

# Urban–rural Differences in Suicide Rates, by Sex and Three Leading Methods: United States, 2000–2018

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## Key findings

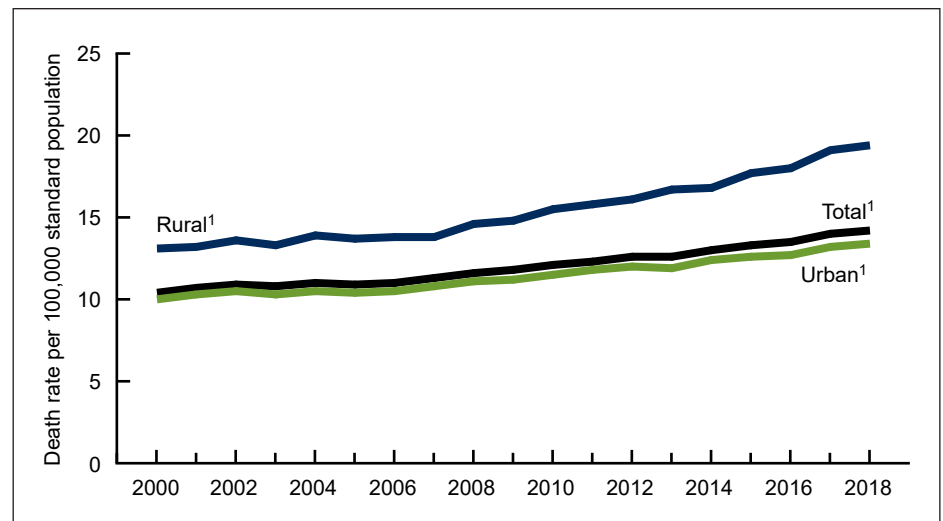
### Data from the National Vital Statistics System, Mortality

- Suicide rates for urban and rural areas increased overall from 2000 through 2018, with the pace of increase greater for rural suicide rates, compared with urban, after 2007.
- In 2018, the rural male suicide rate (30.7 per 100,000) was higher than the urban male suicide rate (21.5); the rural rate for females (8.0) was higher than the urban rate (5.9).
- Over the period 2000–2018, the rural male suffocation-related suicide rate more than doubled (3.7 compared with 8.8), and in 2018, the rural male firearm-related suicide rate (18.7) was 63% higher than the urban male firearm-related suicide rate (11.5).
- Over the period of 2000–2018, the rural female suffocation-related suicide rate more than quadrupled (0.5 compared with 2.4), and firearms remained the leading method of suicide in rural females.

Suicide has remained the 10th leading cause of death in the United States since 2008, with deaths due to firearms, suffocation (including hangings), and poisoning representing the leading methods of suicide (1,2). There are known differences in suicide rates by sex and geographic distribution (3). This report uses final mortality data from the National Vital Statistics System to present trends in suicide mortality from 2000 through 2018 among all ages by urban–rural classification of the decedent’s county of residence and sex for the leading methods of suicide—firearms, suffocation, and poisoning.

**From 2000 through 2018, rural suicide rates were higher than urban suicide rates, and the difference increased over the period.**

Figure 1. Age-adjusted suicide rates, by urban–rural status: United States, 2000–2018



<sup>1</sup>Significant increasing trend from 2000 through 2018, with different rates of change over time;  $p < 0.05$ .  
 NOTES: Suicides in all ages are identified using the *International Classification of Diseases, 10th Revision* underlying cause-of-death codes U03, X60–X84, and Y87.0. Age-adjusted death rates are calculated using the direct method and the 2000 U.S. standard population. Classification of the decedent’s county of residence is based on the 2013 NCHS Urban–Rural Classification Scheme for Counties, available from: [https://www.cdc.gov/nchs/data/series/sr\\_02/sr02\\_166.pdf](https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf). Access data table for Figure 1 at: <https://www.cdc.gov/nchs/data/databriefs/db373-tables-508.pdf#1>.  
 SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality.



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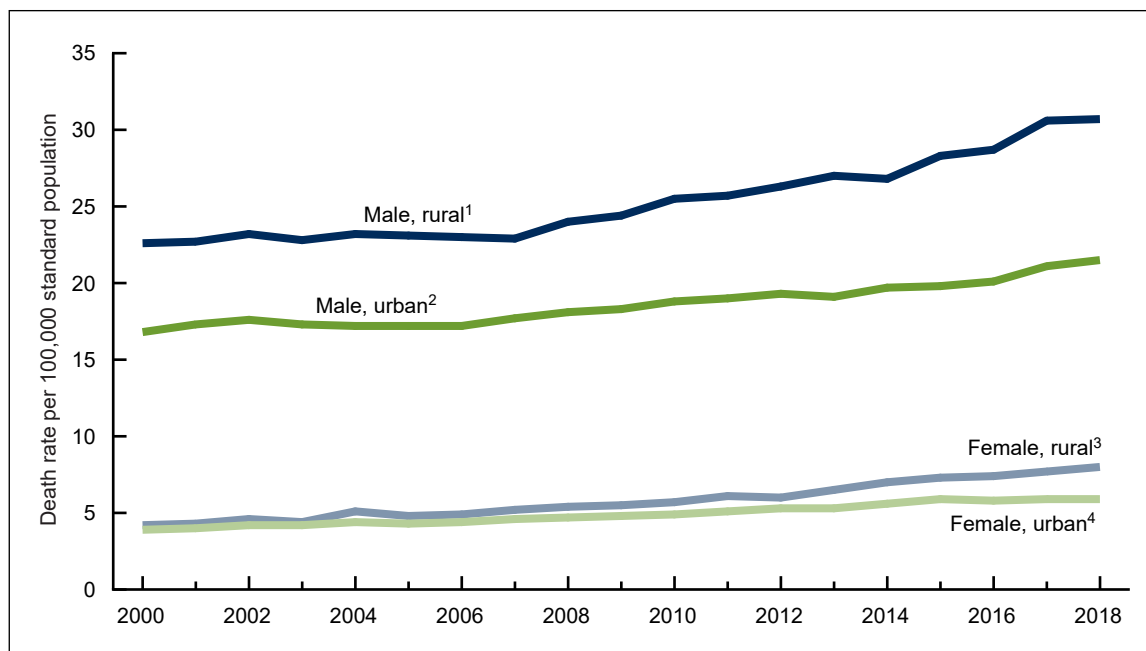


- Rural suicide rates increased 48% from 2000 (13.1 per 100,000) through 2018 (19.4), with greater annual percentage increases after 2007 (1% annually from 2000 to 2007; 3% annually from 2007 through 2018) (Figure 1).
- Urban suicide rates increased 34% from 2000 (10.0) through 2018 (13.4), with greater annual percentage increases after 2006 (1% annually from 2000 to 2006; 2% annually from 2006 through 2018).

**For both males and females, the difference in suicide rates between rural and urban areas widened over the 2000 through 2018 period.**

- For males, rural suicide rates remained stable from 2000 to 2007, then increased 34% from 2007 (22.9 per 100,000) through 2018 (30.7), while urban suicide rates increased 17% between 2006 (17.2) and 2016 (20.1), and then did not change significantly through 2018 (21.5) (Figure 2).
- For females, rural suicide rates nearly doubled over the 2000 through 2018 period (from 4.2 to 8.0), whereas urban suicide rates increased 51% from 2000 through 2015 (from 3.9 to 5.9), and then remained stable.
- In both urban and rural areas, suicide rates for males were higher than for females; in urban areas, the male rate in 2018 was 3.6 times higher than the female rate (21.5 compared with 5.9), and in rural areas, was 3.8 times higher (30.7 compared with 8.0).

Figure 2. Age-adjusted suicide rates, by sex and urban–rural status: United States, 2000–2018



<sup>1</sup>Stable trend from 2000 to 2007; significant increasing trend from 2007 through 2018;  $p < 0.05$ .

<sup>2</sup>Stable trend from 2000 to 2005; significant increasing trend from 2005 to 2016; stable trend from 2016 through 2018;  $p < 0.05$ .

<sup>3</sup>Significant increasing trend from 2000 through 2018;  $p < 0.05$ .

<sup>4</sup>Significant increasing trend from 2000 to 2015, with different rates of change over time; stable trend from 2015 through 2018,  $p < 0.05$ .

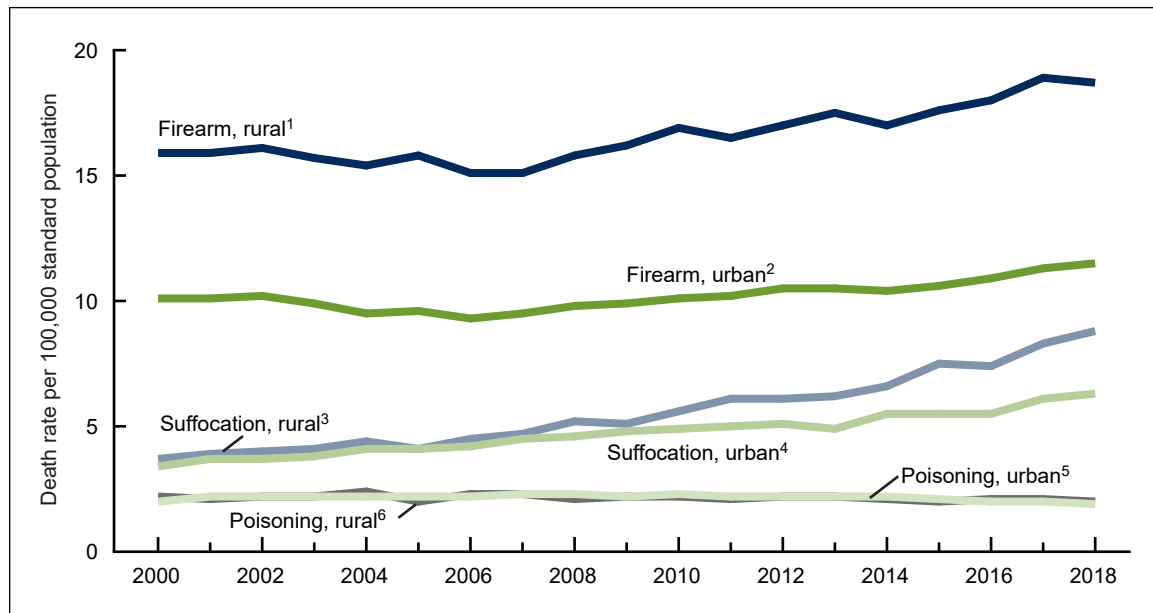
NOTES: Suicides in all ages are identified using the *International Classification of Diseases, 10th Revision* underlying cause-of-death codes U03, X60–X84, and Y87.0. Age-adjusted death rates are calculated using the direct method and the 2000 U.S. standard population. Classification of the decedent's county of residence is based on the 2013 NCHS Urban–Rural Classification Scheme for Counties, available from: [https://www.cdc.gov/nchs/data/series/sr\\_02/sr02\\_166.pdf](https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf). Access data table for Figure 2 at: <https://www.cdc.gov/nchs/data/databriefs/db373-tables-508.pdf#2>.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality.

**For males, rural firearm-related suicides rates remained higher than urban rates over the 2000 through 2018 period, while suffocation-related suicide rates increased the most in both urban and rural areas.**

- For males, firearms were the leading method in both rural and urban areas, with rates in both areas increasing 24% from 2006 through 2018 (15.1 per 100,000 compared with 18.7 for rural; 9.3 compared with 11.5 for urban) (Figure 3).
- Suffocation-related suicide rates for males in both rural and urban areas increased steadily over the 2000–2018 period, more than doubling in rural areas (3.7 compared with 8.8) and increasing 85% in urban areas (3.4 compared with 6.3).
- Poisoning-related suicide rates for males were similar in rural and urban areas and decreased from 2000 through 2018 in rural areas (2.2 compared with 2.0) and from 2010 through 2018 in urban areas (2.3 compared with 1.9).
- In 2000, the firearm-related suicide rate for rural males was 57% higher than the urban rate (15.9 compared with 10.1), and this difference increased to 63% in 2018 (18.7 compared with 11.5).

Figure 3. Age-adjusted suicide rates among males, by leading method and urban–rural status: United States, 2000–2018

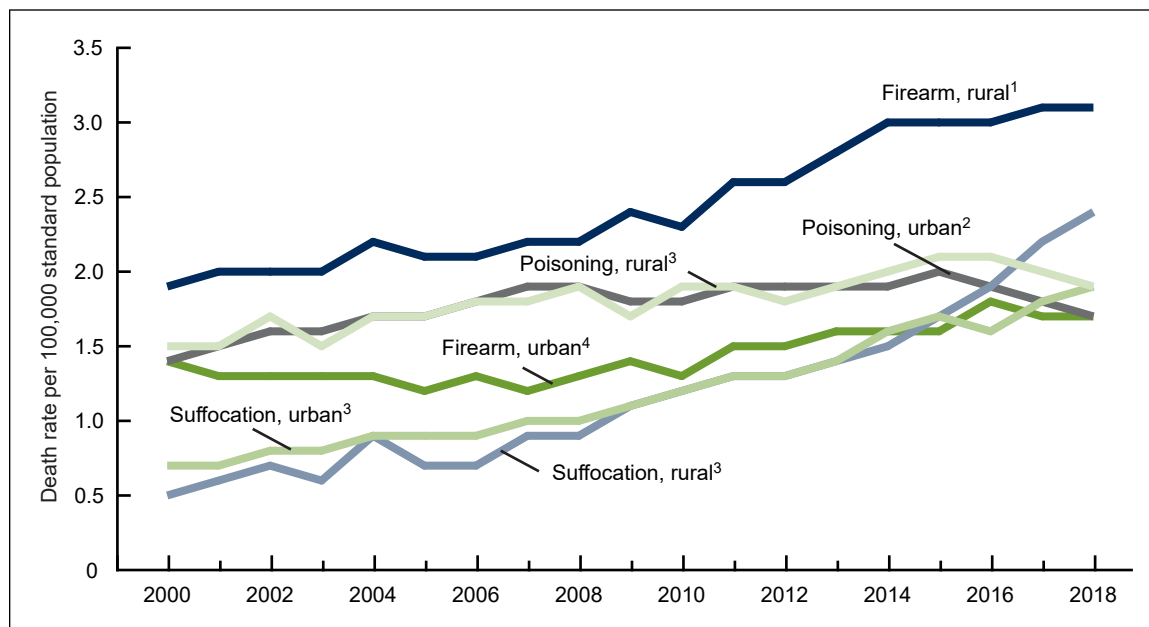


<sup>1</sup>Stable trend from 2000 to 2006; significant increasing trend from 2006 through 2018;  $p < 0.05$ .  
<sup>2</sup>Significant decreasing trend from 2000 to 2006; significant increasing trend from 2006 through 2018;  $p < 0.05$ .  
<sup>3</sup>Significant increasing trend from 2000 through 2018, with different rates of change over time;  $p < 0.05$ .  
<sup>4</sup>Significant increasing trend from 2000 through 2018;  $p < 0.05$ .  
<sup>5</sup>Significant increasing trend from 2000 to 2010; significant decreasing trend from 2010 through 2018;  $p < 0.05$ .  
<sup>6</sup>Significant decreasing trend from 2000 through 2018;  $p < 0.05$ .  
 NOTES: Suicides in all ages are identified using the *International Classification of Diseases, 10th Revision* underlying cause-of-death codes U03, X60–X84, and Y87.0. Age-adjusted death rates are calculated using the direct method and the 2000 U.S. standard population. Classification of the decedent's county of residence is based on the 2013 NCHS Urban–Rural Classification Scheme for Counties, available from: [https://www.cdc.gov/nchs/data/series/sr\\_02/sr02\\_166.pdf](https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf). Access data table for Figure 3 at: <https://www.cdc.gov/nchs/data/databriefs/db373-tables-508.pdf#3>.  
 SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality.

**For females, rural firearm-related suicide rates remained higher than urban rates over the 2000 through 2018 period, while suffocation rates in rural areas experienced the highest rate of increase.**

- For females in rural areas, firearms were the leading method of suicide and increased 58% from 2000 (1.9 per 100,000) through 2014 (3.0), and then remained stable through 2018. For females in urban areas, firearm-related suicide increased 42% from 2005 (1.2) through 2018 (1.7) (Figure 4).
- Rural suffocation-related suicide rates for females increased steadily over the period and were more than 4 times higher in 2018 (2.4) than in 2000 (0.5). Urban suffocation-related suicide rates more than doubled from 2000 (0.7) through 2018 (1.9) and passed poisoning to become the leading method in urban areas in 2018.
- While rural and urban female poisoning-related suicide rates were similar and increased from 2000 through 2015, the rate in urban areas declined 15% between 2015 (2.0) and 2018 (1.7). The observed decline in rural areas from 2016 through 2018 was not statistically significant.

Figure 4. Age-adjusted suicide rates among females, by leading method and urban–rural status: United States, 2000–2018



<sup>1</sup>Significant increasing trend from 2000 to 2014, with different rates of change over time; stable trend from 2014 through 2018;  $p < 0.05$ .  
<sup>2</sup>Significant increasing trend from 2000 to 2016, with different rates of change over time; significant decreasing trend from 2016 through 2018;  $p < 0.05$ .  
<sup>3</sup>Significant increasing trend from 2000 through 2018;  $p < 0.05$ .  
<sup>4</sup>Significant decreasing trend from 2000 to 2006; significant increasing trend from 2006 through 2018;  $p < 0.05$ .  
 NOTES: Suicides in all ages are identified using the *International Classification of Diseases, 10th Revision* underlying cause-of-death codes U03, X60–X84, and Y87.0. Age-adjusted death rates are calculated using the direct method and the 2000 U.S. standard population. Classification of the decedent's county of residence is based on the 2013 NCHS Urban–Rural Classification Scheme for Counties, available from: [https://www.cdc.gov/nchs/data/series/sr\\_02/sr02\\_166.pdf](https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf). Access data table for Figure 4 at: <https://www.cdc.gov/nchs/data/databriefs/db373-tables-508.pdf#4>.  
 SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality.

## Summary

In 2018, suicide was the 10th leading cause of death (4). Sex and urban–rural disparities in methods of suicide may inform targeted suicide prevention strategies. From 2000 through 2018, differences in suicide rates between rural and urban areas increased. Rural suicide rates increased 48% from 2000 through 2018 compared with a 34% urban rate increase. In rural and urban areas, suicide rates for males remained higher than for females. The rural male suicide rate was 3.8 times higher than the female rate in 2018, and the urban male suicide rate was 3.6 times higher than the female rate. The rural male suicide rate increased 34% from 2007 through 2018 compared with a 17% urban rate increase. The rural female suicide rate nearly doubled from 2000 through 2018 compared with a 51% urban rate increase.

Of the three leading methods of suicide, firearm-related suicide remained the leading method in 2018 among rural males and females (2). The rural firearm-related suicide rate was 63% higher than the urban rate for males and 82% higher for females. Over the 2000 through 2018 period, suffocation-related suicides had the greatest rate of increase, more than doubling in rural areas for males and quadrupling in rural areas for females. By 2018, suffocation was the leading method of suicide for females in urban areas. Poisoning-related suicides decreased overall from 2000 through 2018 for males in both urban and rural areas and from 2015 through 2018 for females in urban areas.

## Definitions

Firearms: Includes handguns, rifles, shotguns or other large firearms, or other unspecified firearms.

Poisoning: Includes overdose of medicinal (such as opioids or sedatives) and nonmedicinal substances (such as gases or other toxic materials).

Suffocation: Includes hanging, strangulation, or other means resulting in oxygen deprivation.

## Data source and methods

The National Vital Statistics System's multiple-cause-of-death mortality files for 2000–2018 for all ages were used for the analysis in this report (5). *International Classification of Diseases, 10th Revision* (ICD–10) codes were used to identify suicide deaths: U03, X60–84, and Y87.0. Means of suicide deaths were categorized using the underlying cause-of-death ICD–10 codes: firearms (X72–X74), suffocation (X70), and poisoning (X60–X69). Age-adjusted death rates were calculated using the direct method and the 2000 U.S. standard population (6).

Urban–rural categorization was based on the 2013 NCHS Urban–Rural Classification Scheme for Counties (7). This county-level scheme includes six designations from most urban to most rural: large central metro, large fringe metro, medium metro, small metro, micropolitan, and noncore. For the purposes of this study, urban classification included the four metropolitan categories and rural, the micropolitan and noncore designations. Trends in age-adjusted suicide rates were evaluated using the Joinpoint Regression Program (Version 4.7.0.0) (8). Joinpoint uses a least-squares regression analysis to fit a series of joined lines on a log scale. For this study, the minimum number of joints was zero and the maximum number was three. The level of significance for a change in trend was  $p$  less than or equal to 0.05. Urban-rural rates were compared using a two-sided  $z$  test with a significance level of 0.05.

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## References

1. Hedegaard H, Curtin SC, Warner M. Suicide mortality in the United States, 1999–2017. NCHS Data Brief, no 330. Hyattsville, MD: National Center for Health Statistics. 2018.
2. Hedegaard H, Curtin SC, Warner M. Suicide rates in the United States continue to increase. NCHS Data Brief, no 309. Hyattsville, MD: National Center for Health Statistics. 2018.
3. Ivey-Stephenson AZ, Crosby AE, Jack SPD, Haileyesus T, Kresnow-Sedacca M. Suicide trends among and within urbanization levels by sex, race/ethnicity, age group, and mechanism of death—United States, 2001–2015. *MMWR Surveill Summ* 66(18):1–16. 2017. Available from: <https://www.cdc.gov/mmwr/volumes/66/ss/pdfs/ss6618.pdf>.
4. Centers for Disease Control and Prevention. WISQARS. Ten leading causes of death by age group. Available from: <https://webappa.cdc.gov/sasweb/ncipc/leadcause.html>.
5. National Center for Health Statistics. Mortality multiple cause files. 2018. Available from: [https://www.cdc.gov/nchs/data\\_access/vitalstatsonline.htm#Mortality\\_Multiple](https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm#Mortality_Multiple).
6. Anderson RN, Rosenberg HM. Age standardization of death rates: Implementation of the year 2000 standard. *National Vital Statistics Reports*; vol 47 no 3. Hyattsville, MD: National Center for Health Statistics. 1998.
7. Ingram DD, Franco SJ. 2013 NCHS urban–rural classification scheme for counties. National Center for Health Statistics. *Vital Health Stat* 2(166). 2014.
8. National Cancer Institute. Joinpoint Regression Program (Version 4.3.1.0) [computer software]. 2016.

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