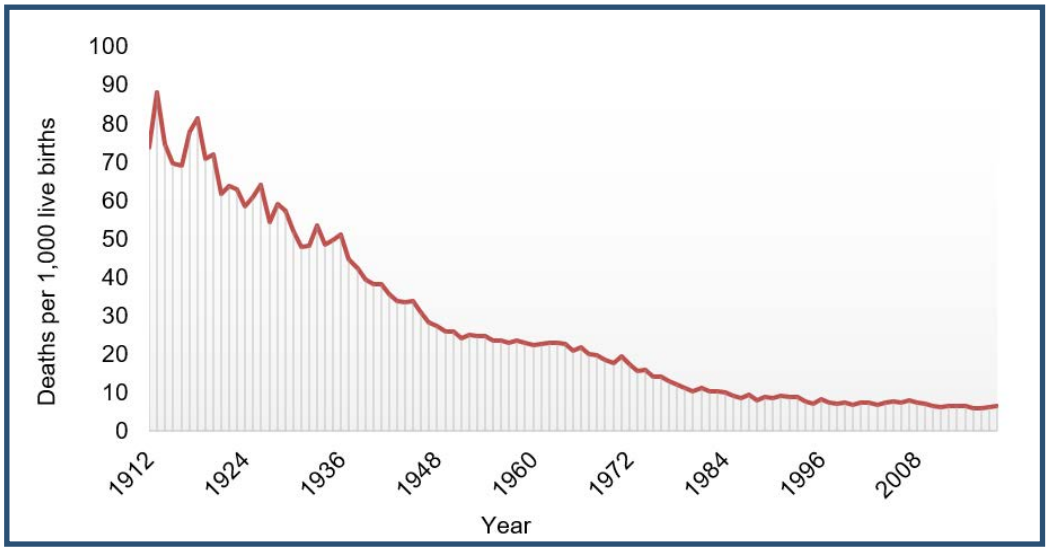
Table A. Stillbirths Among the Non-Hispanic White, Non-Hispanic Black, and Hispanic Populations, by Three Leading Causes of Fetal Death, Kansas, 2014-2018

Cause of Fetal Death by Population Group	Number of Deaths	Percent of Deaths
Non-Hispanic White (n=637)		
1. Fetus affected by complications of placenta, cord and membranes (P02)	186	29.2
2. Fetal death of unspecified cause (P95)	184	28.9
3. Congenital anomalies (Q00-Q99)	67	10.5
Non-Hispanic Black (n=138)		
1. Fetus affected by complications of placenta, cord and membranes (P02)	36	26.1
2. Fetal death of unspecified cause (P95)	28	20.3
3. Fetus affected by maternal complications of pregnancy (P01)	24	17.4
Hispanic, any race (n=200)		
1. Fetal death of unspecified cause (P95)	65	32.5
2. Fetus affected by complications of placenta, cord and membranes (P02)	38	19.0
3. Fetus affected by maternal conditions that may be unrelated to present pregnancy (P00)	20	10.0

INFANT MORTALITY

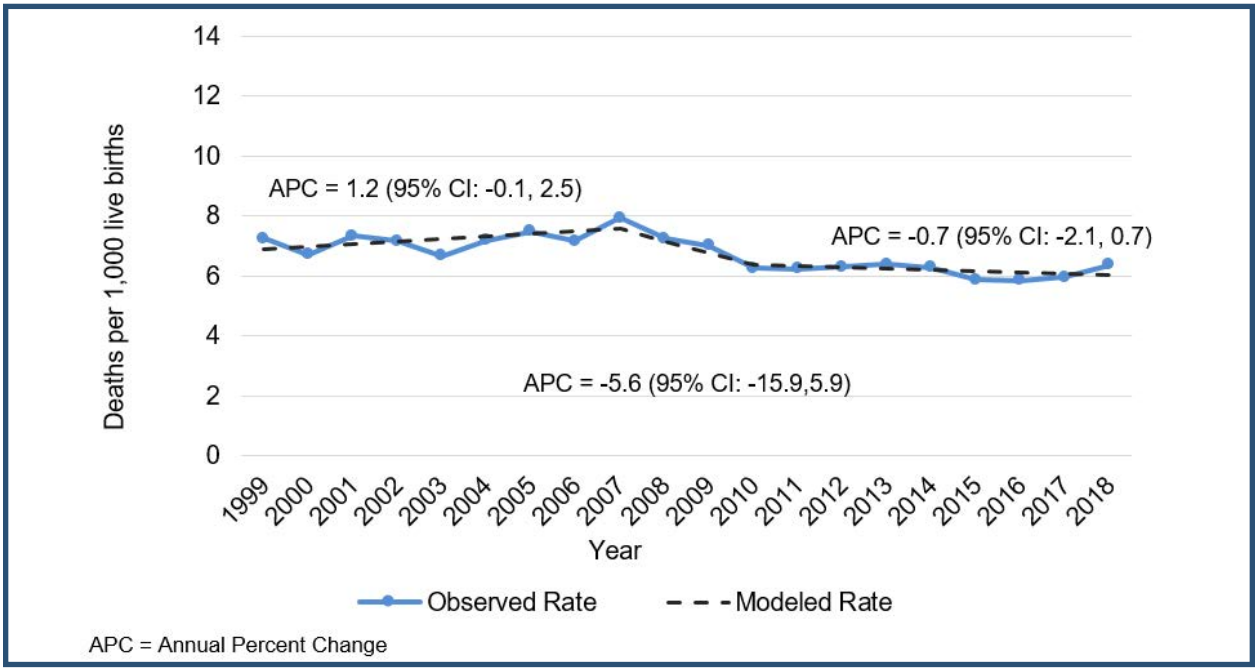
Although infant mortality dropped dramatically from the early to late 1900s, the rate did not change significantly from 1999 to 2018 (Figures C-D).

Figure C. Infant Mortality Rates, Kansas, 1912-2018



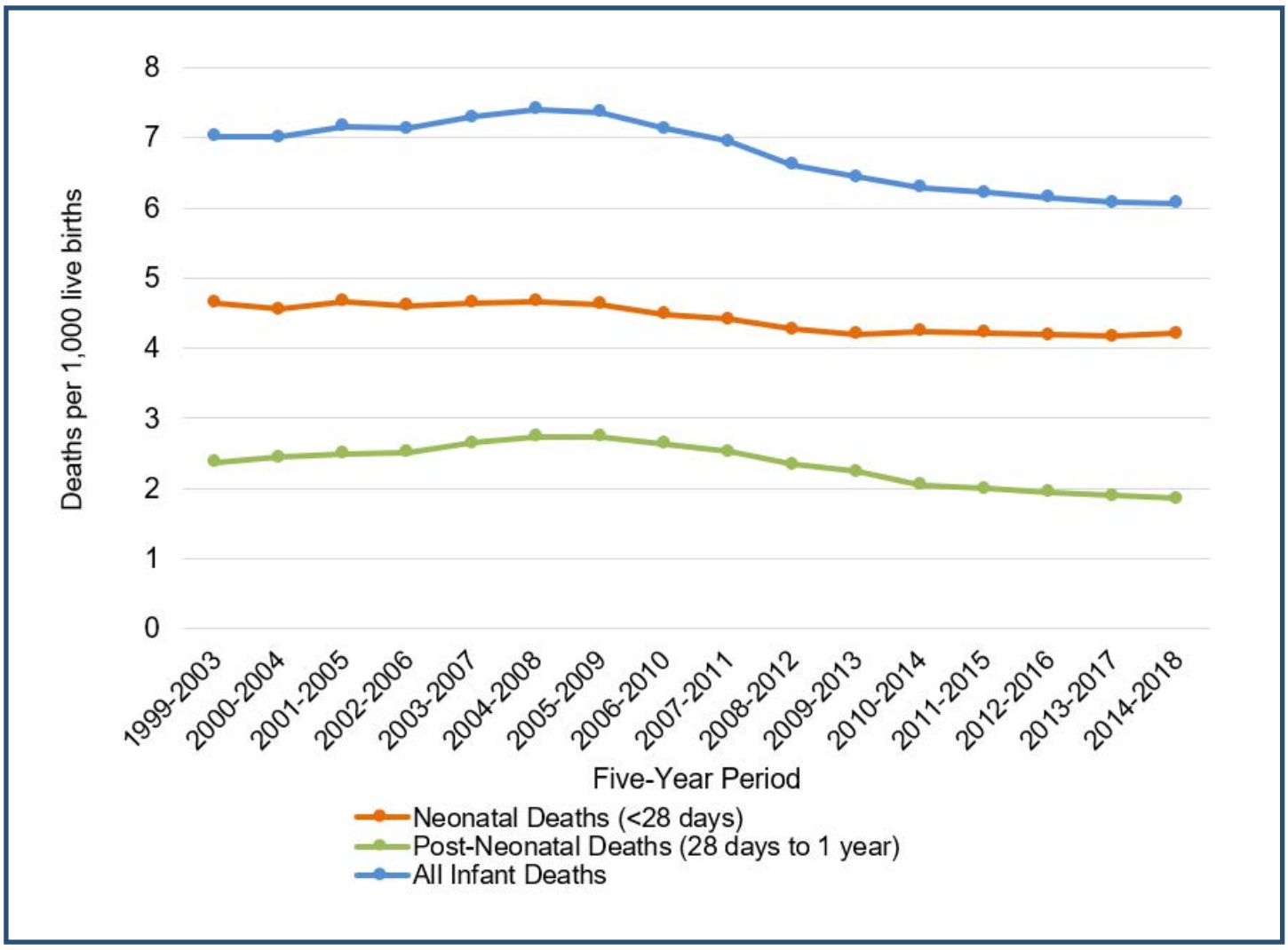
Observed changes between 1999 and 2018 were not significant. Infant mortality rose from 1999 to 2007, at a non-significant annual percent change (APC) of 1.2%. This was followed by a steep, although non-significant decrease by 5.6% per year from 2007 to 2010, and a slighter, non-significant decrease by 0.7% per year since 2010. In 2018, the Kansas infant mortality rate was 6.4 deaths per 1,000 live births (231 infant deaths; 95% CI: 5.5, 7.2).

Figure D. Infant Mortality Rates, Kansas, 1999-2018



Most Kansas infant deaths are neonatal deaths, occurring before the infant reaches 28 days of age. In 2014-2018, there were 796 neonatal deaths (69.4% of deaths, or 4.2 deaths per 1,000 live births; 95% CI: 3.9, 4.5) and 351 post-neonatal deaths (30.6% of deaths, or 1.9 per 1,000 live births; 95% CI: 1.7, 2.1) (Tables 1-2, 6). During the twenty-year period of 1999 to 2018, the five-year rolling average neonatal mortality rate peaked in 2004-2008 (Figure 3), and has since remained lower. The five-year rolling average post-neonatal mortality rate peaked in 2005-2009.

Figure E. Five-Year Rolling Average Infant Mortality Rates, by Infant's Age, Kansas, 1999-2018

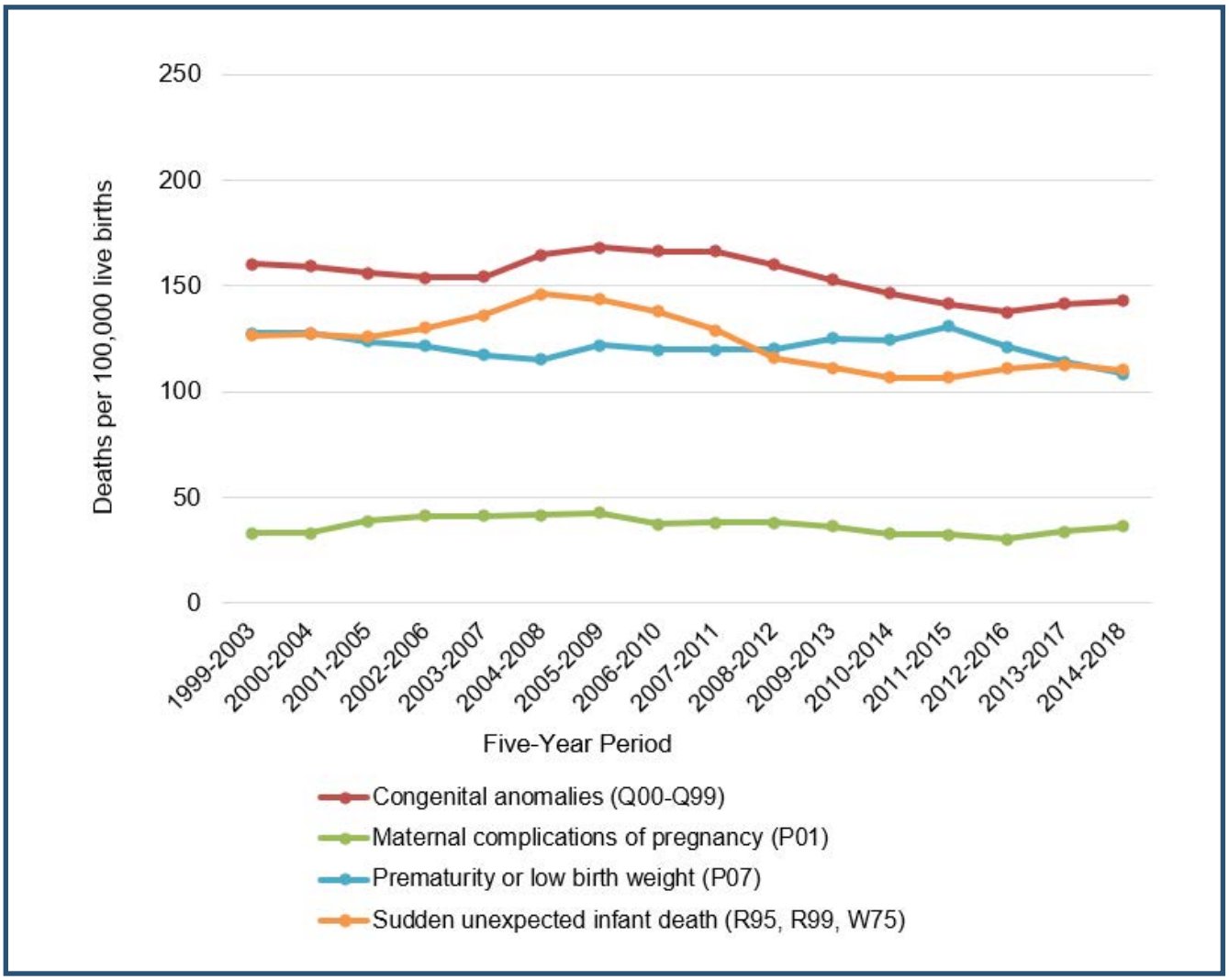


LEADING CAUSES OF INFANT MORTALITY

Twenty-year trends in the four leading causes of infant death are shown in Figure F. The four leading causes include:[1,20]

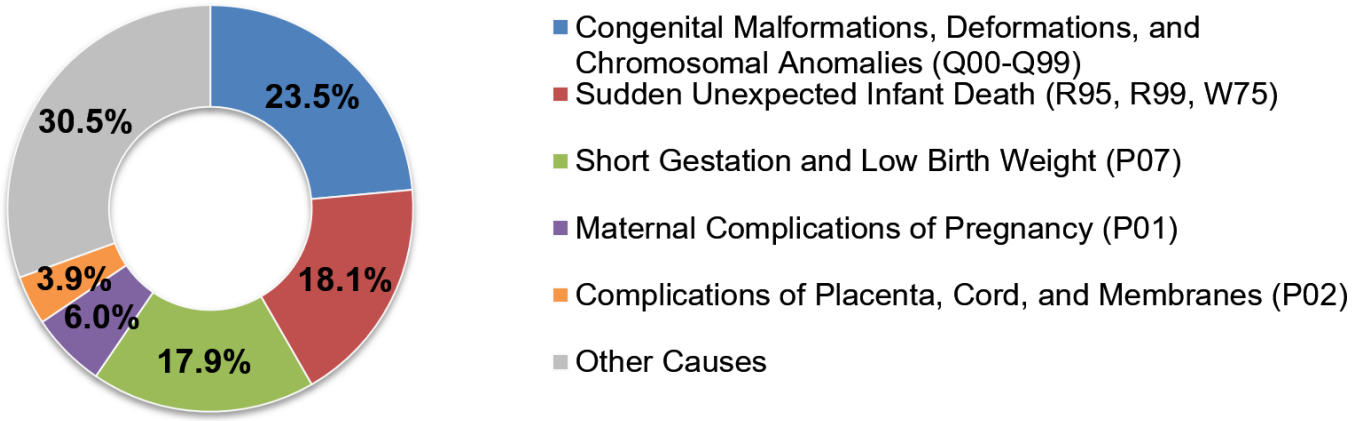
- Congenital anomalies (ICD-10 codes Q00-Q99), also known as birth defects
- Sudden Unexpected Infant Deaths or SUIDs (ICD-10 codes R95, R99, and W75)
- Prematurity or low birth weight (ICD-10 code P07)
- Maternal complications of pregnancy (P01)

Figure F. Five-Year Rolling Average Infant Mortality Rates for Four Leading Causes of Infant Death, Kansas, 1999-2018



Congenital anomalies were the leading cause of death for each rolling five-year period from 1999 to 2018 (Figure F). During this time, annual infant mortality due to congenital anomalies dropped at a statistically significant rate of 0.9% per year (95% CI: -1.7%, -0.0%). In 2014-2018, nearly 1 in 4 infant deaths (23.5%) were due to congenital anomalies (Figure G, Table B). The most frequent birth defects included congenital malformations of the circulatory system (21.5%, ICD-10 codes Q20-Q28), followed by chromosomal abnormalities (20.0%, ICD-10 codes Q90-Q99) and congenital malformations of the nervous system (17.8%, ICD-10 codes Q00-Q07).

Figure G. Leading Causes of Infant Mortality, Kansas, 2014-2018



The second leading cause of infant death in 2014-2018 was sudden unexpected infant death (SUID). 18.1% of infant deaths were SUIDs, at a rate of 110.0 infant deaths per 100,000 live births (95% CI: 95.0, 125.0). SUID was the leading cause of death in infants who had reached at least 28 days of age (51.3%) (Table 5). From 1999 to 2018, there were no statistically significant changes in the annual SUID rate.

The third and fourth leading causes of infant death in 2014-2018 were prematurity or low birth weight (17.9% of infant deaths) and maternal complications of pregnancy (6.0%). Other leading causes of infant deaths in 2014-2018 are listed in Table B.

Table B. Infant Deaths by Ten Leading Causes of Infant Death, Kansas, 2014-2018

Cause of Death (ICD-10 Code)	Number of Deaths	Percent of Deaths	Rate* (95% Confidence Interval)
All Causes	1,147	100.0	606.6 (571.4, 641.8)
1. Congenital anomalies (Q00-Q99)	270	23.5	142.8 (125.7, 159.8)
2. Sudden Unexpected Infant Death (R95, R99, W75)	208	18.1	110.0 (95.0, 125.0)
Sudden Infant Death Syndrome (R95)	81	38.9	
Ill-defined and unknown cause (R99)	79	38.0	
Accidental suffocation and strangulation in bed (W75)	48	23.1	
3. Disorders related to short gestation and low birth weight, not elsewhere classified (P07)	205	17.9	108.4 (93.6, 123.3)
4. Newborn affected by maternal complications of pregnancy (P01)	69	6.0	36.5 (28.4, 46.2)
5. Complications of placenta, cord, and membranes (P02)	45	3.9	23.8 (17.4, 31.8)
6. Bacterial sepsis of newborn (P36)	27	2.4	14.3 (9.4, 20.8)
7. Neonatal hemorrhage (P50-P52, P54)	23	2.0	12.2 (7.7, 18.3)
8. Accidents (unintentional injuries) (V01-X59, excluding W75)	20	1.7	10.6 (6.5, 16.3)
9. Diseases of the circulatory system (I00-I99)	19	1.7	10.0 (6.0, 15.7)
10. Assault (homicide) (U01, X85-Y09)	18	1.6	9.5 (5.6, 15.0)

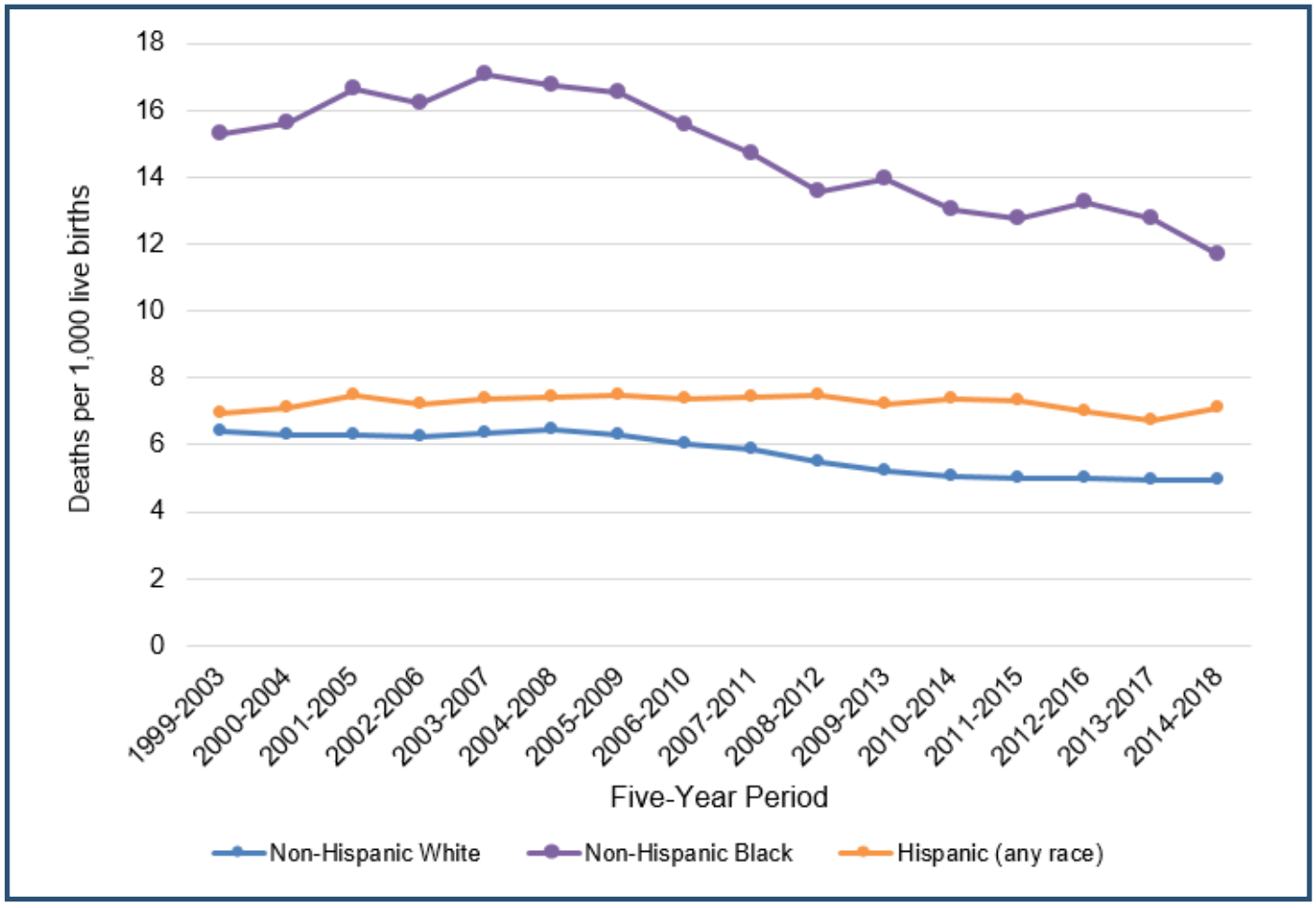
* Infant deaths per 100,000 live births

INFANT MORTALITY BY RACE AND ETHNICITY

From 1999 to 2018, infant mortality among the Non-Hispanic Black population was consistently double that of the Non-Hispanic White population (Table 3). However, Non-Hispanic Black infant mortality decreased significantly, by 1.8% per year (95% CI: -3.2%, -0.3%). Infant mortality also dropped among the Non-Hispanic White population, by 2.0% per year (95% CI: -2.5%, -1.4%). Meanwhile, infant mortality among the Hispanic population did not see any improvement. In 2018, the Hispanic infant mortality rate was 9.0 infant deaths per 1,000 live births (95% CI: 6.8, 11.8) - the highest it had been in the past twenty years. Yet there was no statistically significant change in Hispanic infant mortality during these two decades.

Figure H conveys the trend in infant mortality in five-year rolling averages, for these three population groups. Due to small sample size and unreliability of estimates, trends are not shown for other population groups.

Figure H. Five-Year Rolling Average Infant Mortality Rates Among the Non-Hispanic White, Non-Hispanic Black, and Hispanic Populations, Kansas, 1999-2018



In 2014-2018, the leading cause of death for Non-Hispanic Black infants was prematurity or low birth weight (Table C). Meanwhile, the leading cause of death among Non-Hispanic White and Hispanic infants was congenital anomalies. The Non-Hispanic Black population had at least twice the rate of deaths due to prematurity or low birth weight, compared to the Non-Hispanic White and Hispanic populations (Table C). The SUID rate was also significantly higher among Non-Hispanic Black births, compared to Non-Hispanic White births.

Table C. Infant Deaths Among the Non-Hispanic White, Non-Hispanic Black, and Hispanic Populations by Four Leading Causes of Infant Death, Kansas, 2014-2018

Cause of Death by Population Group	Number of Deaths	Percent of Deaths	Rate† (95% Confidence Interval)
Non-Hispanic White (n=657)			
1. Congenital anomalies (Q00-Q99)	180	27.4	135.2 (115.4, 155.0)
2. Sudden unexpected infant death (R95, R99, W75)	119	18.1	89.4 (73.3, 105.4)
3. Disorders related to short gestation and low birth weight, not elsewhere classified (P07)	102	15.5	76.6 (61.7, 91.5)
4. Newborn affected by complications of pregnancy (P01)	30	4.6	22.5 (15.2, 32.2)
Non-Hispanic Black (n=148)			
1. Disorders related to short gestation and low birth weight, not elsewhere classified (P07)	37	25.0	292.0 (205.6, 402.5)
2. Sudden unexpected infant death (R95, R99, W75)	31	20.9	244.7 (166.2, 347.3)
3. Newborn affected by maternal complications of pregnancy (P01)	18	12.2	142.1 (84.2, 224.5)
4. Congenital anomalies (Q00-Q99)	17	11.5	134.2 (78.2, 214.8)
Hispanic, any race (n=217)			
1. Congenital anomalies (Q00-Q99)	52	24.0	169.7 (126.8, 222.6)
2. Disorders related to short gestation and low birth weight, not elsewhere classified (P07)	42	19.4	137.1 (98.8, 185.3)
3. Sudden unexpected infant death (R95, R99, W75)	38	17.5	124.0 (87.8, 170.2)
4. Newborn affected by maternal complications of pregnancy (P01)	13	6.0	42.4 (22.6, 72.6)

†Infant deaths per 100,000 live births

INFANT MORTALITY BY GEOGRAPHIC AREA

Rates by County

The counties with the highest number of infant deaths in 2014-2018 included Sedgwick (245 or 21.4%), Johnson (147 or 12.8%), Wyandotte (99 or 8.6%), and Shawnee (89 or 7.8%). These four counties accounted for half (50.6%) of all infant deaths (Table 4).

The counties with the highest reliable (relative standard error ≤ 30%) infant mortality rates included:

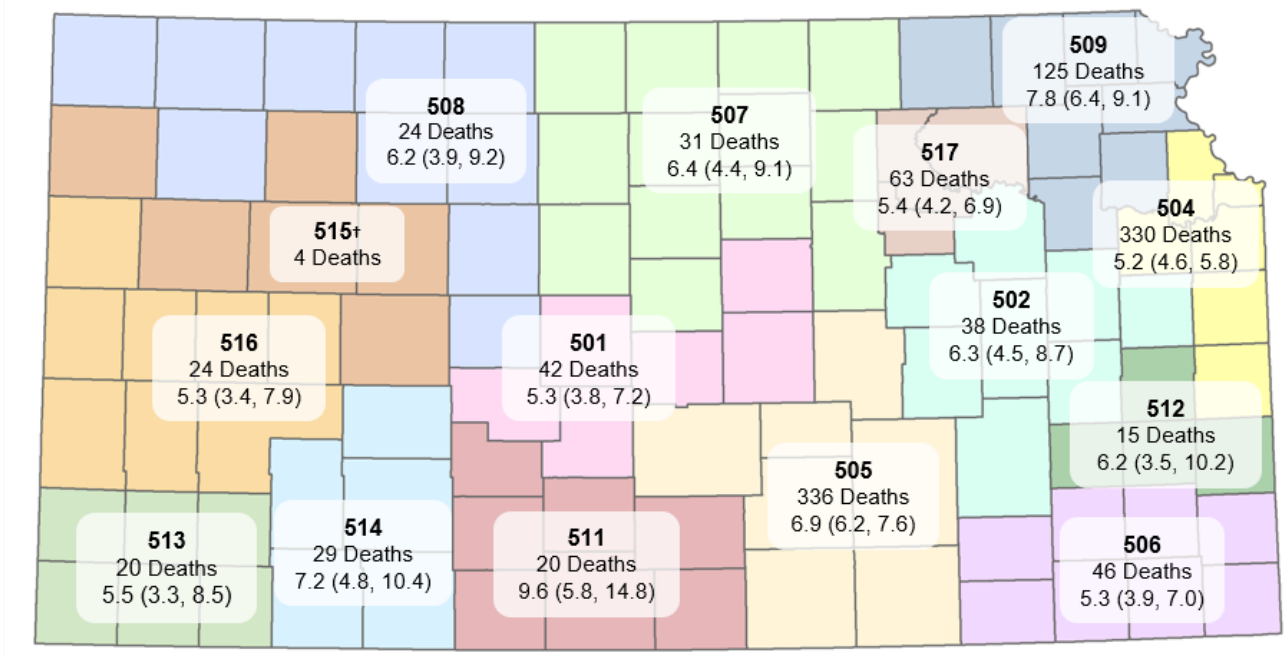
- Harvey (9.1 infant deaths per 1,000 live births; 95% CI: 5.4, 14.4)
- Butler (8.3; 95% CI: 5.7, 11.9)
- Shawnee (8.1; 95% CI: 6.5, 10.0)
- Lyon (7.4; 95% CI: 4.1, 12.1)
- Wyandotte (7.4; 95% CI: 6.0, 9.0)

The counties with the lowest (reliable) non-zero rates were:

- Johnson (4.0 deaths per 1,000 live births; 95% CI: 3.4, 4.7)
- Saline (5.5; 95% CI: 3.3, 8.5)
- Finney (5.7; 95% CI: 3.4, 8.9)
- Geary (5.8; 95% CI: 3.9, 8.4)
- Riley (5.8; 95% CI: 3.8, 8.4)

As the number of deaths was too small for analysis in many counties, counties were combined into Health Preparedness Regions (Figure 9). The region with the highest reliable (relative standard error ≤ 30%) infant mortality rate was the South Central Coalition, at 9.6 deaths per 1,000 live births (95% CI: 5.8, 14.8). The region with the lowest infant mortality rate was the Kansas City Metro Region, at 5.2 deaths per 1,000 live births (95% CI: 4.6, 5.8).

Figure I. Infant Deaths and Mortality Rates* with 95% Confidence Intervals, by Kansas Health Preparedness Region, Kansas, 2014-2018



Kansas 5-Year Infant Mortality Rate: 6.1 (5.7, 6.4)

Kansas Public Health Regions

501 - Central Kansas
502 - EC Coalition
504 - KC Metro
505 - KS SC Metro
506 - Lower 8 of SE KS
507 - NC KS Pub Health Initiative
508 - Northwest BT Region
509 - Northeast Corner
511 - SC Coalition
512 - SEK
513 - SW KS Health Initiative
514 - SW Surveillance
515 - WC Pub Health Initiative
516 - Western Pyramid
517 - Wildcat

*Rate per 1,000 live births
†Numbers too small to calculate rates (Relative Standard Error > 50%).
Residence data
Source: Bureau of Epidemiology and Public Health Informatics, Kansas Department of Health and Environment

Rates by Urban/Rural Residence

Among county peer groups in 2014-2018, infant death rates did not differ significantly between Frontier, Rural, Densely-Settled Rural, Semi-Urban, and Urban populations (Table 4). However, differences were found when categorizing counties via the NCHS urban-rural classification system. Medium metro counties (which included Butler, Harvey, Kingman, Sedgwick, and Sumner) had the highest infant mortality rate (7.1 deaths per 1,000 live births; 95% CI: 6.3, 7.8). The lowest rate (5.1) was among large fringe metro counties (which included Johnson, Leavenworth, Linn, Miami, and Wyandotte) (95% CI: 4.5, 5.7).

Rates by Zip Code

Thirty-one zip codes had sufficient infant deaths in 2014-2018 to allow analysis. The zip codes with the highest reliable (relative standard error ≤ 30%) mortality rates included:

- One in Shawnee County:
  - 66604 (12.3 deaths per 1,000 live births; 95% CI: 7.4, 19.2)
- Three in Sedgwick County:
  - 67218 (10.8; 95% CI: 6.6, 16.7)
  - 67211 (10.7; 95% CI: 6.3, 16.9)
  - 67214 (9.7; 95% CI: 5.4, 15.9)
- One in Johnson County:
  - 66202 (9.3; 95% CI: 4.8, 16.2)

The zip-codes with the lowest reliable (relative standard error ≤ 30%) rates were:

- Two in Johnson County:
  - 66062 (2.9 deaths per 1,000 live births; 95% CI: 1.6, 4.8)
  - 66061 (4.2; 95% CI: 2.5, 6.6)
- Two in Geary County:
  - 66441 (5.0; 95% CI: 2.8, 8.3)
  - 66442 (5.2; 95% CI: 2.9, 8.8)
- One in Saline County:
  - 67401 (5.5; 95% CI: 3.2, 8.6)

CHARACTERISTICS OF LINKED INFANT DEATHS, 2014-2018

In this section, a variety of maternal and infant characteristics are presented on infants who died in 2014-2018, from information in linked birth certificates. Rates are presented, with the numerator as the number of infants who died in 2014-2018, and the denominator as the number of births during the same period.

Race/Ethnicity

The mother's race/ethnicity was known for 1,132 (99.6%) of the 1,136 linked infant deaths that occurred in 2014-2018 (Table 9). Seven hundred twenty-eight infants (64.1%) were born to Non-Hispanic White mothers, corresponding to a rate of 5.5 infant deaths per 1,000 live births that occurred during those years (95% CI: 5.1, 5.9) (Tables 9-10, Figure K). One hundred forty-four (12.7%) were born to Non-Hispanic Black mothers, corresponding to a rate of 11.4 deaths per 1,000 live births (95% CI: 9.5, 13.2). One hundred eighty-six linked infant deaths (16.4%) were born to Hispanic mothers, corresponding to a rate of 6.1 deaths per 1,000 live births (95% CI: 5.2, 6.9). Rates for other population groups are displayed in Figure K.

Birth Weight

Low birth weight was highly correlated with infant mortality. Of the linked infant deaths that occurred in 2014-2018, where birth weight was known, 729 deaths (64.5%) were born at a low birth weight (under 2,500 grams) (Table 9). For every 20 low birth weight births, 1 infant death occurred (54.0 deaths per 1,000 live births; 95% CI: 50.0, 58.0), compared to only 2.3 deaths per 1,000 babies born at a normal or high birth weight (95% CI: 2.3, 2.5) (Tables 9-10). Nearly half (49.2%) of the linked infant deaths occurred to infants born at a very low birth weight (less than 1,500 grams).

Gestational Age

Prematurity is an important factor in infant death. Of the linked infant deaths where gestational age was known, 540 (48.2%) were very premature (less than 32 weeks). Forty-six (4.1%) were moderately premature (32 to 33 weeks), 119 (10.6%) were late premature (34 to 36 weeks), 185 (16.5%) were early term (37 and 38 weeks), and 230 (20.5%) were born at term (Table 9). For every 100 preterm births that occurred in 2014-2018, there were 4.1 infant deaths (95% CI: 3.8, 4.4) (Tables 9-10).

Prematurity was also associated with specific leading causes of death (Table 8). The leading cause of death among premature infants was short gestation and low birth weight (27.4%), followed by birth defects (19.1%). Meanwhile, the leading cause of death among infants who were born at term was SUID (42.2%).

Preterm-Related Mortality

Preterm-related deaths include deaths where the infant was born at under 37 weeks of gestation, and where the underlying cause of death was considered a direct consequence of preterm birth.[1,20] From 1999 to 2018, there was no significant change in preterm-related mortality, despite a general downward trend (Figure 10). In 2014-2018, the preterm-related mortality rate was 201.5 deaths per 100,000 live births (Table D).

Figure J. Preterm-Related Mortality Rates from the Linked Birth-Infant Death File, Kansas, 1999-2018

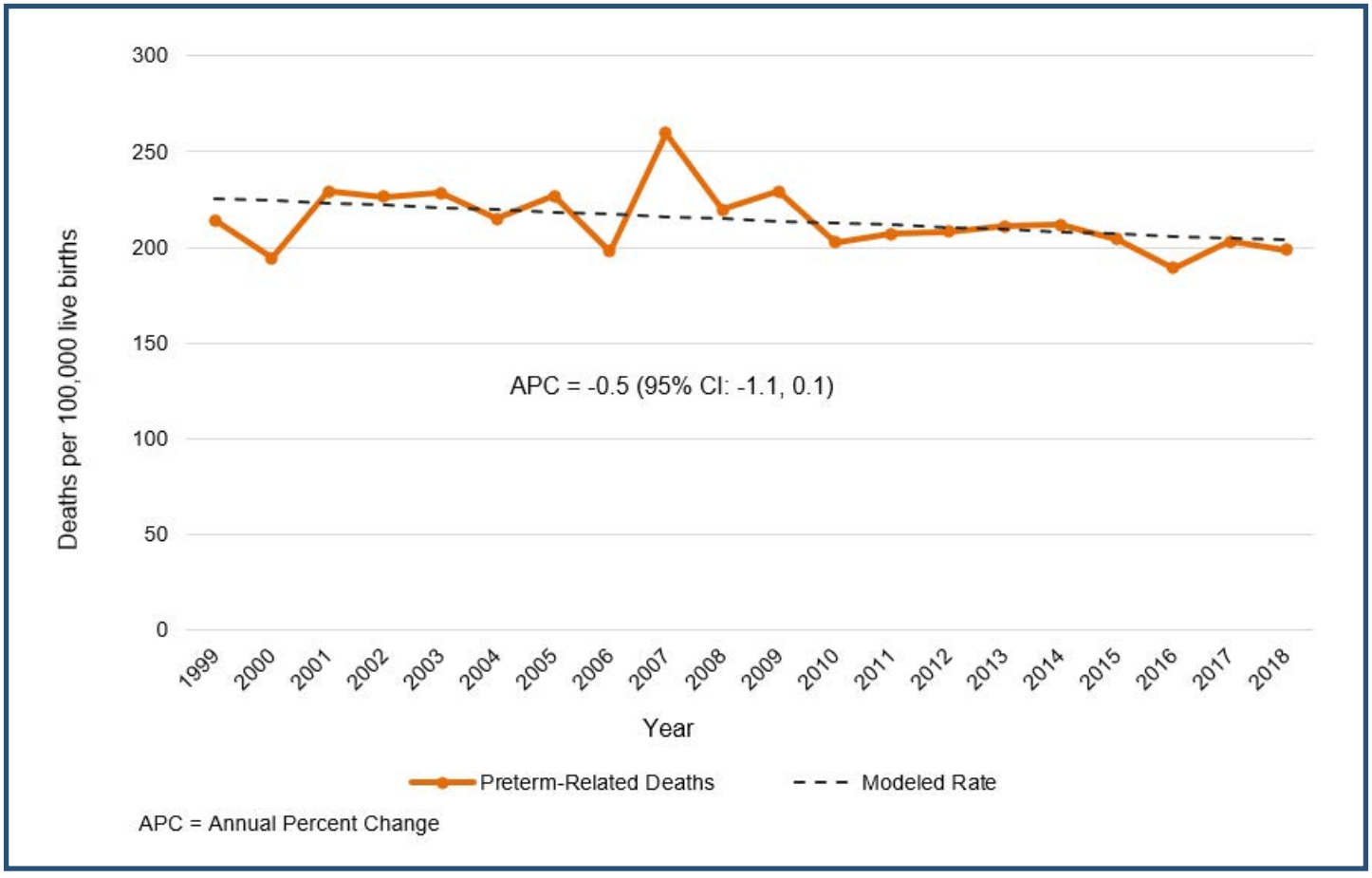


Table D. Preterm-Related Infant Deaths and Mortality Rates Among the Non-Hispanic White, Non-Hispanic Black, and Hispanic Populations, Kansas, 2014-2018

Race/Ethnicity	Number (% of Linked Deaths)	Rate* (95% Confidence Interval)
All	381 (33.5%)	201.5 (181.2, 221.7)
Non-Hispanic White	215 (29.5%)	161.5 (139.9, 183.1)
Non-Hispanic Black	71 (49.3%)	560.4 (437.7, 706.8)
Hispanic (any race)	72 (38.7%)	235.0 (183.9, 295.9)

* Deaths per 100,000 live births
A cause of death was considered preterm-related if the infant was born preterm (<37 completed weeks of gestation), with the underlying cause of death assigned to one of these ICD-10 categories: K550, P000, P010, P011, P015, P020, P021, P027, P070-P073, P102, P220-P229, P250-P279, P280, P281, P360-P369, P520-P523, or P77.

In 2014-2018, the burden of preterm-related mortality was greater among the Non-Hispanic Black and Hispanic populations, compared to the Non-Hispanic White population (Table D). Nearly half of Non-Hispanic Black infant deaths (49.3%) were preterm-related. The preterm-related mortality rate among the Non-Hispanic Black population was 560.4 deaths per 100,000 live births. This rate was more than triple that of the Non-Hispanic White population (161.5 deaths per 100,000 live births), and more than double that of the Hispanic population (235.0).

Mother's Age

The mother's age was known for 1,135 (99.9%) of the linked infant deaths. The highest percentage of deaths occurred to infants whose mothers were aged 25 to 29 years old (33.6%), followed by mothers aged 20 to 24 years old (24.8%), 30 to 34 years old (21.5%), and 35 to 39 years old (9.3%) (Table 9). Births to mothers under 20 years had a higher infant mortality rate (8.2 deaths per 1,000 live births; 95% CI: 6.6, 10.0) than among births where the mother was 25 to 34 years old (5.7; 95% CI: 5.2, 6.1) or older than 35 years (5.6; 95% CI: 4.6, 6.5) (Tables 9-10, Figure K).

Plurality

Birth plurality (the total number of births resulting from a single pregnancy) was known for all 1,136 of the linked deaths (Table 9). Nearly 9 in 10 of the infants (87.3%) were singletons at birth (992). One hundred thirty-eight (12.1%) were part of twin deliveries, and 0.5% (6) were part of triplet or above deliveries. In total, 144 of the linked infant deaths occurred among plural births (12.7%), corresponding to an infant mortality rate of 23.9 deaths per 1,000 live, plural births (95% CI: 19.9, 27.8) (Tables 9-10, Figure K). By comparison, for every 1,000 singleton live births, there were 5.4 infant deaths (95% CI: 5.1, 5.8).

Birth Order

Birth order was known for all 1,136 linked deaths (Table 9). Births with an order of 4 or more were associated with a higher infant mortality rate (7.2 deaths per 1,000 live births; 95% CI: 6.2, 8.2), compared to births of order 2 or 3 (Tables 9-10, Figure K).

Pre-pregnancy Body-Mass Index (BMI)

Maternal body-mass index (BMI) prior to the pregnancy was known for 1,106 linked infant deaths (97.4%; Table 9). More than 1 in 3 deaths were to infants whose mothers were obese (35.8%), and a similar percentage (35.3%) were to mothers of normal weight. Maternal obesity was associated with an infant mortality rate of 7.7 deaths per 1,000 live births (95% CI: 6.9, 8.4) (Tables 9-10, Figure K). This was higher than the mortality rate among births to mothers of normal weight (4.8 deaths per 1,000 live births; 95% CI: 4.4, 5.3), and among births to mothers who were overweight (5.6; 95% CI: 5.0, 6.3). Births to underweight mothers were associated with an infant mortality rate of 6.5 deaths per 1,000 live births (95% CI: 4.5, 8.9).

Marital Status

Marital status was known for 1,133 (99.7%) of the linked deaths. For half of the infant deaths (50.3%), the mother was not married at the time of her pregnancy or delivery (Table 9). In 2014-2018, the infant mortality rate among births to unmarried mothers (8.3 deaths per 1,000 live births; 95% CI: 7.7, 9.0) was nearly twice that of births to married mothers (4.7; 95% CI: 4.3, 5.0) (Tables 9-10, Figure K).

Pay Source

Delivery payer was known for 1,123 linked infant deaths (98.9%) (Table 9). The highest percent of these births were paid for by private insurance (44.4%), followed by Medicaid (43.5%), and selfpay (7.0%) (Table 9). The infant mortality rate among births where Medicaid was the primary payer was 8.1 deaths per 1,000 live births (95% CI: 7.4, 8.9) (Tables 9-10, Figure K). This was significantly higher than that among births primarily paid for by private/employer insurance (4.8 deaths per 1,000 live births; 95% CI: 4.4, 5.2), and among all births where Medicaid was not the primary payer (5.0; 95% CI: 4.6, 5.3).

Mother's Education

Education level was known for 744 (97.9%) of the linked deaths to mothers aged 25 years and older (Table 9). Mothers whose education level was high school or GED had the highest percentage of infant deaths (25.7%), followed by those with some college but no degree (22.4%), and those with a Bachelor's Degree (19.2%). Among births to mothers aged 25 years and older, those to mothers with at least some college education had the lowest infant mortality rate (4.7 deaths per 1,000 live births; 95% CI: 4.3, 5.1) (Tables 9-10, Figure K). This rate was lower than among births to mothers aged 25 years and older who did not have a high school diploma or GED (7.3 deaths per 1,000 live births; 95% CI: 5.8, 9.0), and to those who had a high school or GED but no college education (8.5; 95% CI: 7.3, 9.7).

Prenatal Care Onset

The month prenatal care began was known for 1,100 (96.8%) of the linked infant deaths (Table 9). For the majority of these (75.6%), the mother had started prenatal care in the first trimester of pregnancy. Nearly 1 in 20 linked infant deaths (4.8%) had no prenatal care. The mortality rate among births with no prenatal care was 31.7 deaths per 1,000 live births (95% CI: 23.7, 41.6) (Tables 9-10, Figure K). In comparison, among births with first-trimester onset of prenatal care, the infant mortality rate was only 5.5 deaths per 1,000 live births (95% CI: 5.1, 5.8).

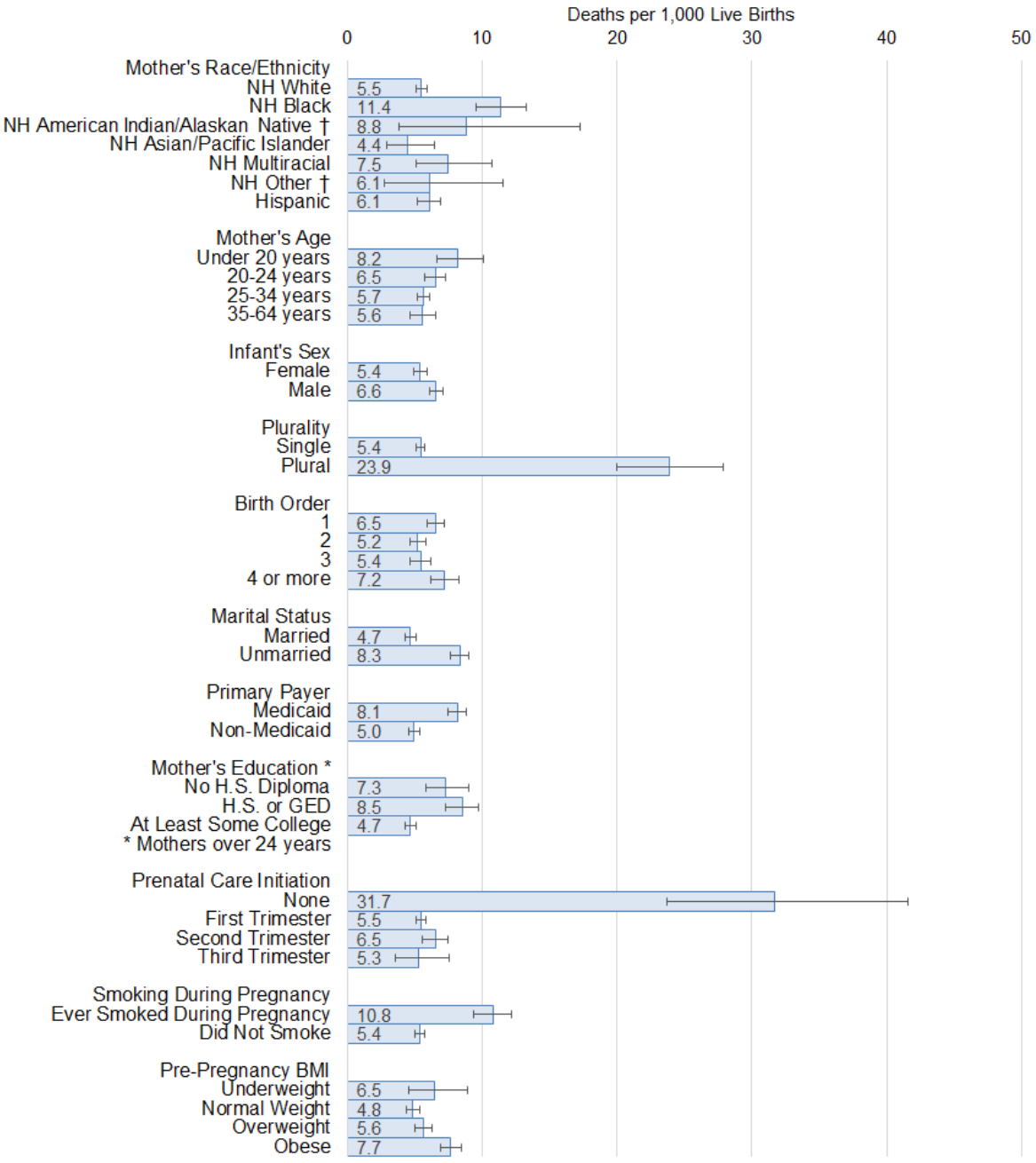
Adequacy of Prenatal Care Utilization (APNCU) Index

The APNCU index was known for 1,097 linked records (96.6%) (Table 9). Of these, almost half (48.1%) had Adequate Plus prenatal care, 27.1% had Adequate, 7.9% had Intermediate and 16.9% had Inadequate prenatal care. Meanwhile, among all births that occurred in 2014-2018 (Table 10), 10.8% received Inadequate prenatal care, 52.9% received Adequate prenatal care, and 30.4% received Adequate Plus prenatal care. In interpreting the APNCU index, it is important to remember that this is a quantitative measure that relies on timing and number of visits. It may not be an effective measure of the quality of care received, especially by high-risk pregnancies.

Smoking Status

Smoking status was known for 1,122 linked infant deaths (98.8%) (Table 9). Mothers reported smoking at some time during pregnancy in 19.2% of infant deaths. In 2014-2018, births to smokers had twice the infant mortality rate (10.8 deaths per 1,000 live births; 95% CI: 9.3, 12.2) of births to nonsmokers (5.4; 95% CI: 5.0, 5.7) (Tables 9-10, Figure K).

Figure K. Infant Mortality Rates by Maternal Characteristics and Aspects of the Pregnancy, from the Linked Birth-Infant Death File, Kansas, 2014-2018



Error bars represent 95% confidence intervals.
† Estimate is statistically unreliable (Relative Standard Error > 30%).

DISCUSSION

Despite gains in preventing infant mortality over the past century, the overall infant mortality rate in Kansas did not change significantly from 1999 to 2018. However, some promising trends in fetal and infant mortality include declines in infant mortality among the Non-Hispanic White and Non-Hispanic Black populations, and a decrease in perinatal mortality.

Overall, the stillbirth rate has increased in Kansas. However, the increase in recent years may be partially due to changes in the state's stillbirth reporting law during 2014. Over the past twenty years, Kansas has seen a drop in the rate of perinatal deaths, which includes stillbirths of at least 28 weeks gestation, and deaths to infants under 7 days of age.

The infant mortality rate in Kansas in 2018 (6.4 deaths per 1,000 live births) was higher than the overall rate for the United States in 2018, which was 5.7.[17] Kansas as a whole did not meet the Healthy People 2020 objective of 6.0 deaths per 1,000 live births. The Non-Hispanic White population met the target, while the Non-Hispanic Black and Hispanic populations did not. From 1999 to 2018, the infant mortality rate among Non-Hispanic White and Non-Hispanic Black births decreased significantly. The same improvements were not seen for Hispanic births.

Some areas in the state continued to see higher infant mortality than others. Harvey, Butler, and Shawnee counties each had an infant mortality rate greater than 8 infant deaths per 1,000 live births. The high infant mortality rates in Harvey and Butler counties contributed to the high infant mortality rate seen among all medium metro counties combined. Meanwhile, counties with the lowest infant mortality rates included Johnson, Saline, and Finney counties.

Leading causes of infant death included congenital anomalies, disorders related to short gestation and low birth weight, and SUID. In general, prematurity and low birth weight continue to be pivotal risk factors for infant death. More than one-third of infant deaths were considered preterm-related.

The burden of prematurity and low birth weight particularly impacted Non-Hispanic Black births. Disorders related to short gestation and low birth weight were the leading cause of death for Non-Hispanic Black infants. Non-Hispanic Black births also experienced a higher rate of preterm-related deaths than Hispanic or Non-Hispanic White births.

Besides gestational age and low birth weight, other characteristics of the mother and delivery appeared to be correlated with infant death. Lifestyle-related risk factors (e.g., pre-pregnancy obesity, smoking during pregnancy) were associated with higher infant mortality rates. Importantly, characteristics that may at least partially stem from or interact with social, economic, or environmental factors (e.g., marital status, Medicaid status, education level, and timing of prenatal care entry) also correlated with infant mortality. However, more in-depth analysis is needed to assess the degree to which potential risk factors may influence infant mortality, as well as each other.

As a next step, it would be useful to conduct a detailed Perinatal Periods of Risk (PPOR) analysis among the 2014-2018 infant death and stillbirth cohort.[21] The PPOR method involves identifying the number of stillbirths and infant deaths in a community that may have been preventable, and assessing which risk or protective factors may be most important in preventing future stillbirths and infant deaths.

TECHNICAL NOTES

Statistical Methodology

Crude infant mortality rates were calculated per year, per a combination of years, and for specific subpopulations. Due to the relatively small number of infant deaths each year, preselected intervals of years were combined to increase data reliability. Five years (2014-2018) were combined for characteristic analysis, and intervals of 20 years and approximately 100 years were used for trend analysis. The long-term (~100 years) infant mortality numbers and rates may be underreported due to incomplete data collection in the early 1900s.

Data Suppression. The relative standard error (RSE) was used to evaluate reliability of rates. Values with a relative standard error of 30 percent or less were considered reliable. Values with a relative standard error greater than 30 percent but 50 percent or less were considered unreliable, and rates with RSE greater than 50 percent have been suppressed in this document.

Statistical Significance. The following statistical tests have been applied where statistically significant differences have been noted in this document. When counts were ≥100, a normal distri-bution was assumed and the z-test was used to compare two infant mortality rates.[22] When counts were <100, a Poisson probability distribution was assumed and confidence intervals were calculated at the 95% confidence level to compare two infant mortality rates. If the confidence intervals of two values did not overlap, it was considered a conservative estimate of a significant difference. Caution should be used in interpreting these differences, due to the relatively small number of occurrences and yearly fluctuations.

Trend Analysis. Poisson Joinpoint regression was performed to model trends, and the annual percent change (APC) was used to characterize the trend over time.[23,24] Statistical significance was considered as a p-value of less than 0.05. Where the numerator was less than 20 or the denominator was less than 50, years were combined into five-year intervals and rolling averages were calculated.

Inclusion of Stillbirths. Stillbirths are also included in this report. These events may have risk factors similar to those for infant deaths. In Kansas, as of July 2014, a stillbirth is defined as complete expulsion or extraction from its mother of a human child the gestational age of which is not less than 20 completed weeks, resulting in other than a live birth, and which is not an induced termination of pregnancy.[19] The old law required stillbirths to be reported when fetal weight was greater than 350 grams. The change may result in slightly different counts because of the different definitions of stillbirth and implementation occurring mid-year. The reporting certificate did not change. The new definition has resulted in more events being reported. For consistency, in this publication, only stillbirths of at least 20 weeks gestation were included, for all years.

All data reported are based on Kansas residence, unless otherwise noted.

Linkage to Birth Records

This report also provides findings based on the linking of birth certificate and infant death certificate data. Where referenced, the linked birth/infant death statistics are based on the period-linked birth-death cohort. The birth-death cohort includes infant deaths that occurred during the given years, and births that occurred during the same years.[22]

The birth/infant death data analyzed are based on a union of single year linked birth/infant death files created six months after a given event year ended. Linkage of the respective records is performed by the BEPHI Public Health Informatics group using deterministic methodology based on the presence of a birth certificate identification number in the death history file. A manual matching process is used for infant deaths that do not match automatically. Because of the timeframe for creating the annual linked birth/infant death statistical files, infant death reports received later than six months after the end of a given event year are not included in the given event year.

Linked data are an important tool to examine infant mortality comparisons between Kansas and other states including the District of Columbia, or the United States. To obtain statistically reliable state-specific data stratified by race and ethnicity, it is necessary to combine years. For this report, five years (2014-2018) of linked birth/infant deaths were combined to obtain statistically reliable data for stratification on characteristic variables.

For Kansas, between 2014 and 2018, there were 1,147 resident infant deaths reported to KDHE (Table E). Of those, 1,136 (99.0%) were linked to a birth certificate.*

Table E. Percent of Infant Deaths Linked to Birth Records,* Kansas, 2014-2018

	Total Infant Deaths	Linked Infant Deaths	
Year	Number	Number	Percent
2014	246	246	100.0
2015	230	228	99.1
2016	223	221	99.1
2017	217	214	98.6
2018	231	227	98.3
Totals	1147	1136	99.0

* Note: Previous iterations of *Selected Special Statistics: Stillbirths and Infant Deaths* indicated that all 230 infant deaths in 2015 were linked to a birth certificate. However, only 228 infant deaths were actually linked. The two unlinked deaths have not been included in this report.

This method of linking the infant death and their birth records is valuable for exploring the various relationships of the infant deaths with factors surrounding birth and with mother's risk factors. The death file contains age at death and underlying cause. The birth file contains birth weight, gestational age, and information on the mother such as age, marital status, educational level, and maternal risk factors such as tobacco use.

Note on Transition to the 2003 Birth Certificate

Data for 2005 and years following are based on Kansas implementation of the 2003 revision of the U.S. Standard Certificates of Live Birth, Death, and Stillbirth. Data for prior years is based on the 1989 revision of the U.S. Standard Certificate of Live Birth, Death, and Stillbirth. Data analysis involving the 2005 Kansas Certificate of Live Birth is affected in several ways:

- Changes in both question wording and sources for the information collected make it inappropriate to evaluate trends across 2004 and 2005 in some variables such as month prenatal care began and education level
- Calculating Month Prenatal Care Began – prior to 2005 – the mother was asked for the month prenatal care began. Starting in 2005, the dates used to calculate the month pre-natal care began included the first day of the last menses before pregnancy and the date of the first prenatal visit. This change makes rates calculated after 2004 incompatible with earlier years. Such comparisons are inappropriate.
- KDHE publishes data on resident births and deaths. If the event occurs out of state and the state is not using the 2003 revision of the birth certificate, missing data may result. This is an important factor in border counties.
- KDHE excludes unknowns from the denominator for all calculations that result in percentage rates involving birth data. Other states may choose to include unknowns in the denominator. The Kansas method provides a more accurate representation of the rates.
- The 2003 revision process resulted in recommendations that the prenatal care information be gathered from the prenatal care or medical records, whereas the 1989 revision did not recommend a source for these data. In the case of premature births, sometimes these records aren't available when the infant is delivered.
- Infant mortality rates reported by NCHS may vary slightly from rates reported by KDHE. NCHS rates are based on data reported to it by all states. Some of those out-of-state occurrence infant deaths may not be reported to KDHE in time for inclusion in the respective year's Annual Summary of Vital Statistics or subsequent reports.
- Percentages may not add to 100 percent due to rounding.

Notes on Specific Variables & Terms

Infant Age at Death

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

Gestational Age

The obstetric estimate of gestational age was coded in weeks. Consistent with NCHS practice, for infants, any gestational age outside of 17-47 weeks was recoded as unknown.[20,25] Preterm births were those of less than 37 weeks. Early term births were considered as those at 37-38 weeks.

Only stillbirths of at least 20 weeks gestation were included in this report, consistent with the change in fetal death reporting requirements in Kansas, which occurred in mid-2014. Stillbirths of unknown gestational age were excluded from this report.

Perinatal Mortality

Consistent with NCHS practice, in this report, a perinatal death was defined as a death occurring to an infant fewer than 7 days old, or to a fetus of at least 28 weeks gestation.[20,26] This differs from the definition used in the *Annual Summary of Vital Statistics, 2018*.[18]

Cause of Death

The cause of death referred to in this report is the primary or underlying cause of death. It is defined as the disease or injury which initiated the chain of events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury. The underlying causes of death are established through a system known as the International Statistical Classification of Diseases and Related Health Problems,10th Revision (ICD 10).[27] This system promotes uniformity and comparability in the collection and presentation of mortality data.

Causes of death were ranked according to the *NCHS Instruction Manual, Part 9*, *ICD-10 Cause-of-Death Lists for Tabulating Mortality Statistics, Effective 1999*.[28] The List of 130 Selected Causes of Infant Death was used for infant deaths, and the List of 124 Selected Causes of Fetal Death was used for stillbirths. There is one exception. In this report, when ranking leading causes of infant death, Sudden Infant Death Syndrome (SIDS) deaths (ICD-10 code R95) are combined with accidental suffocation and strangulation in bed (ICD-10 code W75) and unknown cause (ICD-10 code R99). This combination is known as Sudden Unexpected Infant Death (SUID).[20,29]

Population Groups

This report uses the concept of reporting race and Hispanic origin combined into distinct categories of population groups. This was done to preserve the self-reported information on race and origin reported in the expanded categories. The use of population groups assures a better uniformity of the numerators and denominators in rate calculations. Because of different tabulation methods, totals for population groups may not equal those tabulated by either race or Hispanic origin individually. Rates calculated exclusively on Hispanic origin treat unknowns differently. The aggregation grid for population groups is listed on page 12 of the *Annual Summary of Vital Statistics*, 2018.[18] Application of this grid assures that every combination of race and origin is assigned to a population group. In instances where the Hispanic origin of an individual is unknown, the person is assigned to a population group solely on the basis of race and is considered Non-Hispanic.

In the death certificate statistics (unlinked data) of this document, the population groups are classified using the race/ethnicity of the decedent as reported on the death certificate. The funeral director supplies this information, which is provided by an informant such as a family member.

In the linked birth/infant death statistics, the population groups are classified using the race/ethnicity reported on the birth certificate for the mother. For more information on the population groups, see the Technical Notes in the *Annual Summary of Vital Statistics*, 2018.[18]

Mother's Age

In this report, maternal age values outside the range of 10-64 years were recoded as unknown.

Body-mass Index

Body-mass index was calculated using the mother's height and pre-pregnancy weight. Only values within the range of 13.0-69.9 were included. All other values were considered unknown.

County Peer Group and Urban-Rural Classifications

The county of residence was determined from the Federal Information Processing Standards (FIPS) code for each Kansas county. Beginning in 2011, events with unknown county FIPS codes are included in that year's total counts. Prior to 2011, they were excluded.

For various demographic studies, it is useful to consider groups of counties with similar characteristics. "Peer Groups" of counties, as used in this summary, are defined as those with similar population density based on a method derived by the KDHE Bureau of Community Health Systems (Table E). The peer county grouping system should not be confused with other definitions of urban and rural areas. The KDHE Bureau of Epidemiology and Public Health Informatics applies these definitions, updating the groups with every decennial census. Based on the 2010 U.S. Census, eight Kansas counties changed peer groups. In order to facilitate a time series comparison, Peer-Group statistics for prior years are based on the Peer-Group in effect during that decade. Sources for calculation of population densities are population figures from the 2010 U.S. Census and land areas from the 2010 U.S. Census.

In addition to peer groups, this report utilizes an urban-rural classification scheme developed by the National Center for Health Statistics (NCHS) in 2013.[30] Table F describes the definition for each classification system. The Appendix lists each Kansas county by its peer groups based on the 2000 and 2010 Census, respectively, as well as its NCHS 2013 urban-rural category.

Table F. Urban-Rural Classification Scheme, Based on the Kansas County Peer Groups

Kansas County Peer Groups	
Category	Description
Frontier	<6.0 persons per square mile
Rural	6.0-19.9 persons per square mile
Densely-Settled Rural	20.0-39.9 persons per square mile
Semi-Urban	40.0-149.9 persons per square mile
Urban	150.0+ persons per square mile

Table G. 2013 Urban-Rural Classification Scheme by the National Center for Health Statistics

NCHS 2013 Urban-Rural Classification Scheme[30]	
Category	Description
Rural	
Noncore	Nonmetropolitan counties that did not qualify as a micropolitan
Micropolitan	Counties in micropolitan statistical areas
Urban	
Small metro	Counties in metropolitan statistical areas of populations less than 250,000.
Medium metro	Counties in metropolitan statistical areas of populations of 250,000 to 999,999.
Large fringe metro	Counties in metropolitan statistical areas of 1 million or more population that did not qualify as large central metro counties.
Large central metro*	Counties in metropolitan statistical areas of 1 million or more population that: • contain the entire population of the largest main city of the metropolitan statistical area, or • whose entire population is within the largest main city of the metropolitan statistical area, or • contain at least 250,000 residents of any main city of the metropolitan statistical area.

* Note: As of 2013, no Kansas counties qualified for the large central metro category.

LIMITATIONS

This report's findings are subject to several limitations. An important concern is the issue of receiving vital events from other states within the KDHE reporting deadline. Vital statistics are gathered on an occurrence basis but are traditionally reported on a residence basis. For complete residence statistics, reports must be received from other states for events occurring to Kansas residents. Delays or other late reporting may result in some out-of-state vital events not being received by KDHE by the cutoff date of June 30 of the year following the event year. Past evaluations indicate that over 99 percent of all vital events to Kansas residents are received before the cutoff date.

Evaluation of the linked birth/infant death cohort is subject to limitations due to the inability to link all deaths to a corresponding birth report. This inability may be due to a number of reasons related to receipt of the corresponding record from another state, name differences between the two reports, both events not occurring in Kansas, or residency changes.

Additionally, comparison of Kansas linked data to other state or national data has limitations due to the timeliness of the national reports as well as differences in methodology. As mentioned earlier, out-of-state births may not be available to match infant deaths at the state level, but are available for matching at the national level.

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

A weakness in relation to stillbirth reporting is that the causes of stillbirths are not as well documented as those of infant deaths. Additionally, since KSA 65-2401 was revised in mid-2014 to change the stillbirth reporting requirements from weight of the fetus (>350 grams) to length of gestation (≥ 20 weeks), vital records data for this year may not represent a consistent picture of all stillbirths.[19]

In general, the accuracy of the information presented in this report depends on the quality of the birth and death certificate information that was reported to KDHE. Some characteristics of the mother and delivery, such as smoking status, may be underreported, which may affect their reliability.

The analysis of risk factors that was performed in this report was intended only as a preliminary step toward assessing risk factors and causality for infant mortality. A more detailed analysis would be needed to investigate the extent to which each of these factors influences the risk for infant mortaility.

Finally, due to small sample size and unreliability of estimates, this report did not deeply explore trends in infant mortality among the Non-Hispanic Native American/Alaskan Native, Asian/Pacific Islander, other race, and multiracial populations.

REFERENCES

1. Ely DM, Driscoll AK. Infant mortality in the United States, 2017: Data from the period linked birth/infant death file. *Natl Vital Stat Rep*. 2019;68(10).

2. Reidpath D, Allotey P. Infant mortality rate as an indicator of population health. *J. Epidemiol Com-munity Health*. 2003; 57:344-346.

3. Infant Mortality. Centers for Disease Control and Prevention. https://www.cdc.gov/reproductivehealth/maternalinfanthealth/infantmortality.htm. Published March 27, 2019. Accessed June 18, 2020.

4. FAQ: Reducing Risks of Birth Defects. American College of Obstetricians and Gynecologists. https://www.acog.org/Patients/FAQs/Reducing-Risks-of-Birth-Defects. Updated October 2019. Ac-cessed June 18, 2020.

5. FAQ: Preterm Labor and Birth. American College of Obstetricians and Gynecologists. https://www.acog.org/Patients/FAQs/Preterm-Labor-and-Birth. Published January 2019. Accessed June 18, 2020.

6. Premature Birth. Centers for Disease Control and Prevention. https://www.cdc.gov/reproductivehealth/features/premature-birth/index.html. Updated October 17, 2019. Accessed June 18, 2020.

7. Pregnancy Complications. Centers for Disease Control and Prevention. https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-complications.html. Updated October 2018. Accessed June 18, 2020.

8. Safe Infant Sleep Basics: Known Risk Factors for SIDS and Other Sleep-Related Causes of Infant Death. National Institutes of Health, Eunice Kennedy Shriver National Institute of Child Health and Human Development. https://safetosleep.nichd.nih.gov/safesleepbasics/risk/factors. Accessed June 18, 2020.

9. Moon RY, Task Force on Sudden Infant Death Syndrome. SIDS and other sleep-related infant deaths: Evidence base for 2016 updated recommendations for a safe infant sleeping environment. *Pediatrics*. 2016;138(5). doi: https://doi.org/10.1542/peds.2016-2940

10. Kilpatrick SJ, Papile L, Macones GA, Watterberg KL, eds. Guidelines for Perinatal Care. 8th ed. Elk Grove Village, IL: American Academy of Pediatrics, 2017.

11. Stress and Pregnancy. March of Dimes. https://www.marchofdimes.org/materials/Maternal-Stress-Issue-Brief-January2015.pdf.Access June 29, 2020

12. Committee on Underserved Women; Committee on Obstetric Practice. Committee Opinion No. 721: Smoking Cessation During Pregnancy. *Obstet Gynecol.* 2017;130(4):e200–e204. doi:10.1097/AOG.0000000000002353

13. England LJ, Kendrick JS, Wilson HG, Merritt RK, Gargiullo PM, Zahniser SC. Effects of smoking reduction during pregnancy on the birth weight of term infants. *Am J Epidemiol*. 2001;154:694–701. doi: https://doi.org/10.1093/aje/154.8.694

14. FAQ: Breastfeeding Your Baby. American College of Obstetricians and Gynecologists. https://www.acog.org/Patients/FAQs/Breastfeeding-Your-Baby. Updated March 2019. Accessed June 18, 2020.

15. Hauck FR, Thompson JMD, Tanabe KO, Moon RY, Vennemann MM. Breastfeeding and reduced risk of sudden infant death syndrome: a meta-analysis. *Pediatrics*. 2011;128:103-110. doi:10.1542/peds.2010-3000

16. 2020 Topics & Objectives: Maternal, Infant, and Child Health. Office of Disease Prevention and Health Promotion, Healthy People 2020. https://www.healthypeople.gov/2020/topics-objectives/topic/maternal-infant-and-child-health/objectives. Accessed June 18, 2020.

17. Xu JQ, Murphy SL, Kochanek KD, Arias E. Mortality in the United States, 2018. *NCHS Data Brief*. 2020;(355):1-8.

18. Oakley D, Crawford G, Savage C. Kansas Annual Summary of Vital Statistics, 2018. Kansas Department of Health and Environment. 2019 [cited 2020 Jun 18].

19. Kansas Statutes: Chapter 65: Public Health. Article 24: Uniform Vital Statistics Act. Kansas Legislature. http://www.kslegislature.org/li/b2019_20/statute/065_000_0000_chapter/065_024_0000_article/065_024_0001_section/065_024_0001_k/. Accessed June 18, 2020.

20. Federally Available Data (FAD) Resource Document. Health Resources and Services Administration, Maternal & Child Health Bureau. https://mchb.tvisdata.hrsa.gov/Home/Resources. Updated April 1, 2019. Accessed June 18, 2020.

21. Perinatal Periods of Risk (PPOR). CityMatCH. https://www.citymatch.org/perinatal-periods-of-risk-ppor. Updated March 14, 2017. Accessed June 18, 2020.

22. User Guide to the 2017 Period Linked Birth/Infant Death Public Use File. Centers for Disease Control and Prevention. https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm. Accessed June 18, 2020.

23. Joinpoint Regression Program. National Cancer Institute. https://surveillance.cancer.gov/joinpoint. Updated January 2, 2020. Accessed June 18, 2020.

24. Average Annual Percent Change (AAPC) and Confidence Interval. National Cancer Institute. https://surveillance.cancer.gov/help/joinpoint/setting-parameters/method-and-parameters-tab/apc-aapc-tau-confidence-intervals/average-annual-percent-change-aapc. Accessed June 18, 2020.

25. User Guide to the 2018 Natality Public Use File. Centers for Disease Control and Prevention. https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm. Accessed June 18, 2020.

26. Gregory ECW, Drake P, Martin JA. Lack of change in perinatal mortality in the United States, 2014-2016. NCHS Data Brief. 2018;(316).

27. International Statistical Classification of Diseases and Related Health Problems. Tenth Revision. World Health Organization, Geneva 1992.

28. Instruction Manuals. Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. https://www.cdc.gov/nchs/nvss/instruction_manuals.htm. Up-dated September 2018. Accessed June 18, 2020.

29. Sudden Unexpected Infant Death and Sudden Infant Death Syndrome: Data and Statistics. Centers for Disease Control and Prevention. https://www.cdc.gov/sids/data.htm. Updated September 13, 2019. Accessed June 18, 2020.

30. Ingram DD, Franco SJ. 2013 NCHS urban-rural classification scheme for counties. *Vital Health Stat*. 2014;2(166).

DETAILED TABLES

Table 1
Births, Stillbirths, Perinatal Deaths, and Infant Deaths by Year and Period of Death
Kansas, 1999-2018

Year	Total * Deliveries	Live Births	Stillbirth at ≥20 weeks	Stillbirth at ≥28 Weeks	Hebdomadal † Deaths	Perinatal ‡ Deaths	Neonatal § Deaths	Postneonatal ¶ Deaths	Infant # Deaths
1999	38,915	38,748	167	107	159	266	189	92	281
2000	39,824	39,654	170	112	146	258	174	92	266
2001	39,028	38,832	196	123	148	271	178	107	285
2002	39,475	39,338	137	89	155	244	192	90	282
2003	39,551	39,353	198	117	138	255	177	85	262
2004	39,728	39,553	175	109	144	253	176	108	284
2005	39,894	39,701	193	129	153	282	196	101	297
2006	41,076	40,896	180	126	137	263	176	117	293
2007	42,134	41,951	183	121	163	284	211	122	333
2008	41,993	41,815	178	116	160	276	193	110	303
2009	41,596	41,388	208	126	144	270	176	114	290
2010	40,603	40,439	164	106	143	249	170	83	253
2011	39,811	39,628	183	112	121	233	157	90	247
2012	40,498	40,304	194	136	142	278	173	81	254
2013	38,977	38,805	172	113	140	253	166	82	248
2014	39,391	39,193	198	103	138	241	175	71	246
2015	39,357	39,126	231	102	132	234	160	70	230
2016	38,298	38,048	250	138	119	257	145	78	223
2017	36,647	36,464	183	89	128	217	154	63	217
2018	36,464	36,268	196	88	136	224	162	69	231

*Total Deliveries = Live births + Stillbirths at ≥20 weeks.

†Hebdomadal Deaths = Deaths at less than 7 days of age.

‡Perinatal Deaths = Stillbirths at ≥28 weeks + Hebdomadal deaths.

§Neonatal Deaths = Deaths at less than 28 days of age.

¶Postneonatal Deaths = Deaths between 28 days and 1 year of age.

#Infant Deaths = Deaths under 1 year of age.

Residence data

Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment

Table 2
Stillbirth, Perinatal, and Infant Mortality Rates by Period of Death
Kansas, 1999-2018

Year	Stillbirth*	Hebdomadal Deaths‡	Perinatal Deaths†	Neonatal Deaths‡		Postneonatal Deaths‡	Infant Deaths‡	
				KS	US		KS	US
1999	4.3	4.1	6.8	4.9	4.7	2.4	7.3	7.1
2000	4.3	3.7	6.5	4.4	4.6	2.3	6.7	6.9
2001	5.0	3.8	7.0	4.6	4.5	2.8	7.3	6.9
2002	3.5	3.9	6.2	4.9	4.7	2.3	7.2	7.0
2003	5.0	3.5	6.5	4.5	4.6	2.2	6.7	6.9
2004	4.4	3.6	6.4	4.4	4.5	2.7	7.2	6.8
2005	4.8	3.9	7.1	4.9	4.5	2.5	7.5	6.9
2006	4.4	3.3	6.4	4.3	4.5	2.9	7.2	6.7
2007	4.3	3.9	6.8	5.0	4.4	2.9	7.9	6.8
2008	4.2	3.8	6.6	4.6	4.3	2.6	7.2	6.6
2009	5.0	3.5	6.5	4.3	4.2	2.8	7.0	6.4
2010	4.0	3.5	6.1	4.2	4.1	2.1	6.3	6.2
2011	4.6	3.1	5.9	4.0	4.1	2.3	6.2	6.1
2012	4.8	3.5	6.9	4.3	4.0	2.0	6.3	6.0
2013	4.4	3.6	6.5	4.3	4.0	2.1	6.4	6.0
2014	5.0	3.5	6.1	4.5	3.9	1.8	6.3	5.8
2015	5.9	3.4	6.0	4.1	3.9	1.8	5.9	5.9
2016	6.5	3.1	6.7	3.8	3.9	2.1	5.9	5.9
2017	5.0	3.5	5.9	4.2	3.8	1.7	6.0	5.8
2018	5.4	3.7	6.2	4.5	n.a.	1.9	6.4	5.7

*Per 1,000 (live births + stillbirths).

†Per 1,000 (live births + stillbirths at ≥28 weeks).

‡Per 1,000 live births.

n.a. = US final death data for 2018 are not yet available

Residence data

Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment

Table 3
Infant Deaths and Mortality Rates*
By Selected Population Group of Mother§
Kansas, 1999-2018

Year	White Non-Hispanic†			Black Non-Hispanic†			Black NH‡ to White NH‡ Ratio of Rates	Hispanic Any Race			Total Infant Mortality Rate
	Live Births	Infant Deaths	Rate	Live Births	Infant Deaths	Rate		Live Births	Infant Deaths	Rate	
1999	30,362	215	7.1	2,815	42	14.9	2.1	4,204	15	3.6	7.3
2000	30,538	192	6.3	2,822	33	11.7	1.9	4,742	32	6.7	6.7
2001	29,703	190	6.4	2,745	54	19.7	3.1	4,875	36	7.4	7.3
2002	29,811	187	6.3	2,845	44	15.5	2.5	5,006	40	8.0	7.2
2003	29,482	172	5.8	2,730	40	14.7	2.5	5,417	45	8.3	6.7
2004	29,624	200	6.8	2,782	46	16.5	2.4	5,458	28	5.1	7.2
2005	28,903	181	6.3	2,670	45	16.9	2.7	6,073	52	8.6	7.5
2006	29,392	181	6.2	2,801	49	17.5	2.8	6,568	41	6.2	7.2
2007	30,170	205	6.8	2,856	56	19.6	2.9	6,676	56	8.4	7.9
2008	29,863	184	6.2	2,936	39	13.3	2.2	6,781	57	8.4	7.2
2009	29,471	178	6.0	2,830	44	15.5	2.6	6,790	40	5.9	7.0
2010	29,000	142	4.9	2,780	33	11.9	2.4	6,407	50	7.8	6.3
2011	28,382	150	5.3	2,708	35	12.9	2.4	6,293	42	6.7	6.2
2012	28,995	145	5.0	2,682	38	14.2	2.8	6,286	54	8.6	6.3
2013	27,821	137	4.9	2,549	39	15.3	3.1	6,139	44	7.2	6.4
2014	28,009	146	5.2	2,629	29	11.0	2.1	6,129	40	6.5	6.3
2015	27,717	130	4.7	2,585	27	10.4	2.1	6,290	48	7.6	5.9
2016	26,786	139	5.2	2,494	38	15.2	2.2	6,300	32	5.1	5.9
2017	25,431	120	4.7	2,463	29	11.8	2.5	5,945	43	7.2	6.0
2018	25,196	122	4.8	2,499	25	10.0	2.1	5,976	54	9.0	6.4

* Rate per 1,000 live births.

† Due to changes in the collection of the race item on certificates, use caution when comparing 2005-2018 data to prior years. See Technical Notes.

‡ NH = non-Hispanic, population group includes unknown Hispanic origin.

§ Other non-Hispanic data is not included in this table due to small numbers but is available upon request.

Residence data

Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment

Table 4
Infant Deaths and Mortality Rates by County of Residence
Peer Group, and Urban-Rural Classification*
Kansas, 2014-2018

County of Residence						Total Infant Deaths	Total Live Births	Infant Mortality Rate†	95% Confidence Intervals	
	2014	2015	2016	2017	2018	2014-2018	2014-2018	2014-2018	Lower	Upper
Kansas	246	230	223	217	231	1,147	189,099	6.1	5.7	6.4
Allen	1	1	0	0	4	6	737	8.1 ‡	3.0	17.7
Anderson	1	1	0	1	1	4	508	na	na	na
Atchison	0	2	1	0	0	3	975	na	na	na
Barber	0	0	0	2	1	3	288	na	na	na
Barton	3	3	0	0	1	7	1,638	4.3 ‡	1.7	8.8
Bourbon	0	2	1	2	0	5	1,015	4.9 ‡	1.6	11.5
Brown	1	0	1	4	0	6	624	9.6 ‡	3.5	20.9
Butler	9	8	3	6	5	31	3,713	8.3	5.7	11.9
Chase	0	0	0	0	0	0	129	0.0	0.0	0.0
Chautauqua	0	0	0	0	0	0	167	0.0	0.0	0.0
Cherokee	0	0	0	0	2	2	1,152	na	na	na
Cheyenne	0	0	0	0	0	0	159	0.0	0.0	0.0
Clark	1	0	0	0	1	2	113	na	na	na
Clay	0	3	2	0	0	5	495	10.1 ‡	3.3	23.6
Cloud	0	0	1	3	1	5	533	9.4 ‡	3.0	21.9
Coffey	0	0	0	0	0	0	425	0.0	0.0	0.0
Comanche	0	1	1	0	0	2	90	na	na	na
Cowley	2	2	0	5	2	11	2,099	5.2 ‡	2.6	9.4
Crawford	1	1	4	4	1	11	2,428	4.5 ‡	2.3	8.1
Decatur	0	0	0	0	0	0	164	0.0	0.0	0.0
Dickinson	2	1	2	3	1	9	1,074	8.4 ‡	3.8	15.9
Doniphan	0	1	0	1	1	3	393	na	na	na
Douglas	7	6	8	11	6	38	5,968	6.4	4.5	8.7
Edwards	0	0	0	0	1	1	153	na	na	na
Elk	0	0	2	0	0	2	137	na	na	na
Ellis	3	4	3	1	1	12	1,670	7.2	3.7	12.6
Ellsworth	0	0	0	0	0	0	294	0.0	0.0	0.0
Finney	3	7	2	3	4	19	3,316	5.7	3.4	8.9
Ford	4	9	3	1	5	22	3,123	7.0	4.4	10.7
Franklin	5	2	2	1	0	10	1,538	6.5 ‡	3.1	12.0
Geary	7	8	3	5	6	29	4,963	5.8	3.9	8.4
Gove	0	0	1	0	0	1	188	na	na	na
Graham	1	0	0	1	0	2	110	na	na	na
Grant	0	1	0	0	2	3	615	na	na	na
Gray	0	1	0	0	0	1	414	na	na	na
Greeley	0	0	0	0	0	0	89	0.0	0.0	0.0
Greenwood	0	1	0	1	1	3	313	na	na	na
Hamilton	0	0	1	1	0	2	176	na	na	na
Harper	3	0	0	1	1	5	364	13.7 ‡	4.5	32.1
Harvey	3	3	4	3	5	18	1,969	9.1	5.4	14.4
Haskell	0	0	1	1	0	2	273	na	na	na
Hodgeman	0	1	1	0	0	2	93	na	na	na
Jackson	1	3	3	1	1	9	861	10.5 ‡	4.8	19.8
Jefferson	1	3	0	2	0	6	929	6.5 ‡	2.4	14.1
Jewell	0	0	1	0	0	1	155	na	na	na
Johnson	34	35	26	25	27	147	36,612	4.0	3.4	4.7
Kearny	0	1	0	0	1	2	316	na	na	na
Kingman	0	0	0	1	0	1	385	na	na	na
Kiowa	0	0	0	0	0	0	176	0.0	0.0	0.0
Labette	2	2	4	1	0	9	1,342	6.7 ‡	3.1	12.7
Lane	0	0	0	0	0	0	82	0.0	0.0	0.0
Leavenworth	5	5	6	11	6	33	4,955	6.7	4.6	9.4
Lincoln	0	1	0	0	0	1	151	na	na	na
Linn	1	2	1	0	1	5	516	9.7 ‡	3.1	22.6
Logan	0	0	0	0	0	0	220	0.0	0.0	0.0

Table 4
Infant Deaths and Mortality Rates by County of Residence
Peer Group, and Urban-Rural Classification*
Kansas, 2014-2018

County of Residence	2014	2015	2016	2017	2018	Total Infant Deaths 2014-2018	Total Live Births 2014-2018	Infant Mortality Rate† 2014-2018	95% Confidence Intervals Lower	95% Confidence Intervals Upper
Lyon	3	2	2	2	6	15	2,038	7.4	4.1	12.1
McPherson	2	2	1	1	1	7	1,613	4.3 ‡	1.7	8.9
Marion	0	1	1	0	0	2	582	na	na	na
Marshall	1	0	1	1	1	4	611	na	na	na
Meade	0	0	1	0	1	2	278	na	na	na
Miami	4	0	2	1	1	8	1,867	4.3 ‡	1.8	8.4
Mitchell	1	0	0	1	0	2	402	na	na	na
Montgomery	3	4	4	3	0	14	1,998	7.0	3.8	11.8
Morris	2	0	0	0	0	2	315	na	na	na
Morton	0	0	0	0	2	2	161	na	na	na
Nemaha	2	1	1	0	1	5	742	6.7 ‡	2.2	15.7
Neosho	3	0	0	1	3	7	983	7.1 ‡	2.9	14.7
Ness	0	0	0	1	0	1	158	na	na	na
Norton	0	0	1	0	1	2	290	na	na	na
Osage	2	1	2	3	0	8	852	9.4 ‡	4.1	18.5
Osborne	1	0	0	0	0	1	222	na	na	na
Ottawa	0	0	0	0	0	0	278	0.0	0.0	0.0
Pawnee	0	2	0	0	1	3	328	na	na	na
Phillips	1	0	0	0	0	1	302	na	na	na
Pottawatomie	2	1	1	2	0	6	1,839	3.3 ‡	1.2	7.1
Pratt	4	0	0	0	4	8	635	12.6 ‡	5.4	24.8
Rawlins	0	0	0	0	0	0	164	0.0	0.0	0.0
Reno	6	4	4	5	2	21	3,438	6.1	3.8	9.3
Republic	1	0	1	0	0	2	248	na	na	na
Rice	4	0	0	2	0	6	584	10.3 ‡	3.8	22.4
Riley	7	3	5	3	10	28	4,844	5.8	3.8	8.4
Rooks	1	0	0	0	0	1	304	na	na	na
Rush	0	0	1	0	0	1	152	na	na	na
Russell	1	0	0	0	0	1	394	na	na	na
Saline	1	1	4	7	6	19	3,484	5.5	3.3	8.5
Scott	0	0	0	0	0	0	311	0.0	0.0	0.0
Sedgwick	43	41	60	44	57	245	35,590	6.9	6.0	7.7
Seward	5	3	2	1	2	13	2,101	6.2	3.3	10.6
Shawnee	12	18	21	22	16	89	10,985	8.1	6.5	10.0
Sheridan	0	0	0	0	0	0	138	0.0	0.0	0.0
Sherman	1	0	0	0	0	1	377	na	na	na
Smith	0	0	0	0	1	1	191	na	na	na
Stafford	0	0	0	0	0	0	260	0.0	0.0	0.0
Stanton	0	0	0	0	0	0	139	0.0	0.0	0.0
Stevens	0	0	0	0	0	0	359	0.0	0.0	0.0
Sumner	2	2	0	1	3	8	1,317	6.1 ‡	2.6	12.0
Thomas	2	1	2	0	0	5	583	8.6 ‡	2.8	20.0
Trego	1	0	0	0	0	1	168	na	na	na
Wabaunsee	0	0	0	0	0	0	376	0.0	0.0	0.0
Wallace	1	0	0	0	0	1	111	na	na	na
Washington	0	1	1	1	0	3	372	na	na	na
Wichita	0	0	0	0	0	0	121	0.0	0.0	0.0
Wilson	1	0	0	0	0	1	536	na	na	na
Woodson	0	0	0	0	0	0	162	0.0	0.0	0.0
Wyandotte	25	21	17	13	23	99	13,401	7.4	6.0	9.0
n.s.	0	0	0	0	0	0	10	0.0	0.0	0.0

Table 4
Infant Deaths and Mortality Rates by County of Residence
Peer Group, and Urban-Rural Classification*
Kansas, 2014-2018

County of Residence	2014	2015	2016	2017	2018	Total Infant Deaths 2014-2018	Total Live Births 2014-2018	Infant Mortality Rate† 2014-2018	95% Confidence Intervals Lower	95% Confidence Intervals Upper
Peer Group										
Frontier	7	5	9	6	9	36	6,413	5.6	3.9	7.8
Rural	26	14	14	16	14	84	13,856	6.1	4.8	7.5
Densely -Settled Rural	41	51	27	31	37	187	31,067	6.0	5.2	6.9
Semi-Urban	46	34	35	38	36	189	30,242	6.2	5.4	7.1
Urban	126	126	138	126	135	651	107,511	6.1	5.6	6.5
Urban-rural 6-level classification (NCHS)										
Noncore	38	20	25	27	31	141	23,359	6.0	5.0	7.0
Micropolitan	50	57	39	40	38	224	38,358	5.8	5.1	6.6
Small metro	32	36	40	45	34	187	27,047	6.9	5.9	7.9
Medium metro	57	54	67	55	70	303	42,974	7.1	6.3	7.8
Large fringe metro	69	63	52	50	58	292	57,351	5.1	4.5	5.7
Large central metro	0	0	0	0	0	0	0	0.0	0.0	0.0
Urban-rural 2-level classification (NCHS)										
Rural	88	77	64	67	69	365	61,717	5.9	5.3	6.5
Urban	158	153	159	150	162	782	127,372	6.1	5.7	6.6

*See Technical Notes for Peer Group and Urban-Rural Classification definitions.
†Rate per 1,000 live births.
‡Rate has a relative standard error greater than 30%, should be used with caution since it doesn't meet the standard of reliability.
n.a. = Rates with an relative standard error greater than 50% have been suppressed.
Residence data
Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment

Table 5
Infant Deaths by Ten Leading Causes of Infant Death by Period of Death
Kansas, 2014-2018

Cause of Death	Age of Infant						
	Under 1 Day	1-6 Days	Hebdomadal Deaths (under 7 days)	7-27 Days	Neonatal Deaths (under 28 days)	Post-Neonatal Deaths (28 days to 1 year)	Under 1 Year
All causes	515	138	653	143	796	351	1,147
1. Congenital Malformations, Deformations, and Chromosomal Anomalies (Q00-Q99)	123	49	172	40	212	58	270
2. Sudden Unexpected Infant Death (R95, R99, W75)	5	5	10	18	28	180	208
3. Short Gestation and Low Birth Weight (P07)	197	6	203	1	204	1	205
4. Maternal Complications of Pregnancy (P01)	66	3	69	0	69	0	69
5. Complications of Placenta, Cord, and Membranes (P02)	39	4	43	2	45	0	45
6. Bacterial Sepsis of Newborn (P36)	5	7	12	15	27	0	27
7. Neonatal Hemorrhage (P50-P52, P54)	3	15	18	3	21	2	23
8. Accidents (Unintentional Injuries) (V01-X59, excluding W75)	1	0	1	4	5	15	20
9. Diseases of the Circulatory System (I00-I99)	1	1	2	3	5	14	19
10. Assault (Homicide) (U01, X85-Y09)	0	0	0	2	2	16	18

Residence data

Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment

Table 6
Infant Deaths by County of Residence
and Period of Death, Kansas, 2014-2018

County of Residence	Hebdomadal Deaths (under 7 days)	Neonatal Deaths (Under 28 days)	Post-Neonatal Deaths (28-364 days)	Total Infant Deaths (under 1 year)
Kansas	653	796	351	1,147
Allen	3	3	3	6
Anderson	3	3	1	4
Atchison	1	2	1	3
Barber	2	3	0	3
Barton	5	6	1	7
Bourbon	3	3	2	5
Brown	6	6	0	6
Butler	13	19	12	31
Chase	0	0	0	0
Chautauqua	0	0	0	0
Cherokee	0	1	1	2
Cheyenne	0	0	0	0
Clark	1	1	1	2
Clay	3	3	2	5
Cloud	3	3	2	5
Coffey	0	0	0	0
Comanche	0	0	2	2
Cowley	6	8	3	11
Crawford	9	10	1	11
Decatur	0	0	0	0
Dickinson	7	8	1	9
Doniphan	2	2	1	3
Douglas	18	22	16	38
Edwards	0	0	1	1
Elk	0	0	2	2
Ellis	9	11	1	12
Ellsworth	0	0	0	0
Finney	10	11	8	19
Ford	13	16	6	22
Franklin	6	7	3	10
Geary	24	26	3	29
Gove	1	1	0	1
Graham	1	2	0	2
Grant	2	2	1	3
Gray	0	0	1	1
Greeley	0	0	0	0
Greenwood	2	2	1	3
Hamilton	2	2	0	2
Harper	3	4	1	5
Harvey	8	9	9	18
Haskell	0	1	1	2
Hodgeman	1	1	1	2
Jackson	4	6	3	9
Jefferson	3	5	1	6
Jewell	1	1	0	1
Johnson	90	106	41	147
Kearny	2	2	0	2
Kingman	0	0	1	1
Kiowa	0	0	0	0
Labette	4	7	2	9
Lane	0	0	0	0
Leavenworth	12	18	15	33
Lincoln	1	1	0	1
Linn	3	3	2	5
Logan	0	0	0	0

Table 6
Infant Deaths by County of Residence
and Period of Death, Kansas, 2014-2018

County of Residence	Hebdomadal Deaths (under 7 days)	Neonatal Deaths (Under 28 days)	Post-Neonatal Deaths (28-364 days)	Total Infant Deaths (under 1 year)
Lyon	9	10	5	15
McPherson	3	4	3	7
Marion	0	0	2	2
Marshall	3	3	1	4
Meade	2	2	0	2
Miami	4	6	2	8
Mitchell	2	2	0	2
Montgomery	8	10	4	14
Morris	2	2	0	2
Morton	1	1	1	2
Nemaha	3	4	1	5
Neosho	3	3	4	7
Ness	1	1	0	1
Norton	2	2	0	2
Osage	2	3	5	8
Osborne	1	1	0	1
Ottawa	0	0	0	0
Pawnee	2	2	1	3
Phillips	1	1	0	1
Pottawatomie	4	5	1	6
Pratt	3	5	3	8
Rawlins	0	0	0	0
Reno	10	13	8	21
Republic	0	0	2	2
Rice	2	3	3	6
Riley	10	18	10	28
Rooks	0	0	1	1
Rush	1	1	0	1
Russell	0	0	1	1
Saline	14	14	5	19
Scott	0	0	0	0
Sedgwick	141	176	69	245
Seward	7	10	3	13
Shawnee	59	68	21	89
Sheridan	0	0	0	0
Sherman	1	1	0	1
Smith	1	1	0	1
Stafford	0	0	0	0
Stanton	0	0	0	0
Stevens	0	0	0	0
Sumner	6	6	2	8
Thomas	3	3	2	5
Trego	0	0	1	1
Wabaunsee	0	0	0	0
Wallace	1	1	0	1
Washington	2	2	1	3
Wichita	0	0	0	0
Wilson	0	0	1	1
Woodson.	0	0	0	0
Wyandotte	52	65	34	99

Residence data

Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment

Table 7
Stillbirths by Ten Leading Causes of Fetal Death and Weeks Gestation
Kansas, 2014-2018

Cause of Death (ICD-10 Code)	Total Stillbirths	Weeks Gestation			
		20-27	28-31	32-41	42-47
All Causes	1,058	538	135	381	4
1. Fetal death of unspecified cause (P95)	296	160	31	104	1
2. Fetus affected by complications of placenta, cord and membranes (P02)	284	110	44	129	1
3. Fetus affected by maternal complications of pregnancy (P01)	113	90	7	16	0
4. Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	109	53	18	38	0
5. Fetus affected by maternal conditions that may be unrelated to present pregnancy (P00)	100	47	15	37	1
6. Syndrome of infant of a diabetic mother and neonatal diabetes mellitus (P70.0-P70.2)	37	7	2	28	0
7. Disorders related to short gestation and low birth weight, not elsewhere classified (P07)	23	21	1	1	0
8. Hydrops fetalis not due to hemolytic disease (P83.2)	13	12	1	0	0
9. In situ neoplasms, benign neoplasms and neoplasms of uncertain or unknown behavior (D00-D48)	12	10	1	1	0
10. Fetus affected by noxious influences transmitted via placenta (P04)	11	3	1	7	0

Residence Data

Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment

Table 8
Linked Infant Deaths
by Ten Leading Causes of Infant Death and Weeks Gestation
Kansas, 2014-2018

	Total	Very Premature <32 weeks	Moderate Premature 32-33 weeks	Late Preterm 34-36 weeks	Total Preterm <37 weeks	Early Term 37-38 weeks	Term >=39 weeks	n.s.*
All causes	1,136	540	46	119	705	185	230	16
1. Congenital Malformations, Deformations, and Chromosomal Anomalies (Q00-Q99)	268	46	25	64	135	74	58	1
2. Short Gestation and Low Birth Weight (P07)	205	193	0	0	193	0	0	12
3. Sudden Unexpected Infant Death (R95, R99, W75)	204	7	9	21	37	70	97	0
4. Maternal Complications of Pregnancy (P01)	68	58	1	5	64	2	1	1
5. Complications of Placenta, Cord, and Membranes (P02)	45	39	1	0	40	2	2	1
6. Bacterial Sepsis of Newborn (P36)	25	22	0	0	22	0	3	0
7. Neonatal Hemorrhage (P50-P52, P54)	23	20	0	0	20	0	3	0
8. Accidents (Unintentional Injuries) (V01-X59, excluding W75)	20	2	0	3	5	3	12	0
9. Diseases of the Circulatory System (I00-I99)	19	4	0	4	8	3	8	0
10. Assault (Homicide) (U01, X85-Y09)	18	0	1	2	3	4	10	1

*n.s. = Unknown or not stated. Records with gestation outside of 17-47 weeks were classified as unknown.

Unknowns are excluded in calculating percents.

Residence data

Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment

Table 9
Linked Infant Deaths by Birth Characteristics
and Selected Population Groups of the Mother
Kansas, 2014-2018

Characteristics	All races and origins	White NH*	Black NH*	American Indian or Alaska Native NH*	Asian or Pacific Islander NH*	Multi Race NH*	Other NH*	Hispanic	Unknown
Total	1,136	728	144	8	27	30	9	186	4
Sex									
Female	498	339	59	3	9	14	4	68	2
Male	638	389	85	5	18	16	5	118	2
Plurality									
Single	992	625	121	7	27	26	9	174	3
Twin	138	98	23	1	-	4	-	11	1
Triplets or more	6	5	-	-	-	-	-	1	-
Plural	144	103	23	1	-	4	-	12	1
n.s.	-	-	-	-	-	-	-	-	-
Birth Order									
1	438	274	51	1	13	8	1	87	3
2	310	205	36	4	10	10	5	39	1
3	191	131	22	1	1	4	2	30	-
4	99	67	13	1	2	2	1	13	-
5 or more	98	51	22	1	1	6	-	17	-
n.s.	-	-	-	-	-	-	-	-	-
Birthweight									
Less than 2,500 grams	729	447	111	6	19	18	3	124	1
Less than 500 grams	269	148	60	2	10	6	1	42	-
500-1499 grams	287	188	32	1	8	5	-	53	-
1,500-2,499 grams	173	111	19	3	1	7	2	29	1
2,500 grams or more	402	278	33	2	8	12	6	62	1
n.s.	5	3	-	-	-	-	-	-	2
Gestational Age									
Premature (< 37 weeks)	705	435	111	3	20	13	5	117	1
Very Premature (< 32 wks)	540	326	92	2	17	10	1	92	-
Moderate Premature (32-33 wks)	46	31	4	-	1	2	1	7	-
Late Premature (34-36 wks)	119	78	15	1	2	1	3	18	1
Early Term (37-38 weeks)	185	117	15	3	2	10	2	36	-
Term (39-47 weeks)	230	168	17	1	4	7	2	30	1
n.s.	16	8	1	1	1	-	-	3	2
Mother's Age									
Under 20 years	93	42	10	-	-	4	-	37	-
20-24 years	282	168	38	1	6	9	1	56	3
25-29 years	381	253	59	2	9	7	5	46	-
30-34 years	244	182	25	3	7	5	-	22	-
35-39 years	105	65	9	2	4	3	3	19	-
40-64 years	30	18	3	-	1	2	-	6	-
n.s.	1	-	-	-	-	-	-	-	1
Marital Status									
Married	563	413	31	4	21	9	7	77	1
Unmarried	570	315	112	4	6	21	2	109	1
n.s.	3	-	1	-	-	-	-	-	2

Table 9
Linked Infant Deaths by Birth Characteristics
and Selected Population Groups of the Mother
Kansas, 2014-2018

Characteristics	All races and origins	White NH*	Black NH*	American Indian or Alaska Native NH*	Asian or Pacific Islander NH*	Multi Race NH*	Other NH*	Hispanic	Unknown
Payor									
Medicaid	488	288	96	2	5	17	2	78	-
Private Insurance	499	367	34	5	20	9	5	57	2
Self Pay	79	27	5	1	2	2	1	41	-
Indian Health Service	-	-	-	-	-	-	-	-	-
Tricare	49	32	7	-	-	2	1	7	-
Other Government	3	3	-	-	-	-	-	-	-
Other	5	5	-	-	-	-	-	-	-
n.s.	13	6	2	-	-	-	-	3	2
Mother's Education*									
8th Grade or Less	23	4	2	-	-	-	5	12	-
9-12 Grade, No Diploma	63	25	12	1	1	1	-	23	-
H.S. or GED	191	112	35	2	7	4	-	31	-
Some College, No Degree	167	116	28	2	2	3	1	15	-
Associate Degree	74	59	7	-	1	3	-	4	-
Bachelor's Degree	143	130	6	1	2	2	-	2	-
Master's Degree	70	51	4	1	6	4	1	3	-
Doctorate	13	10	-	-	2	-	-	1	-
n.s.	16	11	2	-	-	-	1	2	-
*Mothers Over 24 years	760	518	96	7	21	17	8	93	-
Prenatal Care									
None	53	20	13	2	2	3	-	12	1
Month 1	35	25	6	-	-	-	-	4	-
Month 2	435	299	52	2	10	11	1	60	-
Month 3	362	242	44	3	9	8	2	53	1
First Trimester	832	566	102	5	19	19	3	117	1
Month 4	101	54	13	1	3	6	2	22	-
Month 5	53	32	5	-	1	1	1	13	-
Month 6	30	19	3	-	-	-	2	6	-
Second Trimester	184	105	21	1	4	7	5	41	-
Month 7	17	10	1	-	-	-	-	6	-
Month 8	8	2	2	-	-	1	1	2	-
Month 9 & Higher	6	4	-	-	1	-	-	1	-
Third Trimester	31	16	3	-	1	1	1	9	-
n.s.	36	21	5	-	1	-	-	7	2
Adequecy of Prenatal Care									
Adequate Plus	528	348	67	4	12	13	3	81	-
Adequate	297	198	32	1	8	10	1	46	1
Intermediate	87	61	12	-	2	1	1	10	-
Inadequate	185	96	28	3	4	6	4	43	1
n.s.	39	25	5	-	1	-	-	6	2
Smoking During Pregnancy									
Ever Smoked During Pregnancy	215	172	20	1	-	9	-	13	-
Smoking Status Known	1,122	718	143	8	27	29	9	186	2

Table 9
Linked Infant Deaths by Birth Characteristics
and Selected Population Groups of the Mother
Kansas, 2014-2018

Characteristics	All races and origins	White NH*	Black NH*	American Indian or Alaska Native NH*	Asian or Pacific Islander NH*	Multi Race NH*	Other NH*	Hispanic	Unknown
Pre-pregnancy BMI									
Underweight	37	26	3	-	2	-	-	6	-
Normal weight	390	264	34	1	14	12	3	62	-
Overweight	283	178	39	5	5	10	3	43	-
Obese	396	246	61	2	5	7	3	70	2
n.s.	30	14	7	-	1	1	-	5	2

* NH = Non-Hispanic, population group includes unknown Hispanic origin.
Residence data
n.s. = not stated
Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment

Table 10
Live Births by Birth Characteristics
and Selected Population Groups of the Mother
Kansas, 2014-2018

Characteristics	All races and origins	White NH*	Black NH*	American Indian or Alaska Native NH*	Asian or Pacific Islander NH*	Multi Race NH*	Other NH*	Hispanic	Unknown
Total	189,099	133,139	12,670	912	6,112	4,009	1,485	30,640	132
Sex									
Female	92,123	64,772	6,181	450	3,033	1,950	712	14,951	74
Male	96,975	68,367	6,489	462	3,079	2,059	773	15,688	58
n.s.	1	-	-	-	-	-	-	1	-
Plurality									
Single	183,067	128,681	12,145	892	5,947	3,876	1,446	29,961	119
Twin	5,877	4,329	518	20	165	130	36	670	9
Triplets or more	151	129	7	-	-	3	3	9	-
Plural	6,028	4,458	525	20	165	133	39	679	9
n.s.	4	-	-	-	-	-	-	-	4
Birth Order									
1	67,016	48,366	4,384	276	2,588	1,663	497	9,195	47
2	59,587	43,438	3,515	252	2,231	1,155	502	8,461	33
3	35,196	24,322	2,344	175	831	682	296	6,524	22
4	16,278	10,523	1,264	104	276	284	124	3,691	12
5 or more	11,021	6,489	1,163	105	186	225	66	2,769	18
n.s.	1	1	-	-	-	-	-	-	-
Birthweight									
Less than 2,500 grams	13,498	8,748	1,697	51	504	350	123	2,012	13
Less than 500 grams	311	169	71	2	10	6	2	51	-
500-1499 grams	2,079	1,320	302	11	55	63	9	316	3
1,500-2,499 grams	11,108	7,259	1,324	38	439	281	112	1,645	10
2,500 grams or more	175,581	124,380	10,973	861	5,608	3,659	1,362	28,628	110
n.s.	20	11	-	-	-	-	-	-	9
Gestational Age									
Premature (< 37 weeks)	17,220	11,725	1,652	98	529	434	126	2,643	13
Very Premature (< 32 wks)	2,716	1,722	394	12	75	74	15	420	4
Moderate Premature (32-33 wks)	2,046	1,407	210	4	54	49	14	305	3
Late Premature (34-36 wks)	12,458	8,596	1,048	82	400	311	97	1,918	6
Early Term (37-38 weeks)	47,073	31,995	3,584	246	1,731	1,065	361	8,060	31
Term (39-45 weeks)	124,693	89,358	7,431	566	3,848	2,506	996	19,911	77
n.s.	113	61	3	2	4	4	2	26	11
Mother's Age									
Under 20 years	11,345	6,165	1,206	77	118	478	50	3,250	1
20-24 years	43,131	27,566	4,036	275	604	1,442	275	8,918	15
25-29 years	59,337	43,497	3,646	273	1,839	1,126	482	8,442	32
30-34 years	51,042	38,870	2,465	196	2,265	646	434	6,131	35
35-39 years	20,470	14,594	1,097	71	1,085	275	200	3,114	34
40-64 years	3,764	2,445	220	20	201	42	44	785	7
n.s.	10	2	-	-	-	-	-	-	8
Marital Status									
Married	120,770	93,404	3,866	350	5,319	1,691	1,271	14,776	93
Unmarried	68,269	39,706	8,802	562	791	2,316	214	15,846	32
n.s.	60	29	2	-	2	2	-	18	7

Table 10
Live Births by Birth Characteristics
and Selected Population Groups of the Mother
Kansas, 2014-2018

Characteristics	All races and origins	White NH*	Black NH*	American Indian or Alaska Native NH*	Asian or Pacific Islander NH*	Multi Race NH*	Other NH*	Hispanic	Unknown
Payor									
Medicaid	59,994	36,236	7,721	500	1,020	2,022	489	11,981	25
Private Insurance	103,933	84,554	3,389	262	4,287	1,416	629	9,337	59
Self Pay	12,622	4,173	522	21	393	115	263	7,114	21
Indian Health Service	122	31	-	61	-	17	1	12	-
Tricare	9,420	6,485	895	44	337	367	56	1,230	6
Other Government	1,188	710	62	12	33	36	11	324	-
Other	995	610	52	8	28	25	22	249	1
n.s.	825	340	29	4	14	11	14	393	20
Mother's Education*									
8th Grade or Less	4,188	822	188	3	194	15	191	2,774	1
9-12 Grade, No Diploma	7,661	2,909	641	60	187	130	89	3,641	4
H.S. or GED	22,478	13,702	2,118	142	709	441	197	5,163	6
Some College, No Degree	25,522	18,805	2,186	157	579	597	131	3,052	15
Associate Degree	14,241	11,482	769	78	328	246	72	1,263	3
Bachelor's Degree	39,936	34,640	970	85	1,689	447	293	1,788	24
Master's Degree	15,765	13,239	429	32	1,228	166	126	539	6
Doctorate	4,410	3,609	98	1	453	44	50	149	6
n.s.	412	198	29	2	23	3	11	103	43
*Mothers Over 24 years	134,613	99,406	7,428	560	5,390	2,089	1,160	18,472	108
Prenatal Care									
None	1,672	830	250	24	47	28	20	466	7
Month 1	5,008	3,496	321	15	154	98	45	872	7
Month 2	72,474	53,555	4,299	257	2,501	1,293	517	10,026	26
Month 3	74,462	54,845	4,426	349	2,232	1,617	496	10,452	45
First Trimester	151,944	111,896	9,046	621	4,887	3,008	1,058	21,350	78
Month 4	16,654	10,255	1,439	122	500	440	184	3,697	17
Month 5	7,451	4,157	760	56	285	190	85	1,911	7
Month 6	4,166	2,179	439	41	160	120	54	1,172	1
Second Trimester	28,271	16,591	2,638	219	945	750	323	6,780	25
Month 7	2,850	1,497	303	16	92	89	39	811	3
Month 8	1,987	1,001	208	14	78	55	21	609	1
Month 9 & Higher	1,029	529	105	9	27	36	11	307	5
Third Trimester	5,866	3,027	616	39	197	180	71	1,727	9
n.s.	1,346	795	120	9	36	43	13	317	13
Adequecy of Prenatal Care									
Adequate Plus	57,112	42,673	3,302	287	1,819	1,292	291	7,414	34
Adequate	99,276	72,894	5,915	372	3,260	1,876	668	14,242	49
Intermediate	10,897	5,857	1,116	68	282	237	266	3,060	11
Inadequate	20,314	10,782	2,223	175	714	561	246	5,588	25
n.s.	1,500	933	114	10	37	43	14	336	13
Smoking During Pregnancy									
Ever Smoked During Pregnancy	19,969	16,194	1,540	199	89	758	18	1,164	7
Smoking Status Known	188,684	132,874	12,633	908	6,103	3,992	1,485	30,580	109
Pre-pregnancy BMI									
Underweight	5,734	3,891	411	31	420	127	83	768	3
Normal weight	80,592	59,035	4,398	274	3,569	1,568	720	10,978	50
Overweight	50,178	34,362	3,352	252	1,446	1,012	436	9,294	24
Obese	51,710	35,350	4,440	347	650	1,276	231	9,388	28
n.s.	885	501	69	8	27	26	15	212	27

* NH = Non-Hispanic, population group includes unknown Hispanic origin.
Residence data
n.s. = not stated

Source: Bureau of Epidemiology and Public Health Informatics
Kansas Department of Health and Environment