NCHS Data Brief ■ No. 294 ■ December 2017

Drug Overdose Deaths in the United States, 1999–2016

Holly Hedegaard, M.D., Margaret Warner, Ph.D., and Arialdi M. Miniño, M.P.H.

Key findings

Data from the National Vital Statistics System, Mortality

- In 2016, there were more than 63,600 drug overdose deaths in the United States.
- The age-adjusted rate of drug overdose deaths in 2016 (19.8 per 100,000) was 21% higher than the rate in 2015 (16.3).
- Among persons aged 15 and over, adults aged 25–34, 35–44, and 45–54 had the highest rates of drug overdose deaths in 2016 at around 35 per 100,000.
- West Virginia (52.0 per 100,000), Ohio (39.1), New Hampshire (39.0), the District of Columbia (38.8), and Pennsylvania (37.9) had the highest observed age-adjusted drug overdose death rates in 2016.
- The age-adjusted rate of drug overdose deaths involving synthetic opioids other than methadone (drugs such as fentanyl, fentanyl analogs, and tramadol) doubled between 2015 and 2016, from 3.1 to 6.2 per 100,000.

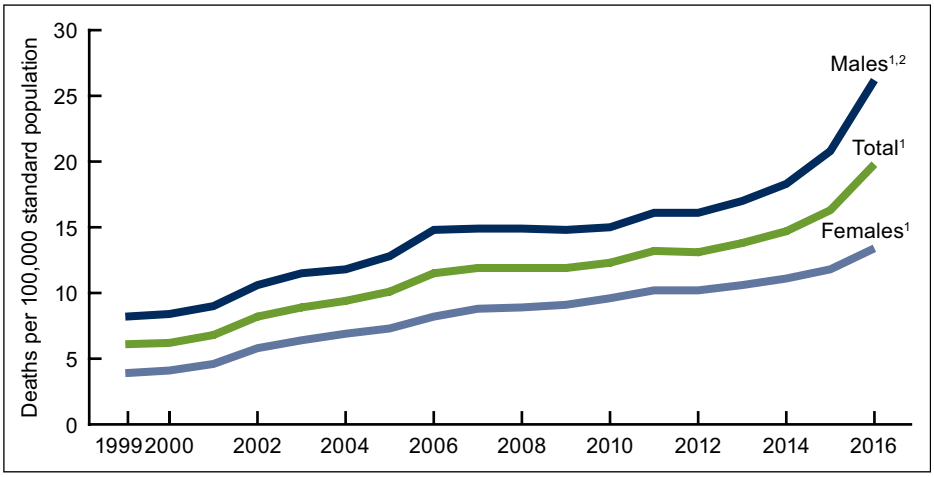
Deaths from drug overdose are an increasing public health burden in the United States (1–4). This report uses the most recent data from the National Vital Statistics System (NVSS) to update trends in drug overdose deaths, describe demographic and geographic patterns, and identify shifts in the types of drugs involved.

Keywords: poisoning • opioids • heroin • National Vital Statistics System Mortality File

In 2016, the age-adjusted rate of drug overdose deaths in the United States was more than three times the rate in 1999.

- In 2016, there were more than 63,600 drug overdose deaths in the United States (Figure 1).
- The age-adjusted rate of drug overdose deaths increased from 6.1 per 100,000 standard population in 1999 to 19.8 in 2016 (Figure 1). The rate

Figure 1. Age-adjusted drug overdose death rates: United States, 1999–2016



[1]Significant increasing trend from 1999 to 2016 with different rates of change over time, $p < 0.001$.
[2]2016 rate for males was significantly higher than for females, $p < 0.001$.
NOTES: Deaths are classified using the *International Classification of Diseases, Tenth Revision*. Drug-poisoning (overdose) deaths are identified using underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. The number of drug overdose deaths in 2016 was 63,632. Access data table for Figure 1 at: https://www.cdc.gov/nchs/data/databriefs/db294_table.pdf#1.
SOURCE: NCHS, National Vital Statistics System, Mortality.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Center for Health Statistics

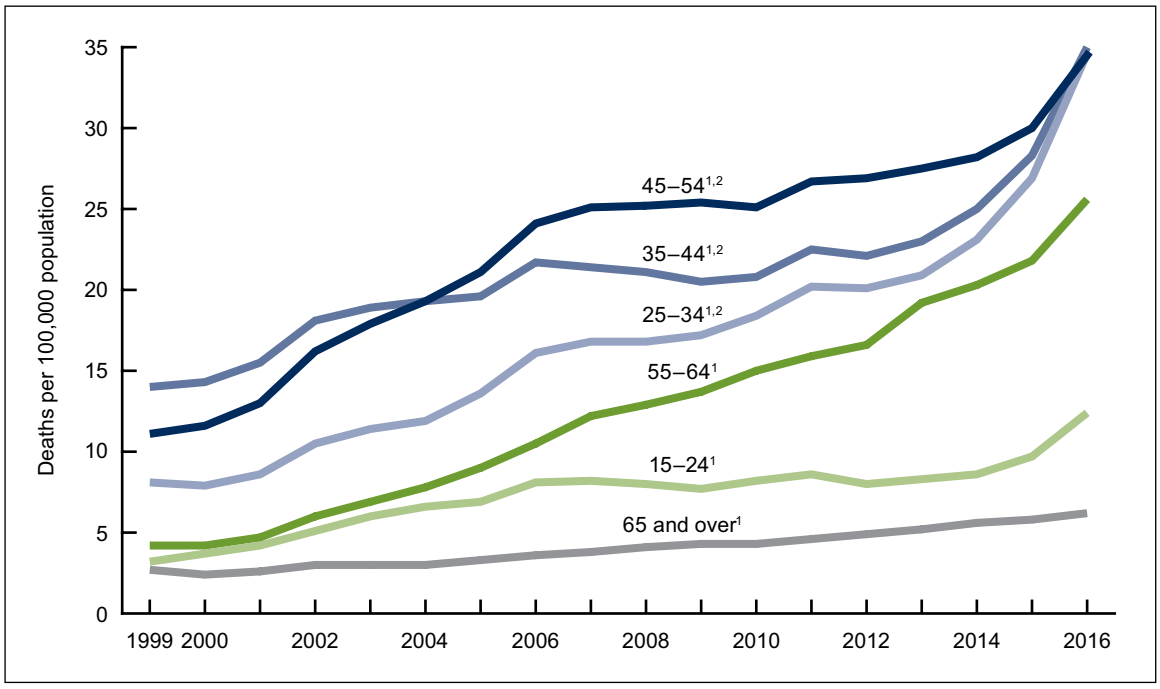
increased on average by 10% per year from 1999 to 2006, by 3% per year from 2006 to 2014, and by 18% per year from 2014 to 2016.

- Rates were significantly higher for males than females. For males, the rate increased from 8.2 in 1999 to 26.2 in 2016. For females, the rate increased from 3.9 in 1999 to 13.4 in 2016.

Among persons aged 15 and over, adults aged 25–34, 35–44, and 45–54 had the highest rates of drug overdose deaths in 2016.

- The rates of drug overdose deaths increased from 1999 to 2016 for all age groups studied (Figure 2).
- Rates in 2016 were highest for persons aged 25–34 (34.6 per 100,000), 35–44 (35.0), and 45–54 (34.5).
- From 2015 to 2016, the greatest percentage increase in the drug overdose death rates occurred among adults aged 15–24, 25–34, and 35–44 with increases of 28%, 29%, and 24%, respectively.
- From 2015 to 2016, the drug overdose death rates for adults aged 45–54, 55–64, and 65 and over increased 15%, 17%, and 7% respectively.

Figure 2. Drug overdose death rates, by selected age group: United States, 1999–2016

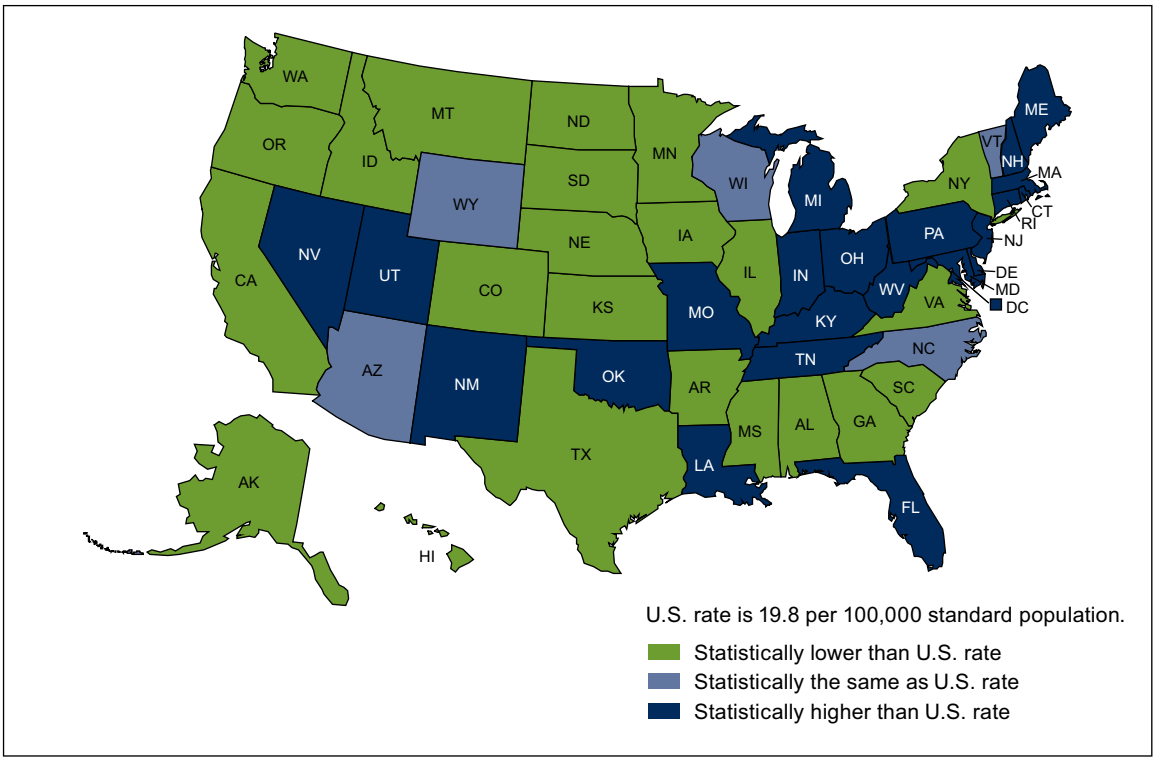


[1]Significant increasing trend from 1999 to 2016 with different rates of change over time, $p < 0.005$.
[2]2016 rate was significantly higher than for the rate for age groups 15–24, 55–64, and 65 and over, $p < 0.05$.
NOTES: Deaths are classified using the *International Classification of Diseases*, Tenth Revision. Drug-poisoning (overdose) deaths are identified using underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Access data table for Figure 2 at: https://www.cdc.gov/nchs/data/databriefs/db294_table.pdf#2.
SOURCE: NCHS, National Vital Statistics System, Mortality.

In 2016, 22 states and the District of Columbia had age-adjusted drug overdose death rates that were statistically higher than the national rate.

- 22 states and the District of Columbia had drug overdose death rates that were higher than the national rate (19.8 per 100,000); 5 states had rates that were comparable to the national rate; and 23 states had lower rates (Figure 3).
- West Virginia (52.0), Ohio (39.1), New Hampshire (39.0), and Pennsylvania (37.9) were the four states with the highest observed age-adjusted drug overdose death rates. The District of Columbia had a rate of 38.8 per 100,000.
- Iowa (10.6), North Dakota (10.6), Texas (10.1), South Dakota (8.4), and Nebraska (6.4) were the five states with the lowest observed age-adjusted drug overdose death rates.

Figure 3. Age-adjusted drug overdose death rates, by state: United States, 2016

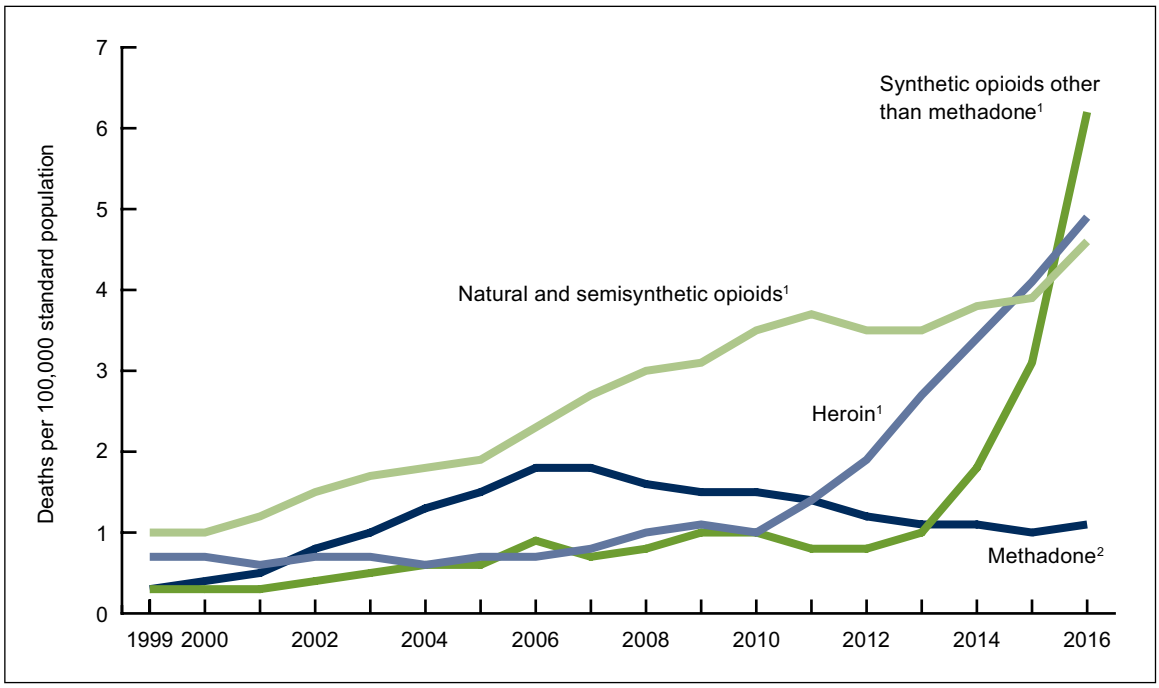


NOTES: Deaths are classified using the *International Classification of Diseases, Tenth Revision*. Drug-poisoning (overdose) deaths are identified using underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Access data table for Figure 3 at: https://www.cdc.gov/nchs/data/databriefs/db294_table.pdf#3.
SOURCE: NCHS, National Vital Statistics System, Mortality.

The age-adjusted rate of drug overdose deaths involving synthetic opioids other than methadone doubled from 2015 to 2016.

- The rate of drug overdose deaths involving synthetic opioids other than methadone, which include drugs such as fentanyl, fentanyl analogs, and tramadol, increased from 0.3 per 100,000 in 1999 to 1.0 in 2013, 1.8 in 2014, 3.1 in 2015, and 6.2 in 2016 (Figure 4). The rate increased on average by 18% per year from 1999 to 2006, did not statistically change from 2006 to 2013, then increased by 88% per year from 2013 to 2016.
- The rate of drug overdose deaths involving heroin increased from 0.7 in 1999, to 1.0 in 2010, to 4.9 in 2016. The rate was steady from 1999 to 2005, then increased on average by 10% per year from 2005 to 2010, by 33% per year from 2010 to 2014, and by 19% from 2014 to 2016.
- The rate of drug overdose deaths involving natural and semisynthetic opioids, which include drugs such as oxycodone and hydrocodone, increased from 1.0 in 1999 to 4.4 in 2016. The rate increased on average by 13% per year from 1999 to 2009 and by 3% per year from 2009 to 2016.
- The rate of drug overdose deaths involving methadone increased from 0.3 in 1999 to 1.8 in 2006, then declined to 1.0 in 2016.

Figure 4. Age-adjusted drug overdose death rates, by opioid category: United States, 1999–2016



[1]Significant increasing trend from 1999 to 2016 with different rates of change over time, $p < 0.05$.
[2]Significant increasing trend from 1999 to 2006, then decreasing trend from 2006 to 2016, $p < 0.05$.
NOTES: Deaths are classified using the *International Classification of Diseases, Tenth Revision*. Drug-poisoning (overdose) deaths are identified using underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Drug overdose deaths involving selected drug categories are identified by specific multiple-cause-of-death codes: heroin, T40.1; natural and semisynthetic opioids, T40.2; methadone, T40.3; and synthetic opioids other than methadone, T40.4. Deaths involving more than one opioid category (e.g., a death involving both methadone and a natural or semisynthetic opioid) are counted in both categories. The percentage of drug overdose deaths that identified the specific drugs involved varied by year, with ranges of 75%–79% from 1999 to 2013, and 81%–85% from 2014 to 2016. Access data table for Figure 4 at: https://www.cdc.gov/nchs/data/databriefs/db294_table.pdf#4.
SOURCE: NCHS, National Vital Statistics System, Mortality.

Summary

This report updates statistics on deaths from drug overdoses in the United States and includes information on trends since 1999 as well as key findings for 2016.

The rates of drug overdose deaths continued to increase. In 2016, the age-adjusted rate of drug overdose deaths (19.8 per 100,000) was more than three times the rate in 1999 (6.1). Rates increased for both males (from 8.2 in 1999 to 26.2 in 2016) and females (from 3.9 in 1999 to 13.4 in 2016). Rates also increased for all age groups studied. In 2016, among persons aged 15 and over, rates were highest for adults aged 25–34, 35–44, and 45–54, at about 35 per 100,000. From 2015 to 2016, drug overdose death rates increased 28% for persons aged 15–24, 29% for persons aged 25–34, 24% for persons aged 35–44, 15% for persons aged 45–54, 17% for persons aged 55–64, and 7% for persons aged 65 and over. In 2016, 22 states and the District of Columbia had age-adjusted drug overdose death rates that were statistically higher than the national rate; 5 states had rates that were comparable to the national rate; and 23 states had lower rates.

The pattern of drugs involved in drug overdose deaths has changed in recent years. The rate of drug overdose deaths involving synthetic opioids other than methadone (drugs such as fentanyl, fentanyl analogs, and tramadol) doubled in a single year from 3.1 per 100,000 in 2015 to 6.2 in 2016. Rates of drug overdose deaths involving heroin increased from 4.1 in 2015 to 4.9 in 2016. Rates of drug overdose deaths involving natural and semisynthetic opioids increased from 3.9 in 2015 to 4.4 in 2016.

Definitions

Drug poisoning (overdose) deaths: Includes deaths resulting from unintentional or intentional overdose of a drug, being given the wrong drug, taking a drug in error, or taking a drug inadvertently.

Natural and semisynthetic opioids: Includes such drugs as morphine, codeine, hydrocodone, and oxycodone.

Synthetic opioids other than methadone: Includes such drugs as fentanyl, fentanyl analogs, and tramadol.

Data source and methods

Estimates are based on the NVSS multiple-cause-of-death mortality files (5). Drug poisoning (overdose) deaths were defined as having an *International Classification of Diseases, Tenth Revision* (ICD–10) underlying-cause-of-death code of X40–X44 (unintentional), X60–X64 (suicide), X85 (homicide), or Y10–Y14 (undetermined intent). Of the drug overdose deaths in 2016, 86% were unintentional, 8% were suicides, 6% were of undetermined intent, and less than 1% were homicides. The type of drug(s) involved are indicated by ICD–10 multiple-cause-of-death codes: heroin (T40.1), natural and semisynthetic opioids (T40.2), methadone (T40.3), and synthetic opioids other than methadone (T40.4).

Age-adjusted death rates were calculated using the direct method and adjusted to the 2000 standard population (6). Differences between national and state estimates were evaluated using two-sided significance tests at the 0.01 level, with the national rate treated as a fixed parameter. Trends in death rates were evaluated using the Joinpoint Regression Program (7). Unless otherwise stated, all comparisons described are statistically significant at the 0.05 level of significance.

Several factors related to death investigation and reporting may affect measurement of death rates involving specific drugs. At autopsy, the substances tested for and the circumstances under which the toxicology tests are performed vary by jurisdiction. This variability is likely to affect substance-specific death rates more than the overall drug overdose death rate. The percentage of drug overdose deaths that identified the specific drugs involved varied by year, with ranges of 75%–79% from 1999 to 2013, and 81%–85% from 2014 to 2016.

Additionally, drug overdose deaths may involve multiple drugs; therefore, a single death might be included in more than one category when describing the rate of drug overdose deaths involving specific drugs. For example, a death that involved both heroin and fentanyl would be included in both the rate of drug overdose deaths involving heroin and the rate of drug overdose deaths involving synthetic opioids other than methadone.

About the authors

Holly Hedegaard is with the National Center for Health Statistics (NCHS), Office of Analysis and Epidemiology. Margaret Warner and Arialdi M. Miniño are with the NCHS Division of Vital Statistics.

References

1. Hedegaard H, Warner M, Miniño AM. Drug overdose deaths in the United States, 1999–2015. NCHS data brief, no 273. Hyattsville, MD: National Center for Health Statistics. 2017. Available from: https://www.cdc.gov/nchs/data/databriefs/db273.pdf.

2. Warner M, Chen LH, Makuc DM, Anderson RN, Miniño AM. Drug poisoning deaths in the United States, 1980–2008. NCHS data brief, no 81. Hyattsville, MD: National Center for Health Statistics. 2011. Available from: https://www.cdc.gov/nchs/products/databriefs/db81.htm.

3. Hedegaard H, Chen LH, Warner M. Drug-poisoning deaths involving heroin: United States, 2000–2013. NCHS data brief, no 190. Hyattsville, MD: National Center for Health Statistics. 2015. Available from: https://www.cdc.gov/nchs/products/databriefs/db190.htm.

4. Rudd RA, Seth P, David F, Scholl L. Increases in drug and opioid-involved overdose deaths—United States, 2010–2015. MMWR Morb Mortal Wkly Rep 65:1445–52. 2016. Available from: https://www.cdc.gov/mmwr/volumes/65/wr/mm655051e1.htm.

5. National Center for Health Statistics. National Vital Statistics System. Mortality multiple cause of death files. 1999–2016. Available from: https://www.cdc.gov/nchs/nvss/dvs_data_release.htm.

6. Murphy SL, Xu JQ, Kochanek KD, Curtin SC, Arias E. Deaths: Final data for 2015. National Vital Statistics Reports; vol 66 no 6. Hyattsville, MD: National Center for Health Statistics. 2017. Available from: https://www.cdc.gov/nchs/data/nvsr/nvsr66/nvsr66_06.pdf.

7. National Cancer Institute. Joinpoint Regression Program (Version 4.3.1.0) [computer software]. 2016.

U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES

Centers for Disease Control and Prevention
National Center for Health Statistics
3311 Toledo Road, Room 4551, MS P08
Hyattsville, MD 20782–2064

For more NCHS Data Briefs, visit:
https://www.cdc.gov/nchs/products/databriefs.htm.

NCHS Data Brief ■ No. 294 ■ December 2017

Suggested citation

Hedegaard H, Warner M, Miniño AM. Drug overdose deaths in the United States, 1999–2016. NCHS Data Brief, no 294. Hyattsville, MD: National Center for Health Statistics. 2017.

Copyright information

National Center for Health Statistics

For e-mail updates on NCHS publication releases, subscribe online at:
https://www.cdc.gov/nchs/govdelivery.htm.

For questions or general information about NCHS:
Tel: 1–800–CDC–INFO (1–800–232–4636)
TTY: 1–888–232–6348
Internet: https://www.cdc.gov/nchs
Online request form: https://www.cdc.gov/info

ISSN 1941–4927 Print ed.
ISSN 1941–4935 Online ed.
DHHS Publication No. 2018–1209
CS287423