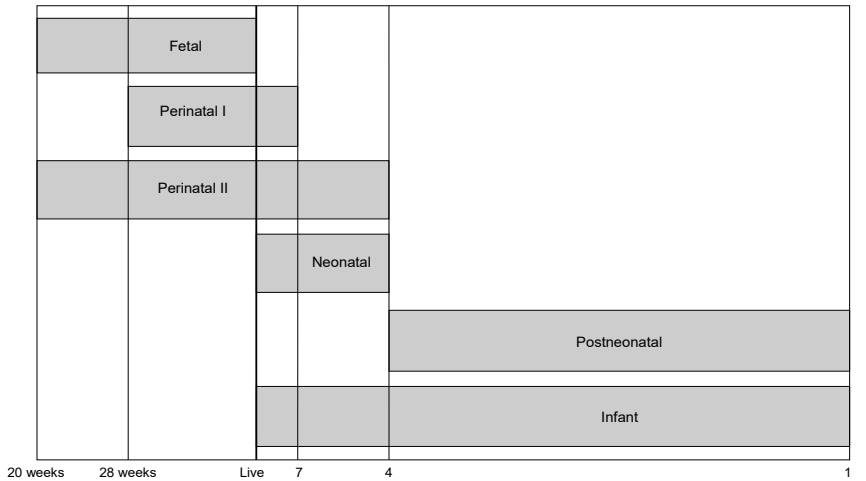
Fetal and infant mortality

Introduction

This report presents fetal and infant mortality data. Fetal deaths included in this report are for fetuses weighing at least 350 grams at delivery, or at least 20 weeks' gestation if delivery weight is unknown. Infant deaths occur within one year of birth. This definition applies to data after 1998. Although fetal and infant death records are useful for statistical descriptions of deaths within a given period, their fundamental purpose is to help discover and evaluate preventive strategies to improve infant health. As an aid to understanding and monitoring health trends, this report divides fetal and infant deaths into five overlapping categories: fetal deaths, perinatal deaths, infant deaths, neonatal deaths and postneonatal deaths. These categories are consistent with the National Center for Health Statistics' definitions (see Figure 7-1).

The five categories of fetal and infant death were analyzed using three databases: fetal deaths, infant deaths and births. National publications covering the subject of fetal and infant death may use one or any combination of these databases. As a result, death rates often vary slightly depending on whether birth or death cohorts were used as the data source for statistical analysis. The next section discusses the definitions for birth and death cohorts.

Figure 7-1.
Fetal*, perinatal and infant death: definitions



*Fetal deaths reported include those with birthweights of at least 350 grams or, if birthweight is unknown, at least 20 weeks gestation.

Throughout this report, some tables display rates and ratios based on small numbers of events. Rates and ratios based on fewer than five events are unreliable. It is important to avoid inferring causal relationships based solely on the data contained in these tables.

Definitions and methodology

The following are definitions of fetal and infant death data components.

- **Fetal deaths** occur among fetuses weighing at least 350 grams at delivery, or that have completed at least 20 weeks' gestation if delivery weight is unknown. To classify an event as a fetal death, the developing fetus dies either in utero (unintentionally) or during delivery. Fetal deaths are classified as early (20–27 weeks' gestation) or late (28 or more weeks' gestation). Oregon public health and safety laws require fetal death reporting.*
- **Infant deaths** occur during a child's first year (measured from birth through 364 days). Infant deaths include both neonatal and postneonatal deaths.
  - » **Neonatal deaths** occur during the first 27 days of life. Neonatal deaths may be early (under seven days) or late (seven to 27 days).
  - » **Postneonatal deaths** occur from day 28 through day 364 after birth.
- **Perinatal deaths definition I** includes fetal deaths at 28 weeks of gestation or more, and infant deaths at less than seven days after birth.
- **Perinatal deaths definition II** includes fetal deaths at 20 weeks or more of gestation, and infant deaths at less than 28 days after birth.
- The **death cohort** for infant death includes all infant

* Prior to Nov. 10, 1998, fetal deaths occurring at 20 weeks of gestation or more were reported. Effective that date, the Oregon Legislature amended ORS 432.333 to read: "Each fetal death of 350 grams or more, or, if weight is unknown, of 20 completed weeks' gestation or more, calculated from the date last normal menstrual period began to the date of delivery, that occurs in this state shall be reported within five days after delivery to the county registrar of the county in which the fetal death occurred or to the Center for Health Statistics or as otherwise directed by the Center for Health Statistics." Currently, hospitals and reporting facilities send all fetal death reports directly to the Oregon Center for Health Statistics rather than to county registrars.

deaths occurring in any given calendar year. In this report, the death cohort consists of infants that died in 2017 and could have been born in either 2016 or 2017. Data from the death cohort are usually available sooner than birth cohort data, as described below. The focus and analysis of the death cohort is on death record information, such as age, residence of the infant and cause of death. Tables 7-1 and 7-2 are based on a death cohort.

- The **birth cohort** for matched infant deaths (each death record matched to its corresponding birth record) is based on analysis of infants born in the same calendar year that die within one year of their birth. In this report, the birth cohort consists of infants born in 2016 that died in either 2016 or 2017. Analysis based on a birth cohort is typically not as timely; however, it allows the analysis of characteristics from the birth record, such as mother's race, age and factors affecting the birth outcomes (e.g., birthweight, prenatal care, mother's use of tobacco). Rates using the birth or death cohorts may differ slightly, but the difference is usually small. Tables 7-8 through 7-18 are based on an infant birth cohort. See Figure 7-2 for a comparison of deaths by birth cohort and death cohort.

Fetal and infant mortality in the 2017 death cohort

This chapter uses data from the 2017 death cohort in the first two tables. Discussion mainly focuses on the cause

Figure 7-2.
Infant deaths by birth cohort and death cohort,
Oregon residents, 2002-2017

of death. Infant characteristics at the time of death are derived from death records, with the primary focus on age at death, county of residence at death, and underlying cause of death. Total age-specific and cause-specific mortality ratios are computed by dividing the number of infant deaths in a calendar year by the number of births in the same calendar year.

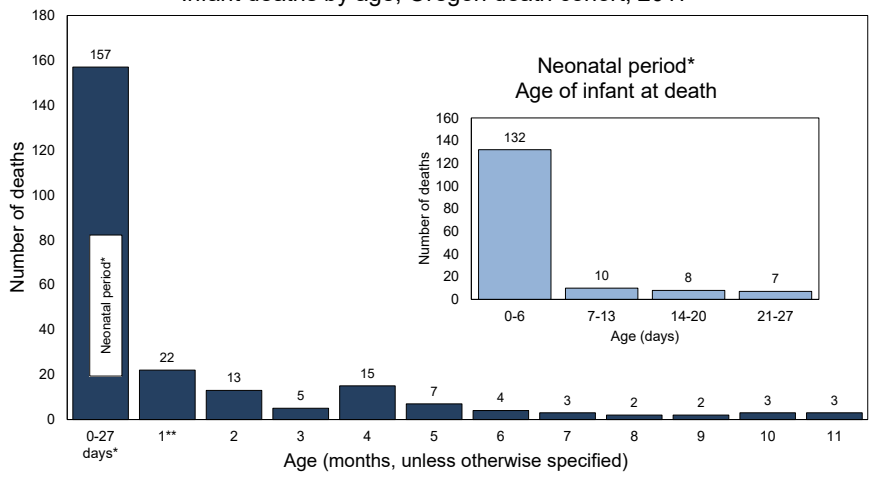
Demographics

During 2017, 236 Oregon resident infants less than 1 year of age died, an increase from 211 in 2016. The infant mortality rate also increased, from 4.6 to 5.4 deaths per 1,000 births (see Table 7-1). Oregon's infant death rate was 8.5% lower than the U.S. rate of 5.9 per 1,000 births during 2016 (the most recent year for which data are available) (1). As in previous years, most infants (66.5%) who died during 2017 were less than 28 days old. More than half (55.9%) of infant deaths occurred within the first week of life (see Figure 7-3).

During 2017, 236 infants died within the first year of life.

Between 2013 and 2017, the infant mortality rates for Oregon counties (excluding counties with fewer than five infant deaths) ranged from 3.8 to 9.2 per 1,000. Only one Oregon county, Polk, had an infant mortality rate significantly higher than the state rate (8.2 and 5.0, respectively). No county had an infant mortality rate significantly lower than the state rate.

Figure 7-3.
Infant deaths by age, Oregon death cohort, 2017



*Neonatal period is <28 days. Inset shows details of neonatal period.
**1 month age group includes infants more than 27 days and less than 2 months of age.

Sudden infant death syndrome

Sudden infant death syndrome (SIDS) is the sudden and unexpected death of an apparently healthy infant less than 1 year of age, usually during the postneonatal period. Historically, Oregon's SIDS rate has been higher than the national rate, and SIDS has been a leading cause of death among Oregon infants (see Figure 7-4). However, since 2001, Oregon's and the nation's rates have been similar. Oregon's rate dropped quickly after the implementation of "Back to Sleep," a national educational campaign begun in 1994 to encourage non-prone sleeping positions for infants.

SIDS accounted for 9% of all infant deaths in 2017.

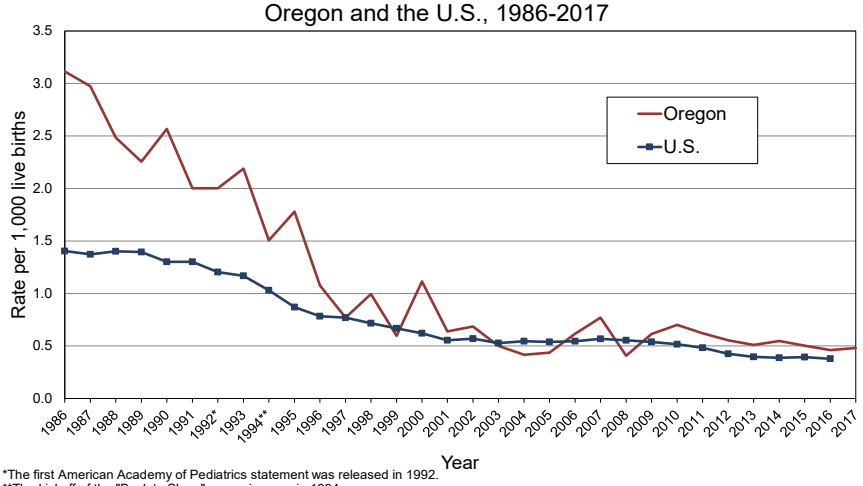
The number of SIDS deaths (21) was the same as during the previous year, and the SIDS death rate among infants was also unchanged at 0.5 per 1,000 live births. In 2017, SIDS accounted for 8.9% of all infant deaths in Oregon and 22.8% of all postneonatal deaths (see Table 7-2).

Neonatal death

Neonatal and postneonatal death rates have been declining since 1936, when the neonatal death rate was 29.0 per 1,000 births and the postneonatal death rate was 15.3 per 1,000 births. In 2017, the neonatal death rate was 3.6 per 1,000 births, up from 3.3 in 2016. The postneonatal death rate was 1.8 per 1,000 births, an increase from 1.4 in 2016 (see Figure 7-5 and Table 7-1).

In 2017, 157 infants died during the neonatal period, an increase from 148 in 2016. Oregon's neonatal death rate has consistently been below that of the United States (see Figure 7-6). The 2017 Oregon rate (3.6) is 7.0% lower than

Figure 7-4.
Sudden infant death syndrome (SIDS) death rates,
Oregon and the U.S., 1986-2017



*The first American Academy of Pediatrics statement was released in 1992.
**The kickoff of the "Back to Sleep" campaign was in 1994.
Death cohort 1986-2017. Changes in cause of death coding affected SIDS death rates beginning in 1999.

Table A - Neonatal deaths due to respiratory distress syndrome, 2001-2017

Year	Number	Percent*	Rate**
2001	5	3.2	11
2002	4	2.3	8.9
2003	3	1.7	6.5
2004	6	3.4	13.1
2005	10	5.6	21.8
2006	5	2.7	10.3
2007	9	4.7	18.2
2008	3	1.9	6.1
2009	2	1.3	4.2
2010	3	2.0	6.6
2011	4	2.8	8.9
2012	4	2.5	8.9
2013	4	2.6	8.9
2014	2	1.3	4.4
2015	2	1.3	4.4
2016	2	1.4	4.4
2017	5	3.2	11.5

* Percent of neonatal deaths due to RDS.
**Per 100,000 live births.

the 2016 national rate of 3.9 (1). Congenital anomalies were responsible for more neonatal deaths than any other cause (35.0%), followed by short gestation and fetal growth (23.6%) and maternal factors (21.0%) (see Table 7-2). Five neonates died from respiratory distress syndrome (RDS) in 2017 (see Table A).

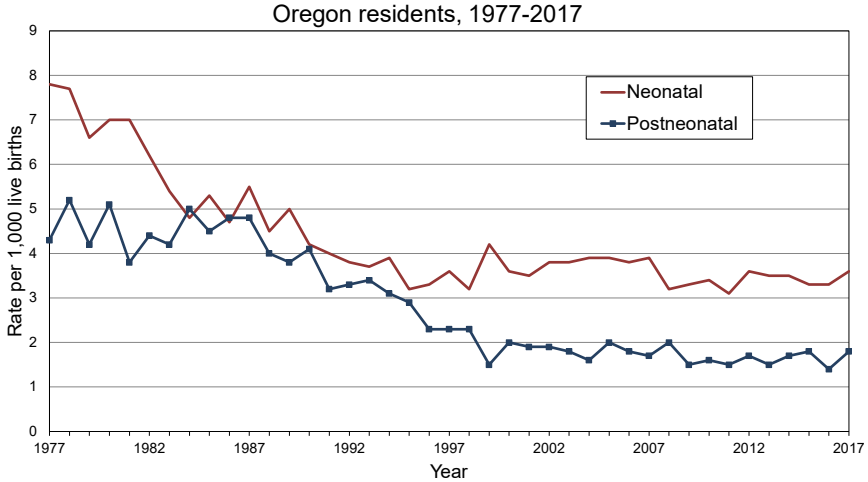
Postneonatal death

In 2017, 79 infants died during the postneonatal period, representing 33.5% of all infant deaths. The postneonatal death rate of 1.8 per 1,000 births represents an increase from 2016 (1.4 per 1,000 births); the difference is not statistically significant (see Figure 7-5). Sudden infant death syndrome (SIDS) was the most common cause of postneonatal death (22.8%). Congenital anomalies were the second-most-common cause and accounted for 21.5% of postneonatal deaths. Unintentional injuries were the third-most-common cause (20.3%) (see Table 7-2). Before 1996, Oregon's postneonatal death rate was higher than the U.S. rate; since then, the state rate has been lower than the national rate (1.8 per 1,000 births for Oregon in 2017 vs. 2.0 per 1,000 births for the latest U.S. data available in 2016 (1).

Fetal death

Fetal deaths were first reported to the Public Health Division in 1928, when the ratio of fetal deaths to live births was 29.0 for every 1,000 births. Since then, this ratio has generally decreased, and has remained under 5.0 since 1998 (see Figure 7-7 and Table 5-2). In 2017, there were 185 Oregon

Figure 7-5.
Neonatal and postneonatal death rates,
Oregon residents, 1977-2017



Death cohort 1977-2017.

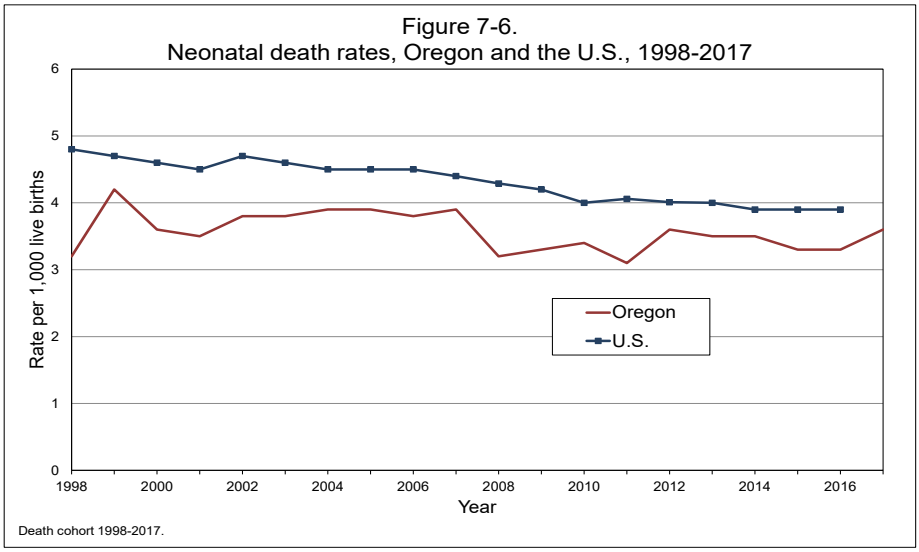


Table B - Fetal death ratios per 1,000 live births, by mother's age, 2013-2017

Age	Year				
	2013	2014	2015	2016	2017
Total	4.2	4.2	4.1	4.0	4.2
15-44	4.1	4.1	4.0	4.0	4.2
15-19	3.5	5.4	4.8	6.0	4.4
20-24	4.2	3.1	4.6	3.6	4.1
25-29	4.3	4.2	2.9	3.9	4.2
30-34	3.2	3.6	3.9	3.6	4.1
35-39	5.7	4.9	5.0	4.8	4.1
40-44	4.7	7.5	6.7	5.4	5.6

* Ratio was not calculated because there were fewer than five fetal deaths in this category.

resident fetal deaths, or 4.2 fetal deaths per 1,000 live births (see Table 7-3). This is not a statistically significant decrease from 2016 when 184 fetal deaths were reported, and the ratio was 4.0 fetal deaths per 1,000 live births (see Table B).

Fetal cause of death

Table 7-4 shows the causes of Oregon's 185 fetal deaths in 2017. "Unspecified" was the most frequently reported cause of fetal death (a total of 82 deaths). Complications of the placenta, cord and membranes were the second most common cause of fetal death (37 deaths), and congenital anomalies and maternal complications of pregnancy tied for third most common (18 deaths). These four causes of death represented 83.8% of all 2017 Oregon fetal deaths. In 1999, the first year in which Oregon used ICD-10 codes, fetal death of unspecified cause represented 18.4% of all

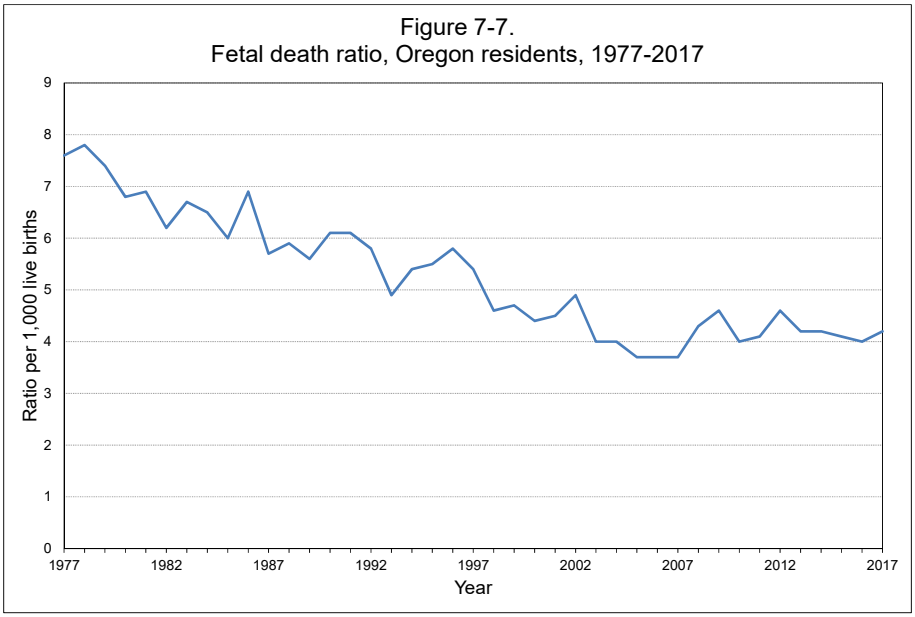


Table C - Percentage of fetal deaths by weeks of gestation, 2008-2017			
Year	Weeks of gestation		
	<28	28-36	37+
2008	41.5	31.6	26.4
2009	33.3	40.3	26.4
2010	39.2	35.4	24.9
2011	36.6	36.6	26.9
2012	36.4	33.5	29.6
2013	39.2	29.1	31.7
2014	34.0	39.3	26.7
2015	40.9	34.9	23.1
2016	42.4	34.2	23.4
2017	34.6	38.4	27.0

fetal deaths. In 2017, this same cause made up 44.3% of fetal deaths, a 140.8% increase.

2016 birth cohort for infant deaths

Infant mortality analyses can also be performed using birth cohort data. The numerators for all rates and ratios are based on the number of infants born in a given year that die prior to their first birthday. Perinatal analyses also include all fetal deaths occurring in the same year. Because infants can be born in one year and die the following year, use of the birth cohort requires that the 2017 death data be included in the report on the 2016 birth cohort. For illustration, 216 of the infants born in 2016 died within the first year of life; of these 216 deaths, 195 died in calendar year 2016, and 21 died in 2017. Those that died in 2017 also appear in this year's report as part of the 2017 death cohort.

The Center for Health Statistics has produced tables containing infant and perinatal death data from the birth, fetal death and matched infant death files. These birth cohort tables display data for infant and perinatal deaths according to several maternal risk factors and low birthweight. Additionally, this report presents neonatal and postneonatal deaths that were matched to their corresponding birth. Thus, a birth occurring at the end of December 2016 may have a matched postneonatal death that occurred up to one year later, at the end of December 2017.

Small numbers

Due to the small number of events in some risk factor categories, this report uses three-year groupings of the risk characteristics to improve statistical reliability. Single-year tables displaying risk factors are also included for comparison with statistics of prior years, but the analysis of risk factors and maternal characteristics are done using only the three-year tables.

Perinatal deaths

Perinatal death, reported in tables 7-13 through 7-16, combines neonatal deaths and fetal deaths of specific gestation (see Figure 7-1). These tables present a comprehensive picture of late-gestation fetal deaths and neonatal deaths. As shown in Figure 7-8, the perinatal death rate (the combined rates of fetal and neonatal death) is generally lower than the rates seen in the 1990s. The

2016 birth cohort's neonatal death rate was 3.3 per 1,000 live births, a slight decrease from the previous cohort's rate of 3.4. Both the fetal and neonatal death rates fluctuate from year to year due to the small number of cases. The fetal death rate hit a low of 3.7 during 2005 to 2007 but has increased slightly since that time.

Neonatal deaths: 2014–2016 birth cohort

Some maternal characteristics may influence pregnancy outcomes of infants that died during the neonatal period. This section discusses marital status, age, ethnicity and race, education, prenatal care, and tobacco use (see Table 7-18).

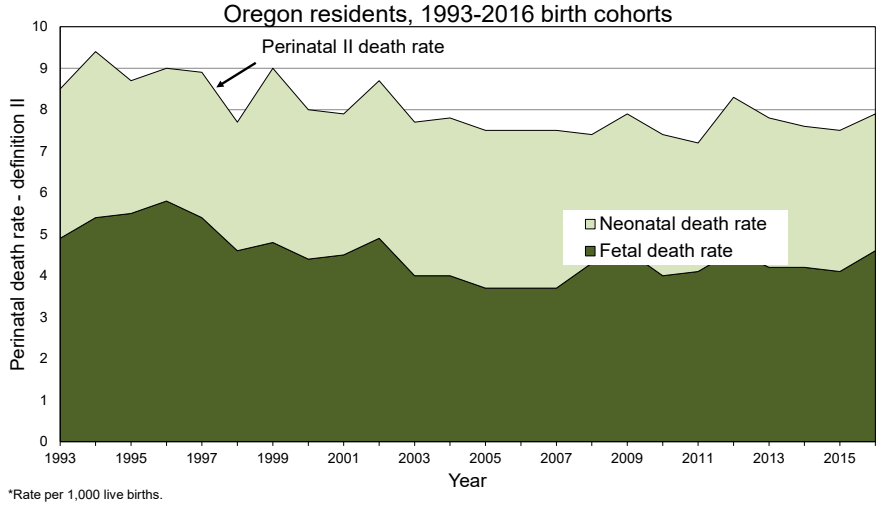
Birthweight

The birthweight of an infant has long been a predictor of subsequent survival. An increase in birthweight correlates with a decrease in the risk of neonatal death. For 2014–2016, the neonatal death rate decreased, on average, by roughly 60% for each 250- to 500-gram increase in birthweight for infants weighing less than 3,000 grams at birth (see Table 7-12). The death rate for infants weighing less than 350 grams was 985.5 per 1,000 live births, decreasing to 0.6 per 1,000 live births for infants weighing more than 2,500 grams (see Table 7-12 and Figure 7-9).

Birthweight has long been a predictor of survival.

Many behavioral, social and medical conditions are associated with higher rates of infant death. These conditions may also have confounding or mitigating effects

Figure 7-8.
Fetal, neonatal and perinatal II death rates*
Oregon residents, 1993-2016 birth cohorts



*Rate per 1,000 live births.

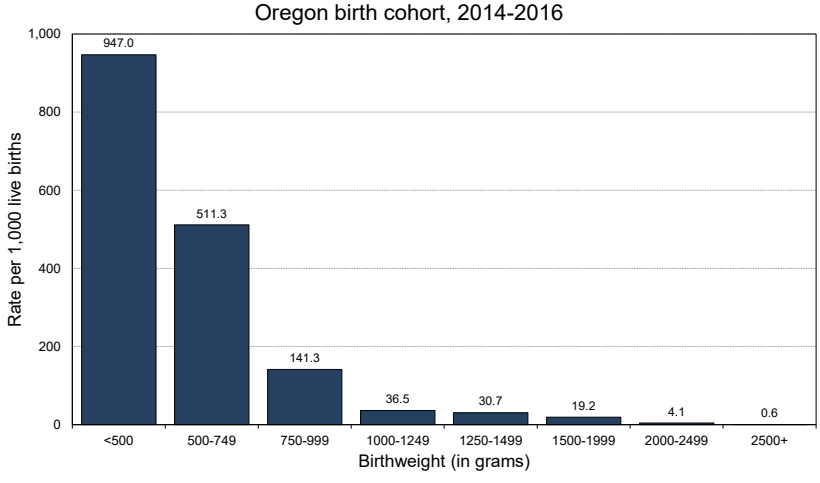
on each other. This report does not try to account for or hold all these variables constant in relation to each other. Instead, it presents a simple descriptive analysis.

Maternal characteristics

The neonatal death rate among infants born to single mothers was higher than for married mothers during 2014–2016 (4.2 versus 2.8 per 1,000). Infants of women with more than a high school education had a lower neonatal death rate (2.7 per 1,000) than infants of women with only a high-school education (4.0 per 1,000).

By race, infants of Non-Hispanic Black mothers (7.5 per 1,000) and mothers of other and unknown race (22.3 per 1,000) had the highest neonatal death rates. Neonatal death rates in both groups were significantly higher than those for infants whose mothers were Asian (2.5) or Hispanic (3.5). The neonatal death rate for infants of White non-Hispanic women was 3.2. Infants born to mothers aged 40–44 years had a significantly higher rate of neonatal infant death than those born to mothers of age groups 20–24, 25–29 and 30–34 years (6.7 versus 3.2, 3.0 and 2.9, respectively). Infants born to mothers aged 15–19 years old also had a significantly higher rate than infants born to mothers of age groups 25–29 and 30–34 years (5.2 versus 3.0 and 2.9, respectively). Infants of multiple gestations (e.g., twins, triplets) had significantly higher rates of neonatal deaths than those with single gestations (18.6 versus 2.8, see Table 7-18).

Figure 7-9.
Neonatal death rates by birthweight,
Oregon birth cohort, 2014-2016



Prenatal care

Women who received prenatal care, regardless of when it began, had significantly lower rates of neonatal deaths than women who received no prenatal care (3.0 versus 33.2 per 1,000 births) (see Table 7-18).

Tobacco use

The infants of women who did not use tobacco had lower rates of neonatal deaths (3.1 per 1,000) than infants of women who smoked before or during pregnancy (3.5 and 4.8 per 1,000, respectively). However, tobacco use may be underreported, which would eliminate some high-risk mothers from the analysis and potentially lowering the reported neonatal death rates for this category (see Table 7-18).

Postneonatal deaths: 2014–2016 birth cohort

Postneonatal death refers to death to an infant between its 28th and 364th day of life. This section discusses the influences of marital status, age, ethnicity and race, education, prenatal care, and tobacco on birth outcomes (see Table 7-18).

Maternal characteristics

Infants born to single mothers had a higher rate of postneonatal death than did infants of married mothers (2.3 versus 1.1). The postneonatal death rate was also significantly higher for infants of mothers who gave birth to multiple infants (4.2 versus 1.4 for singleton births). Infants of women with more than a high-school education had a significantly lower postneonatal death rate (1.1) than infants of high-school graduates (2.5). Non-Hispanic African-American mothers had the highest postneonatal mortality rate (3.1). Infants of younger mothers generally had higher death rates than infants of older mothers. Infants born to mothers aged 30–34 years had the lowest postneonatal death rate (0.9), followed by mothers aged 35–39 years (1.3). Infants born to mothers aged 30–34 years had significantly lower death rates than infants born to mothers aged 15–19 years (2.4) and 20–24 years (2.3; see Table 7-18).

Prenatal care

Infants of women receiving prenatal care in any trimester of pregnancy had lower rates of postneonatal death (1.4) than infants of mothers who received no prenatal care (5.7). Similarly, infants of women who received prenatal care during the first trimester had lower rates (1.3) than those who received no prenatal care.

Tobacco use

The postneonatal death rate of infants born to mothers who used tobacco before or during pregnancy was significantly higher than of those born to mothers who did not smoke (4.7 and 4.1, versus 1.1) (see Table 7-18).

Fetal and early neonatal deaths: birth attendant and place of delivery

In 2011, the Oregon State Legislature passed House Bill 2380, which required the Oregon Public Health Division to add two questions to the Oregon birth record to determine mothers' planned place of birth and birth attendant. Every mother who gave birth in a hospital was asked whether she had planned to give birth in a private home or a freestanding birthing center and who the planned primary attendant type was at the time she went into labor. Overall, two early neonatal deaths and one fetal death with a gestation of 37 weeks or more were planned out-of-hospital births in 2017.

Three types of midwives practice in Oregon: certified nurse midwives (CNM), licensed direct-entry midwives (LDM) and direct entry midwives (DEM). CNMs have completed an accredited, university-affiliated nurse midwifery program and have an active nurse practitioner license. They may attend deliveries in hospitals, freestanding birth centers and homes. LDMs are direct-entry midwives who have volunteered for state licensure through the Oregon Health Licensing Agency. They must meet qualifications and adhere to regulations set by the Oregon Legislature and Board of Direct Entry Midwifery. Lay midwives who are not licensed in Oregon may also certify births, but they must register with the Center for Health Statistics.

In 2017, there were 52 full-term (at least 37 weeks' gestation) fetal deaths. The mother in one of the full-term fetal deaths intended an out-of-hospital birth, and the death occurred in a non-hospital setting (see Table 7-19).

There were 20 full-term early neonatal deaths in 2017. These are deaths of infants who lived less than seven days after birth, after a gestational period of at least 37 weeks. The mothers in most of these deaths (18) intended to deliver in a hospital. Only two full-term early neonatal deaths were planned to occur in a non-hospital setting, and the attendants in both deaths were licensed direct-entry midwives (see Table 7-20).

Endnote

1. These data are from the federal Centers for Disease Control and Prevention's (CDC) WONDER online database (http://wonder.cdc.gov/mortSQL.html). The most recent year for which final mortality data are available was 2016 at the time this report was compiled. Oregon mortality data from the WONDER database may vary slightly from Oregon data presented elsewhere within this annual report due to different file closure dates, different population estimate methodologies, out-of-state reporting by other states to CDC and incorporation of Oregon's physician query results.