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Drug-involved Infant Deaths in the United States, 2015–2017

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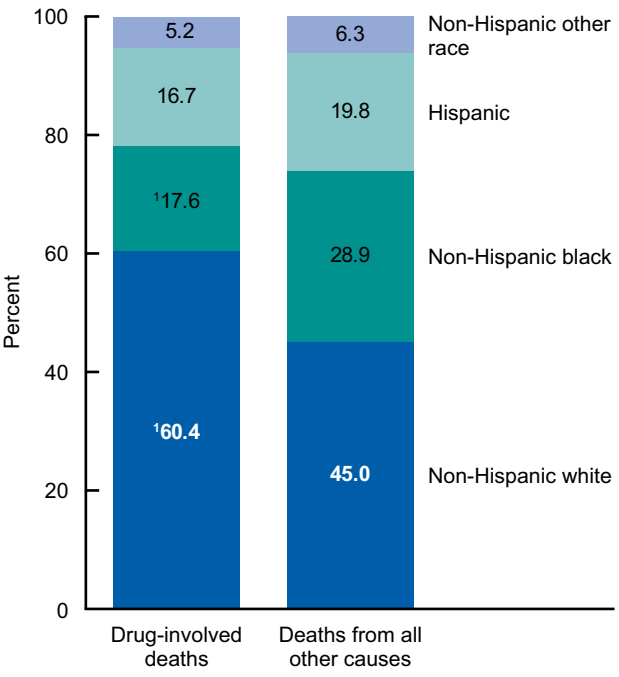
Abstract

Objectives—This report describes drug-involved infant deaths in the United States for 2015–2017 by type of drug involved and selected maternal and infant characteristics. Deaths are grouped according to whether drugs were the underlying or a contributing cause of death.

Methods—Descriptive tabulations are presented using information from the 2015–2017 National Vital Statistics System drug-involved mortality files and the 2015–2017 period linked birth/infant death files. Drug-involved infant deaths are classified according to whether the drug involvement was the underlying or a contributing cause of death. Specific drugs mentioned by type of involvement are presented.

Results—From 2015 through 2017, 442 of the 68,609 total infant deaths (0.64%) in the United States had drug involvement. The drugs most frequently mentioned were methamphetamine, opioids, cocaine, opioid treatment drugs such as methadone or naloxone, and cannabis or cannabinoids. Mothers of infants who died of drug-involved causes were more likely to be non-Hispanic white, aged 35–39, have a high school degree or less, use Medicaid as the source of payment for delivery, and receive late or no prenatal care compared with mothers of infants who died of all other causes. Infants who died as a result of drug involvement were less likely than infants who died of all other causes to be born preterm (before 37 weeks gestation), born at very low birthweights (less than 1,500 grams), or die in the late neonatal period (7–27 days). Of the 442 drug-involved infant deaths, drugs were the underlying cause of death for 163 (37%) infants and a contributing cause of death for 279 (63%) infants. The most common cause of death among infants with drug involvement as the underlying cause of death was Newborn affected by maternal use of drugs of addiction (P04.4) (87 cases); Newborn affected by other forms of placental separation and hemorrhage (P02.1) (43 cases) was the most common cause for infants with drug involvement as a contributing cause of death.

Figure 1. Percent distribution of drug-involved infant deaths and infant deaths from all other causes, by maternal race and Hispanic origin: United States, 2015–2017



[1]Significant difference from deaths from all other causes ($p < 0.05$).
NOTES: Race and Hispanic origin are reported separately on birth certificates; persons of Hispanic origin may be of any race. Race categories are consistent with the 1977 Office of Management and Budget standards. Percentages may not add to 100% due to rounding.
SOURCES: National Center for Health Statistics, National Vital Statistics System, drug-involved mortality file and linked birth/infant death file.

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Keywords: infant death • drug deaths • opioids • National Vital Statistics System

Introduction

Age-adjusted death rates from drug overdose more than tripled from 1999 through 2017, rising from 6.1 to 21.7 deaths per 100,000 standard population in the United States; the rate declined to 20.7 in 2018, rose in 2019 to 21.6, and appeared to increase through the first half of 2020 (1–3). Research on drug overdose deaths largely focuses on deaths among adults or for those aged 15 and over; little is known of the contribution of drug involvement to infant mortality (1,2,4,5). This report describes drug-involved mortality (DIM) among infants (under age 1 year) who died in 2015–2017, deaths which can be assumed to be largely preventable. Drug-involved deaths are defined as deaths that occur due to drug involvement as either the underlying or a contributing cause of death. Among infants, this could occur due to accidental or unintentional ingestion of selected prescription, illicit, or nonmedical-use drugs; maternal use of drugs; and other cases for which drugs were associated with the death. For this analysis, deaths are categorized by whether drugs were the underlying or a contributing cause of death and, when known, the specific drugs involved in the death are identified. Selected maternal and infant characteristics are compared for drug-involved infant deaths and infant deaths from all other causes.

Methods

This report uses data from the 2015–2017 DIM files (6) and the 2015–2017 linked period birth/infant death files to identify and describe drug-involved infant deaths. The DIM data files supplement the standard mortality data files with information mentioned on death certificates in the form of literal text on substances involved in the death (including over-the-counter, prescription, and illicit drugs), and how those substances may have been involved with the death (6). This information is based on data provided by the medical certifier on three fields of the death certificate: the chain of events leading to death from Part I of the certificate, other significant conditions contributing to death from Part II of the certificate, and a description of how the injury occurred (7). The method for characterizing drug involvement in deaths from the DIM files involves searching the literal text for mentions of drugs and substances related to drug use, and for terms modifying the circumstances of the drug and its use (7–10). The drugs or substances identified in the literal text fields are assumed to be involved in the death unless specified otherwise (7). Further details about the DIM files are available elsewhere (7). Specific drug information from the literal text is only available in the DIM data files and cannot be determined from the data in the linked file, making the DIM files the starting point for identifying drug-involved deaths.

The specific drugs involved in the death, when reported on the death certificate, were identified from the specific underlying and multiple cause-of-death codes from the *International Classification of Diseases, 10th Revision* (ICD–10) and the literal fields with a mention of a drug from the 2015–2017 DIM files. Infant deaths were identified in the DIM files and were classified according to whether drugs were the underlying cause or a contributing cause of death to enhance understanding of the role of drugs in the death. The underlying cause of death, for all deaths, is defined as "the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury" (11). A contributing cause of death is a condition that contributed to death but did not result in the underlying cause (12).

Drug involvement was considered the underlying cause of death when the underlying cause-of-death code was one of the following: Newborn affected by maternal use of drugs of addiction (P04.4); Newborn affected by maternal noxious influences (P04.8–P04.9); Neonatal withdrawal symptoms from maternal use of drugs of addiction (P96.1); Accidental poisoning by and exposure to noxious substances (X40–X44); Assault (homicide) by drugs, medicaments, and biological substances (X85); or Poisoning by and exposure to drugs, medicaments and biological substances (Y10–Y14).

Drug involvement was considered a contributing cause of death if any of the ICD–10 codes listed above were identified as a contributing cause of death or if a cause of death was coded to Findings of drugs and other substances, not normally found in blood (R78.1–R78.5); Poisonings by narcotics and psychodysleptics (T40), barbiturates (T42.2), benzodiazepines (T42.4), psychostimulants with abuse potential (T43.6), or other psychotropic drugs (T43.8–T43.9); or Sequelae of poisoning by various substances (T96–T97).

Drug-involved infant deaths identified from the DIM files were matched to their corresponding records in the period linked files by year of death, death certificate number, and state of occurrence to identify maternal and infant characteristics to compare drug-involved infant deaths with infant deaths from all other causes. The period linked birth/infant death data sets include information on all infant deaths under age 1 year reported on death certificates and all live births reported from birth certificates (13). This information includes characteristics of the infant, mother, and mother's pregnancy as well as information on the circumstances of the infant death. As part of the Vital Statistics Cooperative Program, each state provides matching birth and death certificate numbers for each infant under age 1 year who died during a given year to the National Center for Health Statistics. Further discussion of the process of linking births and deaths occurring in different states and file production can be found in the methodology section of the "User Guide to the 2017 Period Linked Birth/Infant Death Public Use File" (13).

Identification of drug-involved infant deaths was conducted using DIM files because literal text information from the death certificate and contextual information on the involvement of the drug in the death is unavailable in period linked birth/infant death files. Drug-involved infant deaths were identified by restricting cases to only those occurring to infants (under age 1 year); records identified from the DIM files were manually reviewed to ensure that only records with drugs of interest were included. Each record with a specific drug mention included at least one drug of interest, with some records mentioning as many as four drugs of interest. The information from these records was then

merged with the infant death records in the period linked files, for infants of U.S. residents, by year of death, death certificate number, and state of occurrence, where matches could be found. The drug-involved infant deaths were then compared with all other infant deaths from the period linked files by selected maternal and infant characteristics.

A total of 906 infant deaths were initially identified from the DIM files; 11 infant deaths were excluded that could not be linked to a birth certificate or were to non-U.S. residents, and 218 were excluded as not drug involved using the "not drug involved" field in the DIM files (for example, where the text indicated a drug-resistant infection [e.g., "METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS INFECTION"] or that the death was not due to a substance mentioned) and through manual review of cause-of-death codes and the literal text. Additional infant deaths were excluded, for example, when the only mentioned drugs were those such as antihistamines, tobacco or alcohol, or those related to medical treatments such as chemotherapy or total parenteral nutrition. Consequently, 442 records were left for analysis.

Race and Hispanic origin—Race and Hispanic origin of the mother are self-reported by the mother and are reported separately on the birth certificate (14). In tabulations of birth data by race and Hispanic origin, data for Hispanic persons are not further classified by race because the majority of women of Hispanic origin self-report as white (14). This report presents data on bridged race and Hispanic origin based on the 1977 Office of Management and Budget standards because the 2003 revision of the certificates of live birth and death use the 1977 standards and were not implemented by all states prior to the 2017 data year in the linked files; multiple-race categories were bridged to single-race categories for comparability across years (13). Infant mortality data are presented by bridged race and Hispanic origin of the mother (13). For more details on the reliability of race and Hispanic-origin data from the linked file compared with the mortality file, see reference 15.

Educational attainment—Educational attainment is the highest degree or level of school completed by the mother at the time of birth and is self-reported by the mother. The education categories reported on the birth certificate are 8th grade or less; 9th through 12th grade, with no diploma; high school graduate or GED completed; some college credit, but not a degree; Associate's degree; Bachelor's degree; Master's degree; and Doctorate or other professional degree. For this report, these categories have been collapsed to less than a high school diploma; high school graduate or GED completed; some college or Associate's degree; and Bachelor's degree or more (14).

Gestational age—Gestational age data shown in this report are based on the obstetric estimate of gestation (OE). National data based on OE data are available from data year 2007 forward (16). The gestational age categories presented in this report are less than 34 weeks (early preterm), 34–36 weeks (late preterm), 37–41 weeks (term), and 42 or more weeks (late term).

Additional maternal characteristics—Additional maternal characteristics in this report include the prenatal receipt of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) benefits; principal source of payment for the delivery; and timing of initiation of prenatal care (PNC). WIC is a program intended to help low-income pregnant women, infants, and children through age 5 years receive proper nutrition (17). The principal source of payment for the delivery is the payment source that covered the majority of the delivery costs; the four categories of payment included in this report are private insurance, Medicaid, self-pay, and other payment sources. The timing of PNC is determined by the month PNC began, which is based on the date of the first prenatal visit, date of birth, and gestational age (based on the OE). The three categories included in this report for timing of PNC are first trimester, second trimester, and third trimester or no prenatal care. These characteristics have been shown to be associated with varying infant outcomes, including risk of poor birth outcomes and infant mortality (18–21). Additionally, source of payment and WIC are sometimes used as crude proxies for socioeconomic status or household income (21,22); research indicates that women who are in lower socioeconomic status groups, or in a household with lower income, are more likely to have adverse birth outcomes (21,22).

Because the delayed implementation of the 2003 Standard Certificate of Live Birth resulted in data that were not comparable across states, births occurring in Connecticut and New Jersey have been excluded from the following analyses: mother's educational attainment, WIC, source of payment for delivery, and PNC (infant deaths associated with births occurring in Connecticut and New Jersey accounted for 2.6% of all infant deaths in the United States from 2015 through 2017). For additional details on maternal and infant characteristics based on birth certificate data, see reference 14.

Statistical analysis—This report presents numbers and percentages. Associations between selected maternal and infant characteristics and infant cause of death (i.e., with or without drug involvement) were evaluated using a chi-squared test. A statement that a given category is more or less likely than another indicates that the percentages are statistically significantly different using a two-tailed z test at the alpha level of 0.05. Confidence intervals were calculated using the Clopper-Pearson Exact method (23). The National Center for Health Statistics standards for data presentation were applied to analyses of percentages, resulting in the suppression of values not meeting standards of reliability based on confidence interval ranges (23). Unknown values were excluded from percent tabulations and comparisons. More information on the methods used to test for statistical significance, as well as information on differences between period and cohort data, the weighting of the linked file, maternal age, period of gestation, birthweight, and cause-of-death classification are available (13,14).

Results

Drug-involved infant deaths and drugs most commonly mentioned on death certificates

During the period 2015–2017, 442 infant deaths were identified as drug involved, representing 0.64% of the 68,609 total infant deaths (Table 1). The drugs most commonly mentioned on the death certificates of these 442 infants were methamphetamine (154 mentions), opioids (80 mentions), and cocaine (78 mentions); 111 certificates had no specific drug mentioned (Table A).

Table A. Frequency of drug type mentions in infant death records: United States, 2015–2017

Drug	Number of mentions
Methamphetamine	154
No specific drug mention	111
Opioids[1]	80
Cocaine	78
Opioid treatment	39
Cannabis or cannabinoid	24
Other stimulants	12
Benzodiazepine	11
Barbiturates	2
Hallucinogen	1

[1]Opioids include fentanyl, heroin, hydrocodone, methadone, morphine, and oxycodone.

NOTE: Multiple drugs can be mentioned within a single infant death record.

SOURCE: National Center for Health Statistics, National Vital Statistics System, drug-involved mortality file.

Drug-involved and infant deaths from all other causes, by maternal characteristics

Maternal race and Hispanic origin

During 2015–2017, a greater proportion of infants who died from drug-involved causes were born to non-Hispanic white mothers compared with the proportion of infants who died from all other causes (60.4% compared with 45.0%); the proportion of drug-involved deaths of infants born to non-Hispanic black mothers was lower (17.6% compared with 28.9%). For infants born to Hispanic women, differences in the percentages of those who died from drug-involved causes and those who died from all other causes were not statistically significant (Table 1, Figure 1).

Maternal age

Mothers of infants who died as a result of drug-involved causes tended to be older than mothers of infants who died from all other causes (Table 1); specifically, they were more likely to be aged 35–39 (29.9% compared with 22.9%) and less likely to be aged 20–24 (4.5% compared with 7.9%). Differences between the two groups were not statistically significant among mothers aged 25–34 and 40 and over (Table 1).

Maternal education

Mothers of infants who died of drug-involved causes tended to have lower educational attainment than mothers of infants who died from all other causes (Table 1 and Figure 2). About two-thirds (67.2%) of all drug-involved infant deaths were among infants born to mothers with a high school degree or less compared with approximately one-half (51.5%) of mothers of infants who died from all other causes; mothers of infants with drug-involved deaths were less likely to have a Bachelor's degree or higher (2.9%) compared with mothers of infants who died from all other causes (18.7%) (Table 1).

Receipt of WIC food for the pregnancy

No statistically significant differences were observed in the percentage of WIC receipt between mothers of infants with drug-involved deaths (43.7%) and mothers of infants who died from all other causes (42.4%) (Table 1).

Source of payment for delivery

Mothers of infants who died from drug-involved causes were more likely to use Medicaid as the source of payment for the delivery than mothers of infants who died from all other causes (82.0% compared with 54.8%) (Table 1 and Figure 2). Conversely, mothers of infants who died from drug-involved causes were less likely to use private health insurance (7.5% compared with 36.8%). Differences between the two groups for self-pay and other sources of payment were not significant (Table 1).

Prenatal care timing

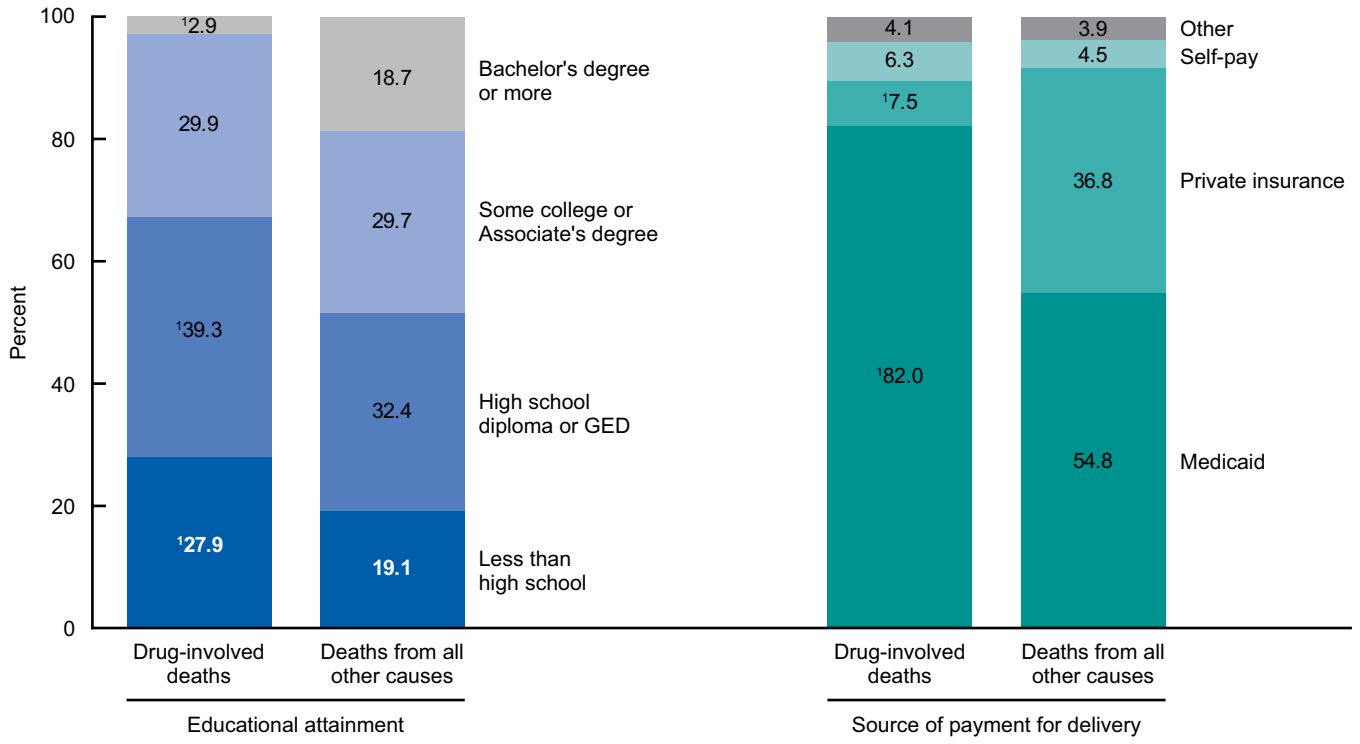
Mothers of infants who died from drug-involved causes were more likely to have received late (beginning in the third trimester) or no PNC compared with mothers of infants who died of all other causes (39.0% compared with 11.6%). Mothers of infants who died from drug-involved causes were less likely to have received PNC in the first trimester (38.2%) compared with mothers of infants who died of all other causes (69.5%). Differences between the two groups for receipt of PNC in the second trimester were not significant (Table 1).

Drug-involved and infant deaths from all other causes, by infant characteristics

Gestational age

Infants who died as a result of drug-involved causes were less likely than infants who died of all other causes to be born preterm (less than 37 weeks, 61.4% compared with 66.9%) and early preterm (less than 34 weeks, 49.4% compared with 56.4%), and were more likely to be born at higher gestational ages (term births, 37 weeks and over, 38.6% compared with 33.1%; and births at 37–41 weeks, 37.9% compared with 32.9%) (Table 2). No significant differences were found for infants born at 34–36 weeks or at 42 weeks or more.

Figure 2. Percent distribution of drug-involved infant deaths and infant deaths from all other causes, by maternal education and source of payment for delivery: United States, 2015–2017



[1]Significant difference from deaths from all other causes ($p < 0.05$).
NOTES: Births occurring in Connecticut and New Jersey were excluded from educational attainment and source of payment for delivery. Percentages may not add to 100% due to rounding.
SOURCES: National Center for Health Statistics, National Vital Statistics System, drug-involved mortality file and linked birth/infant death file.

Birthweight

Infants who died as a result of drug-involved causes were less likely to weigh less than 1,500 grams at birth (43.4%) than infants who died from all other causes (52.0%), and were more likely to weigh 1,500–2,499 grams (20.0% compared with 15.6%). Differences between the two groups were not significant for infants at higher birth weights of 2,500–4,499 grams (Table 2).

Age at death

Infants who died as a result of drug-involved causes were less likely to die in the late neonatal period (7–27 days) compared with infants who died of all other causes (9.5% compared with 13.0%). Differences between the groups were not significant for the total neonatal, early neonatal, or postneonatal periods (Table 2).

Drug-involved infant deaths, by type of involvement

Drug involvement was classified as the underlying cause of death for 163 or 36.9% of infants, and a contributing cause of death for the remaining 279 or 63.1% of infants (Table 3).

Drugs mentioned

Among the deaths for which drug involvement was the underlying cause of death, the most commonly reported drugs were methamphetamine (56 mentions), followed by opioids (42 mentions), cocaine (29 mentions), and opioid treatment drugs (21 mentions) (Table 3). No specific drug was mentioned on 26 of these records. The most commonly reported drugs among infants for whom drug involvement was a contributing cause of death were methamphetamine (98 mentions), followed by cocaine (49 mentions), opioids (38 mentions), and opioid treatment drugs and cannabis or cannabinoids (18 mentions each). No specific drug was mentioned on 85 of these records.

Opioids were the underlying cause of death for 52.5% of infants and a contributing cause for 47.5% of infants with deaths involving opioids. For methamphetamine, these figures were 36.4% and 63.6%, and for cocaine, 37.2% and 62.8%, respectively. Drugs were the underlying cause of death for 23.4% of drug-involved infant deaths for which no specific drug was mentioned on the death certificate.

Other drugs mentioned in drug-involved infant deaths, whether the drug was the underlying or a contributing cause of death, include benzodiazepines, barbiturates, hallucinogens, and other stimulants (Table 3).

Underlying cause-of-death codes

Of the infant deaths for which drug involvement was the underlying cause of death, the most common underlying causes of death were: Newborn affected by maternal use of drugs of addiction (P04.4) (87 cases); Assault (homicide) by drugs, medicaments, and biological substances (X85) (22 cases); and Poisoning by and exposure to narcotics and psychodysleptics (hallucinogens), not elsewhere classified, undetermined intent (Y12) (22 cases) (Table B). Of the 279 infant deaths for which drugs were a contributing cause of death, the most commonly reported underlying causes of death were: Newborn affected by other forms of placental separation and hemorrhage (P02.1) (43 cases), followed by Sudden infant death syndrome (R95) (34 cases), Newborn affected by chorioamnionitis (P02.7) (30 cases), and Accidental suffocation and strangulation in bed (W75) (13 cases).

Discussion

Study findings

This report is the first to identify drug-involved deaths among infants from death certificates; 442 of such deaths occurred during 2015–2017. Compared with mothers of infants who died from all other causes over the study period, mothers of infants who died of drug-involved causes were more likely to be non-Hispanic white, have lower educational attainment, use Medicaid as the source of payment for the delivery, and receive late or no PNC. Infants who died as a result of drug-involved causes were more likely than infants who died of all other causes to be born at term and to have moderately low birthweights (1,500–2,499 grams).

Drugs were the underlying cause of death for over one-third (36.9%) of all drug-involved deaths and a contributing cause of death for nearly two-thirds (63.1%) of these deaths. The most common cause of death for which drugs were the underlying cause was Newborn affected by maternal use of drugs of addiction; the most common underlying cause of death for which drugs were a contributing cause of death was Newborn affected by other forms of placental separation and hemorrhage. The drugs most frequently mentioned for all drug-involved infant deaths were methamphetamine, opioids, cocaine, and opioid treatment drugs. However, no specific drugs were mentioned for 16.0% of infant deaths for which drugs were the underlying cause of death, and 30.5% of deaths for which drugs were a contributing cause of death.

Limitations

There are several potential limitations for the findings in this report. Identifying drug-involved infant deaths depends on the quality and completeness of information provided on death certificates, which vary by decedent, jurisdiction, and time (6,7). The absence of drug-specific information on the death certificate does not mean that the death did not have drug involvement (7).

The high level of unspecified drugs mentioned should be noted; 25% of the drug-involved death records had no specific drug mentioned on the death certificate. For example, records with an underlying or contributing cause-of-death code of P04.4 (Newborn affected by maternal use of drugs of addiction) without indicating a specific drug in the literal text or in any of the cause-of-death codes may have resulted in

Table B. Ranking of the underlying cause of death for infants with drugs as an underlying or contributing cause of death: United States, 2015–2017

Rank	Cause of death (*International Classification of Diseases, 10th Revision* code)	Number of deaths
	Drugs as an underlying cause of death	
	All causes	163
1	Newborn affected by maternal use of drugs of addiction (P04.4)	87
2	Assault (homicide) by drugs, medicaments, and biological substances (X85)	22
2	Poisoning by and exposure to narcotics and psychodysleptics (hallucinogens), not elsewhere classified, undetermined intent (Y12)	22
4	Accidental poisoning by and exposure to narcotics and psychodysleptics (hallucinogens), not elsewhere classified (X42)	9
5	Poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified, undetermined intent (Y11)	6
...	All other causes (residual)	17
	Drugs as a contributing cause of death	
	All causes	279
1	Newborn affected by other forms of placental separation and hemorrhage (P02.1)	43
2	Sudden infant death syndrome (R95)	34
3	Newborn affected by chorioamnionitis (P02.7)	30
4	Accidental suffocation and strangulation in bed (W75)	13
5	Fetus and newborn affected by premature rupture of membranes (P01.1)	7
...	All other causes (residual)	152

... Category not applicable.

SOURCES: National Center for Health Statistics, National Vital Statistics System, drug-involved mortality file and linked birth/infant death file.

underclassification of the drugs involved. The determination of drug involvement for infants is more complicated than that for older individuals because the infant may have come directly in contact with the drug after birth, may have had passive or direct exposure from parents or others after birth, or may have had passive exposure to a substance from the mother while in utero. Further, some drug-involved infant deaths may be the result of illicit parental drug use, which doctors may be hesitant to record on the death certificate, a legal document. Nearly one-half of U.S. states require medical professionals to report if a pregnant woman is found or suspected to be abusing substances (24–27). Most of these states have punitive policies for the substance misuse (criminal or civil penalties that can include incarceration or loss of custody of children), which may create an ethical dilemma for practitioners and discourage pregnant women from seeking treatment for addictions (24–29).

Levels of missing information on the birth certificate were generally higher for drug-involved infant death records compared with records of infants who died of all other causes; see Table C. For example, information on the mother's educational attainment was missing for 11.7% of all drug-involved infant death records compared with 4.4% of records of infants who died from all other causes. Such differences in missing information could impact study results because more complete information could indicate smaller or larger differences between infants with drug-involved deaths and with deaths from all other causes. Further, the results for mother's educational attainment, WIC, source of payment for delivery, and PNC timing are not representative of the entire United States because this information was excluded for infant deaths occurring in Connecticut and New Jersey.

Table C. Percentage of records for which information was missing for selected maternal and infant characteristics: United States, 2015–2017

Maternal and infant characteristics	Drug-involved infant deaths	Infant deaths from all other causes
Maternal characteristic		
Education	11.7	4.4
Mother received WIC food for herself during this pregnancy	10.1	4.0
Source of payment for the delivery	5.5	1.4
Timing of prenatal care	11.0	8.8
Infant characteristic		
Period of gestation	3.4	1.0
Birthweight[1]	0.5	0.7

[1]Missing birthweight was imputed based on a previous record with similar characteristics, when available.

SOURCES: National Center for Health Statistics, National Vital Statistics System, drug-involved mortality file and linked birth/infant death file.

Conclusion

Drug overdose deaths among the general population continue to increase (3). This report demonstrates that information from death certificates can be used to describe the circumstances of drug-involved infant deaths in greater detail, including the specific drugs involved in the death and whether the drug involvement was the underlying or a contributing cause of death. Linking birth and death certificate records provides additional key information on mothers and their babies, increasing understanding of these deaths. The findings in this report may help identify risk factors for drug-involved infant deaths and inform efforts to reduce these preventable deaths.

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List of Detailed Tables

Table 1. Mothers who had a drug-involved infant death and who had an infant death from all other causes, by selected characteristics: United States, 2015–2017

Maternal characteristic	Drug-involved infant deaths				Infant deaths from all other causes			
		95% confidence interval				95% confidence interval		
	Percent	Lower	Upper	Number	Percent	Lower	Upper	Number
Total	100.0	…	…	442	100.0	…	…	68,167
Race and Hispanic origin[1]								
Non-Hispanic white[2]	60.4	55.7	65.0	267	45.0	44.6	45.4	30,659
Non-Hispanic black[2]	17.6	14.2	21.5	78	28.9	28.5	29.2	19,671
Non-Hispanic other race	5.2	–3.9	14.3	23	6.3	5.6	7.0	4,310
Hispanic[3]	16.7	13.4	20.6	74	19.8	19.5	20.1	13,527
Age in years								
Under 20	–	…	…	–	0.1	0.1	0.2	96
20–24[2]	4.5	2.8	6.9	20	7.9	7.7	8.1	5,399
25–29	21.7	18.0	25.9	96	24.7	24.4	25.0	16,837
30–34	29.9	25.6	34.4	132	27.8	27.5	28.2	18,963
35–39[2]	29.9	25.6	34.4	132	22.9	22.6	23.2	15,623
40 and over	14.0	10.9	17.6	62	16.5	16.2	16.8	11,249
Educational attainment[4]								
Less than high school[2]	27.9	23.4	32.6	107	19.1	18.8	19.4	12,140
High school graduate or GED[2]	39.3	34.4	44.4	151	32.4	32.0	32.8	20,559
Some college or Associate's degree	29.9	25.4	34.8	115	29.7	29.4	30.1	18,864
Bachelor's degree or more[2]	2.9	1.4	5.1	11	18.7	18.4	19.0	11,883
Unknown or not stated	…	…	…	51	…	…	…	2,926
Mother received WIC food for herself during this pregnancy[4]								
Yes	43.7	38.8	48.8	171	42.4	42.0	42.8	27,009
No	56.3	51.2	61.2	220	57.6	57.2	58.0	36,694
Unknown or not stated	…	…	…	44	…	…	…	2,669
Source of payment for delivery[4]								
Medicaid[2]	82.0	77.9	85.6	337	54.8	54.4	55.1	35,849
Private health insurance[2]	7.5	5.2	10.5	31	36.8	36.4	37.2	24,085
Self-pay	6.3	4.2	9.1	26	4.5	4.4	4.7	2,978
Other	4.1	2.4	6.5	17	3.9	3.8	4.1	2,555
Unknown or not stated	…	…	…	24	…	…	…	905
Timing of prenatal care[4]								
First trimester[2]	38.2	33.4	43.3	148	69.5	69.1	69.8	42,354
Second trimester	22.7	18.7	27.2	88	18.9	18.6	19.2	11,539
Third trimester or no care[2]	39.0	34.1	44.1	151	11.6	11.4	11.9	7,082
Unknown or not stated	…	…	…	48	…	…	…	5,847

… Category not applicable.
– Quantity zero.
[1]Race and Hispanic origin are reported separately on birth certificates; persons of Hispanic origin may be of any race. Race categories are consistent with the 1977 Office of Management and Budget standards.
[2]Significant difference between percentage of drug-involved infant deaths and percentage of infant deaths from all other causes ($p < 0.05$).
[3]Includes all persons of Hispanic origin of any race.
[4]Excludes births occurring in Connecticut and New Jersey.

NOTES: Chi-squared test statistics for each maternal characteristic by cause of infant death were statistically significant, except WIC receipt ($p < 0.05$). Drug-involved infant deaths were excluded from infant deaths from all other causes. WIC is the Special Supplemental Nutrition Program for Women, Infants, and Children. Percentages may not add to 100% due to rounding.

SOURCES: National Center for Health Statistics, National Vital Statistics System, drug-involved mortality file and linked birth/infant death file.

Table 2. Selected characteristics of drug-involved infant deaths and infant deaths from all other causes: United States, 2015–2017

Infant characteristic	Drug-involved infant deaths				Infant deaths from all other causes			
		95% confidence interval				95% confidence interval		
	Percent	Lower	Upper	Number	Percent	Lower	Upper	Number
Total deaths	100.0	…	…	442	100.0	…	…	68,167
Period of gestation (weeks)								
Less than 37[1]	61.4	56.6	66.0	262	66.9	66.5	67.2	45,137
Less than 34[1]	49.4	44.6	54.3	211	56.4	56.0	56.8	38,065
34–36	11.9	9.0	15.4	51	10.5	10.2	10.7	7,072
37 or more[1]	38.6	34.0	43.4	165	33.1	32.8	33.5	22,374
37–41[1]	37.9	33.3	42.7	162	32.9	32.5	33.2	22,202
42 or more	0.7	0.0	2.0	3	0.3	0.2	0.3	172
Unknown or not stated	…	…	…	15	…	…	…	656
Birthweight (grams)								
Less than 2,500	63.4	58.7	67.9	279	67.7	67.3	68.0	45,698
Less than 1,500[1]	43.4	38.7	48.2	191	52.0	51.7	52.4	35,153
1,500–2,499[1]	20.0	16.4	24.0	88	15.6	15.3	15.9	10,545
2,500 or more	36.6	32.1	41.3	161	32.3	32.0	32.7	21,846
2,500–4,499	36.6	32.1	41.3	161	32.2	31.8	32.5	21,735
4,500 or more	–	…	…	–	0.4	0.4	0.5	272
Unknown or not stated	…	…	…	2	…	…	…	462
Age at death								
Total neonatal	62.2	57.5	66.8	275	66.4	66.0	66.7	45,251
Early neonatal (under 7 days)	52.7	47.9	57.5	233	53.4	53.0	53.8	36,400
Late neonatal (7–27 days)[1]	9.5	6.9	12.6	42	13.0	12.7	13.2	8,851
Postneonatal	37.8	33.2	42.5	167	33.6	33.3	34.0	22,916

… Category not applicable.
0.0 Quantity more than zero but less than 0.05.
– Quantity zero.
[1]Significant difference between percentage of drug-involved infant deaths and percentage of infant deaths from all other causes ($p < 0.05$).

NOTES: Chi-squared test statistics for each infant characteristic by cause of infant death were statistically significant ($p < 0.05$). Drug-involved infant deaths were excluded from infant deaths from all other causes.

SOURCES: National Center for Health Statistics, National Vital Statistics System, drug-involved mortality file and linked birth/infant death file.

Table 3. Drug-involved infant deaths, by drug type and type of drug involvement: United States, 2015–2017

Drug type	Type of drug involvement[1]					
	Underlying cause of death		Contributing cause of death		Total	
	Percent	Number	Percent	Number	Percent	Number
No specific drug mention	23.4	26	76.6	85	100.0	111
Opioids[2]	52.5	42	47.5	38	100.0	80
Opioid treatment	53.8	21	*	18	100.0	39
Psychostimulants:						
Methamphetamine	36.4	56	63.6	98	100.0	154
Cocaine	37.2	29	62.8	49	100.0	78
Cannabis or cannabinoids	*	6	*	18	*	24
Benzodiazepines	*	5	*	6	*	11
Hallucinogens	*	–	*	1	*	1
Barbiturates	*	1	*	1	*	2
Other stimulants	*	5	*	7	*	12
Total[3]	36.9	163	63.1	279	100.0	442

* Estimate does not meet National Center for Health Statistics standards of reliability.
– Quantity zero.
[1]Drug involvement was considered the underlying cause of death when the underlying cause of death was P04.4, P04.8–P04.9, P96.1, X40–X44, X85, or Y10–Y14. Drugs were considered a contributing cause of death when drug involvement was mentioned on the death certificate as contributing to the death, but was not the underlying cause of death.
[2]Opioids include fentanyl, heroin, hydrocodone, methadone, morphine, and oxycodone.
[3]Counts add up to more than the total row due to cases with multiple drugs mentioned in the records.

SOURCES: National Center for Health Statistics, National Vital Statistics System, drug-involved mortality file and linked birth/infant death file.

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