Reproductive and Birth Outcomes: Infant Mortality

Type of EPHT Indicator	Health Outcome
Measures	1. Infant mortality rate 2. Neonatal mortality rate 3. Perinatal mortality rate 4. Postneonatal mortality rate
Derivation of measure	1. **Infants:** Number of deaths occurring in infants younger than 1 year of age (under 366 days during a leap year) in a given year, divided by the number of live births in the same year. 2. **Neonates:** Number of deaths occurring in infants younger than 28 days of age in a given year, divided by the number of live births in the same year 3. **Perinates:** Number of fetal deaths of infants at 28+ weeks gestation, plus deaths of infants younger than 7 days old in a given year, divided by the number of live births plus fetal deaths of infants at 28+ weeks gestation in the same year 4. **Postneonates:** Number of deaths of infants that occurred from 28 days of age to <1 year of age (under 366 days during a leap year) in a given year, divided by the number of live births in the same year Both birth and death counts are geographically classified based on maternal residence at the time of birth.
Unit	1. Deaths per 1,000 live births 2. Deaths per 1,000 live births 3. Deaths per 1,000 live births plus fetal deaths of infants at 28+ weeks gestation 4. Deaths per 1,000 live births
Geographic Scope	Iowa
Geographic Scale	County
Time Period	2000-Most Recent Year Available
Time Scale	Annual or multiyear averages where rates are unstable
Rationale	Fetuses and young children may be particularly susceptible to harmful effects of environmental contaminants. Many environmental contaminants are likely particularly toxic in utero; many cross the placenta and make their way into the circulatory system of the developing fetus. However, specific health effects identified after a common exposure are often not well understood for years Therefore, gross indicators of childhood health—such as mortality—should be tracked as part of an EPHT system. Furthermore, data on births and deaths in a region may be far more complete than data on other health-related events. Overall, congenital malformations, deformations, and chromosomal abnormalities are the substantial leading cause of infant deaths (20.1% of deaths) (1). Disorders related to short gestation and LBW are second, making up 16.6% of deaths. However, importantly, cause of death varies over the first year of life, and

combining all causes obscures the fact that sudden infant death syndrome is the leading cause of death in the postneonatal period.

Disorders related to short gestation and LBW are the leading cause of neonatal death (24.3% of deaths) (1). This is in contrast to the leading cause of postneonatal death, which is sudden infant death syndrome (21.8%). Congenital malformations, deformations, and chromosomal abnormalities are the second-leading cause of neonatal deaths (21.4%) and postneonatal deaths (17.5%) (1).

Restricting infant mortality to deaths that occurr during the perinatal, neonatal, or postneonatal period may limit the etiologic heterogeneity inherent in a gross measure such as overall infant mortality. Also, it may be more likely that the deaths of infants, living in reasonable proximity to where they were born, who die from aged 7 to 28 daysmakes ecological associations with environmental exposures potentially more meaningful. Specifically, exclusion of infants who die within 28 days might reduce etiologic heterogeneity due to differences in early prenatal care and other non-environmental factors likely to influence neonatal survival.

When a fetus or an infant dies during or immediately before or after delivery, it is not always clear whether this event is a live birth and infant death, or a fetal death. Diagnostic ability for detecting signs of life, such as breathing or beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles after expulsion or extraction from the mother may vary across obstetric clinics.

Unexplained fetal death and death related to growth restriction are the leading causes of fetal loss (2). Fetal death is an important cause of mortality, with the rate being many times higher than the rate of sudden infant death syndrome among infants (1). Although the rate of late fetal loss (28+ weeks gestation) has been decreasing in past decades, the rate of intermediate fetal loss (20–27 weeks gestation) has remained relatively constant (3). Markers of increased risk for fetal loss include pre-pregnancy obesity, lower socioeconomic status, non-Hispanic black race, and advanced maternal age.

Use of the Measure	Identifying populations with higher infant, neonatal, perinatal, and postneonatal mortality rates may indicate where potential environmental problems are. It will assist in targeting outreach interventions and improve understanding of geographic variation, time trends, and demographic patterns of infant death.
Limitations of the Measure	An important limitation of this health outcome measure is the heterogeneity in its etiology. Environmental exposure-related causes of infant death are only one piece of a puzzle that includes many other factors, such as access to and quality of health care, competency in childcare, and understanding of injury prevention.
	The maternal residence during pregnancy and the infant's residence during the first year of life are critical data for linking deaths to environmental hazards/exposures; these residences may differ from maternal residence at birth or infant residence at death. The mother may have lived far from the place at which she gave birth during part or all of the pregnancy. The infant who died may

	have been born and lived for a major portion of its life far from the place of death; it may be less likely that neonates and perinates who died were born and lived far from the place of death. NCHS currently uses a period linkage approach that links death certificates to birth certificates. This approach would allow stratification of deaths according to place of birth. However, it does not address the possibility that migration across states or other geographies occurred *during* pregnancy or infancy.
Data Sources	Iowa Department of Public Health vital statistics systems (birth, death, and fetal death records)
Limitations of Data Sources	It may be reasonable to assume universal reporting of live births and infant deaths in the United States; however, some births/deaths may be excluded because of the difficulty in distinguishing a death shortly after birth as a live birth; a death soon after birth might be reported as a fetal death rather than as a live birth and infant death. In addition, some fetal deaths may not be reported as such in some regions, although those occurring at 28+ weeks gestation are more likely to be reported properly. Data on fetal death certificates may not provide all the information that can be collected from birth certificates linked to infant deaths within 7 days; however, many variables used for environmental health tracking (maternal race/ethnicity and age, place of residence) have relatively complete reporting on the fetal death certificate. Births and deaths will be tabulated according to maternal race/ethnicity, using linked data from birth certificates.
Recommendations for Future Development of the Indicator and Measures	Coordinate with the NCHS to use data that they collect from states and localities. Incorporate duration of residence variable into birth and death certificates so that the validity of linking births/deaths by geography (for the purpose of inferring some environmental exposure) can be assessed. Explore development of a measure that excludes intentional deaths and injuries but includes some categories of unintentional poisoning. Exclude lethal genetic conditions known not to have an environmental component to their etiology. Certain infectious disease deaths should perhaps be excluded.