



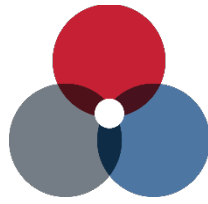
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# **Are Infant Mortality Rate Comparisons Affected by how Live Births are Counted?**

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### Introduction

Infant mortality is used as an indicator of child and maternal health, and also an indicator of the quality of health care. The infant mortality rate is calculated using two components: deaths within the first year of life, compared to the number of live births. Fetal deaths, sometimes referred to as stillbirths, miscarriage, or fetal demise, do not include a live birth and therefore do not impact infant mortality.

In 2016, the infant mortality rate was 5.9 infant deaths per 1,000 live births in the United States and 7.4 infant deaths per 1,000 live births in Ohio. Infant deaths are further subdivided into neonatal deaths (within 28 days of birth) and post-neonatal deaths (from 28 to 364 days after birth). The neonatal death rate was 4.0 per 1,000 births in the US and 5.2 in Ohio. The post-neonatal death rate was 2.0 in the US and 2.3 in Ohio.<sup>1</sup>

After hearing speculation that Ohio's infant mortality rate might be unusually high due to reporting differences, we sought to examine the definitions of "live birth," "stillbirth" and "fetal death," and the standards for reporting each. As medical technology and expertise have increased the viability of extremely preterm (less than 22 weeks) and extremely low birth weight (less than 500 or 1,000 grams) deliveries, we may now see more live births which in other circumstances would have resulted in fetal deaths (miscarriages or stillbirths). This could, in turn, have a statistical impact on the infant mortality rate. In addition, institutional and other factors may influence whether a birth is officially reported as a live birth or as a fetal death. The remainder of this paper will explore some of the research in this area.

### Live Birth and Fetal Death Definitions

The official definitions of live birth adopted by The World Health Organization (WHO)<sup>2</sup> and the Centers for Disease Control and Prevention (CDC)<sup>3</sup> are nearly identical. In both definitions, a live birth can occur,

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<sup>1</sup> Neonatal and post-neonatal rates are for 2013 in the U.S. and 2016 in Ohio.

<sup>2</sup> "Live birth refers to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life – e.g. beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles – whether or not the umbilical cord has been cut or the placenta is attached. Each product of such a birth is considered live born."

<http://who.int/healthinfo/statistics/indmaternalmortality/en>. Accessed 7/16/2018.

<sup>3</sup> "Live birth means the complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy, which, after such expulsion or extraction, breathes or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles – whether or not the umbilical cord has

“irrespective of the duration of pregnancy,” meaning that there is no lower limit for gestation. Almost all U.S. states and territories use substantially the same definition.<sup>4</sup> Eight states, Ohio<sup>5</sup> among them, omit the phrase “irrespective of the duration of pregnancy” or its equivalent. However, since none of these states specify any other limitation, it is assumed here that there remains no lower limit on gestation for any state. All states require the reporting of a live birth regardless of gestation or weight.

On the other hand, there is some variation among countries and U.S. states regarding reporting of fetal deaths.<sup>6</sup> In Ohio, registration is required for any fetal death of at least 20 weeks’ gestation, in which case it is also called “stillborn.”<sup>7</sup> In 2016, there were 904 fetal deaths recorded in Ohio.<sup>8</sup>

### Comparisons of Infant Mortality

Although the official definitions are consistent, among countries, states and even hospitals, there are differences between what is reported as a fetal death and what is counted as infant mortality. When extremely premature and extremely low weight births are removed, the U.S. infant mortality rate does improve. However, it remains above those of many comparable countries.

- In a data brief published by the National Center for Health Statistics in 2009, unadjusted infant mortality rates for 2005 show the United States ranking 30<sup>th</sup> out of 31 countries. The U.S. rate was 6.9 infant deaths per 1,000 births, compared to 3.1 per 1,000 for Norway. When births under 22 weeks gestation were excluded to correct for reporting differences, the U.S. rate dropped to 5.8 per 1,000, compared to Norway’s 3.0. However, the U.S. still ranked poorly, 18<sup>th</sup> out of 21 countries. The study did not conclude that differences in reporting determined the poor U.S. ranking. Instead, it cited the relatively high proportion of preterm births (less than 37 weeks gestation) in the U.S. and its high infant mortality rate among full-term births (37 or more weeks).<sup>9</sup>
- A similar study using 2010 data from the U.S. and 25 other countries from the Organization for Economic Co-operation and Development (OECD) found that unadjusted infant mortality was higher in the U.S. (6.1 per 1,000) than in all other countries in the comparison. Excluding births with a gestation of less than 24 weeks reduced the U.S. rate to 4.2 per 1,000. However, nine of 11 comparison countries still had lower rates than the U.S. Again, the high rate of prematurity (even after excluding gestations of less than 24 weeks) and the high infant mortality rate among

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been cut or the placenta is attached. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps.” Kowaleski J. State definitions and reporting requirements for live births, fetal deaths, and induced terminations of pregnancy (1997 revision). Hyattsville, Maryland: National Center for Health Statistics. 1997

<sup>4</sup> Vermont has no statutory definition of live birth

<sup>5</sup> ORC 3705.01 (A)

<sup>6</sup> “Fetal death means death prior to the complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy and which is not an induced termination of pregnancy. The death is indicated by the fact that after such expulsion or extraction, the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps.” Kowaleski, op. cit.

<sup>7</sup> ORC 3705.01 (B); 3705.20

<sup>8</sup> “Ohio Resident Fetal Deaths by County of Residence and Year of Occurrence, 1986 to 2016,” Ohio Department of Health.

<sup>9</sup> MacDorman MF, Matthews TJ. Behind international rankings of infant mortality: How the United States compares with Europe. NCHS data brief, no. 23. Hyattsville, MD: National Center for Health Statistics. 2009

full-term births in the U.S. were found to be the major factors related to this country's poor ranking.<sup>10</sup>

- A study comparing neonatal mortality (deaths within 28 days of birth) in 25 countries in 2004 was published in the British Medical Journal in 2012. The U.S. ranked 22<sup>nd</sup> using unadjusted data, with a rate of 4.47 neonatal deaths per 1,000 live births. When births of less than 1,000 grams were excluded, the U.S. rate fell to 1.61 per 1,000 and the U.S. ranking rose to 10<sup>th</sup> place. Comparing infant mortality (deaths within one year) across 18 countries, the U.S. ranking rose from 16<sup>th</sup> to 12<sup>th</sup> place when births of less than 1,000 grams were excluded.<sup>11</sup>
- Comparisons between the U.S. and four European countries (Austria, Belgium, Finland and the U.K.) using data from 2000 to 2005 show that unadjusted infant mortality rates were higher in the U.S. by a range of 1.4 to 3.6 deaths per 1,000 live births. When the data set eliminated births at less than 22 weeks and less than 500 grams, excess infant deaths in the U.S. fell to a range of 1.1 to 2.1 per 1,000 compared to the European countries.<sup>12</sup>

Doctors and medical professionals are responsible for distinguishing between a live birth/neonatal death and a fetal death. The classification of each case can be influenced by institutional and other factors. It is not clear the degree to which classification practices differ among Ohio hospitals, but studies in other states indicated that the issue is most likely to impact neonatal infant mortality when death occurs within 28 days of birth.

- In some maternity hospitals in New York City, live births are reported regardless of gestational age; in others, gestational age (usually, 23 weeks) is taken into account. In a comparison of these hospitals' neonatal mortality data from 2007-2009, the neonatal mortality rate for hospitals which did not restrict reporting was 3.54 deaths per 1,000 live births, significantly higher than the rate of 2.68 for those which considered gestational age. When births under 23 weeks gestation were excluded, there was no significant difference in rates between the two groups of hospitals.<sup>13</sup>
- A North Carolina study analyzed fetal deaths and infant deaths occurring less than 24 hours after birth, using data from 31 hospitals in the state from 1995 to 2000. The study found that the birth hospital was an important predictor of whether the death was classified as fetal or infant death. "Among the 31 hospitals selected for study, there was a nearly 15-fold variation in

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<sup>10</sup> MacDorman MF, Matthews TJ, Mohangoo AD, Zeitlin J. international comparisons of infant mortality and related factors: United States and Europe, 2010. National vital statistics reports; Vol. 63 No. 5. Hyattsville, MD: National Center for Health Statistics. 2014.

<sup>11</sup> Joseph KS, Liu S, Rouleau J, et al. Influence of definition based versus pragmatic birth registration on international comparisons of perinatal and infant mortality: population-based retrospective study. BMJ 2012; 344:e746 (Published 17 February 2012)

<sup>12</sup> Chen A, Oster E, Williams H. Why is infant mortality higher in the United States than in Europe? American Economic Journal: Economic Policy. 2016 May; 8 (2) 89-124.

<sup>13</sup> Ramsay SM, De SK (2016) The Definition of Life: The Impact of Physicians' Reporting Practices on Neonatal Mortality Rate in New York City. J Neonatal Clin Pediatr 3: 014.

the probability of events being classified as early neonatal versus fetal death after controlling for numerous other factors that may be associated with this outcome.”<sup>14</sup>

- A state-by-state comparison of fetal and infant deaths from 1999 to 2002 showed that for deliveries of less than 500 grams and at least 20 weeks gestation, states with lower fetal death rates had higher infant death rates within 24 hours of live birth. Six states (Rhode Island, Delaware, Kansas, Maine, Connecticut and Maryland) had a significantly higher likelihood of deaths being classified as live birth/infant death than fetal death.<sup>15</sup>

## Implications

It is clear from these examples that, despite near-uniformity in definitions, in practice there remains much ambiguity about birth outcomes at the lower end of viability. Some of the authors of the studies cited here have suggested that comparisons of infant mortality and fetal death be made only for births or deaths of similar gestational age. Controlling for extremely low weight and extremely premature births does improve the U.S. rate, but we remain behind many other countries. Rather than measurement differences, the international studies attributed the U.S.’s higher rate to the number of deaths following full-term birth and higher rates of prematurity.

Across Ohio, there are two to three times as many neonatal deaths (during the first 28 days) than post-neonatal deaths (between 29 and 364 days) and prematurity-related conditions are the leading cause of infant mortality in Ohio. Therefore, efforts focused on helping women carry pregnancies to term are likely to have a greater impact on reducing infant mortality than statistical changes.



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<sup>14</sup> Woods C, Davis D, Duncan S, et al. Variation in Classification of live birth with newborn period death versus fetal death at the local level may impact reported infant mortality rate. BMC Pediatrics 2014, 14:108

<sup>15</sup> Ehrental D, Wingate M, Kirby R. Variation by state in outcomes classification for deliveries less than 500g in the United States. Matern Child Health J (2011) 15: 42-48