HHS Public Access

Assessing Female Suicide From a Health Equity Viewpoint, U.S. 2004–2018

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Abstract

Introduction: Geographic and urbanization differences in female suicide trends across the U.S. necessitates suicide prevention efforts on the basis of geographic variations. The purpose of this study was to assess female suicide rates by mechanism within Census divisions and by urbanicity to help inform geographically tailored approaches for suicide prevention strategies.

Methods: Data from 2004 to 2018 were obtained from the National Vital Statistics System (analyzed in 2021). Annual counts of female suicides were tabulated for firearm, suffocation, and drug poisoning and stratified by the U.S. Census division and urbanicity. Age-adjusted rates were calculated to describe female suicide incidence by geographic areas and urbanicity. Data were analyzed annually and by 5-year timeframes. Trends in annual female suicide rates by mechanism for 3 urbanization levels were identified using Joinpoint Regression. Annual percent change estimates were calculated for age-adjusted female suicide rates between 2004 and 2018.

Results: Female suicide rates by mechanism were not homogeneous within Census divisions or by urbanization levels. Suicide rates by mechanism across Census divisions within the same urbanization level varied (range=3.38–11.15 [per 100,000 person per year]). From 2014 to 2018 in large metropolitan areas in the northern divisions, rates for suffocation were higher than for firearms and drug poisoning. During the same period, in all urbanization levels in southern divisions, rates for firearms were higher than for suffocation and drug poisoning.

Conclusions: Female suicide mechanisms vary by urbanization level, and this variation differs by region. These results could inform female suicide prevention strategies on the basis of mechanism, urbanization, and geographic region.

INTRODUCTION

In the U.S., suicide ranks in the top 10 causes of death for females aged 10–54 years and can be prevented with strategies incorporating the best available evidence that addresses a range of factors influencing suicide.[1,2] Suicide rates have increased by 33% since 1999, potentially related to factors such as the Great Recession and the opioid overdose epidemic.[3–5] Despite these increases, suicide rates saw a decline for the first time in more than a decade in 2019, with rates declining for both males and females. However, disparities by sex exist. The male suicide rate is >3 times the rate for women in the U.S.[6] Nevertheless, the suicide rate for females increased by approximately 50% from 1999 to 2019, compared with 25% for males during the same time period.[6,7] Because males account for a large majority of suicides in the U.S., studies that look at overall suicide trends tend to reflect what is happening among males, thus overlooking subtler nuances of suicide patterns among females. This study attempts to help address this gap. Describing suicide trends can identify communities and subpopulations at increased risk and aid professionals in tailoring prevention strategies to the needs of these groups.

Literature highlights the increasing suicide burden rural communities experience in comparison with that of their metropolitan counterparts.[3,5,6] These previous findings provide a richer picture of suicide trends by urbanization level in the U.S. In addition, previous research highlights geographic differences in suicide trends by state[4] and county.[8] Suicide rates increased significantly between 1999 and 2016 in 34 states for males and in 43 states for females.[4] The overall rate declined significantly in 5 states from 2018 to 2019.[7] In another report looking at overall suicides, from 2005 to 2015, rates were highest in western U.S. counties, whereas rates were lowest in eastern U.S. counties.[8] These geographic differences in suicide trends show the potential value of tailoring suicide prevention efforts to specific geographic settings.[4,5]

Understanding how people die by suicide or the mechanism used for suicide can help to inform how public health professionals and partners shape suicide prevention strategies. Literature suggests that the mechanisms used for suicide differ by sex,[5,9,10] age,[11,12] and urbanicity.[5] Suicide rates by firearm in rural counties were almost 2 times the rates in metropolitan counties between 2001 and 2015.[5] A better understanding of differences in the mechanism of suicide within and across geographic areas can further inform suicide prevention efforts.

This study adds to the existing literature by identifying health disparities related to the intesection of multiple social and demographic factors. It is well documented that suicide rates differ by race/ethnicity[13,14] and age group,[4] illustrating the important roles these factors play in risk and protection for suicide. Health disparities are differences in health status between people related to social or demographic factors such as race/ethnicity, sex or geographic region.

This study examines suicide rates by mechanism for females within Census divisions and by urbanicity to help inform tailored approaches for suicide prevention strategies. The long-term trend of increasing suicide rates among females warrants further attention to better identify the risk factors, warning signs, and effective prevention strategies for this group. Focusing on females might inform a more gender-sensitive approach to suicide prevention and improve the well-being and health of females. By understanding the mechanisms of suicide for females, levers for change, such as policy and programmatic and behavioral change efforts, can be identified to reduce risk factors and prevent suicide in this population.

To the authors' knowledge, no previous study has described the overlapping and intersectional impact of geographic location and urbanicity on female suicide rates by mechanism. Painting a nuanced picture of suicide trends by geography and urbanicity can help to identify female groups who might be at increased risk for suicide. Applying a health equity lens to epidemiologic data includes identifying the disparities experienced by populations that have been socially, economically, geographically, or environmentally disadvantaged (e.g., gender); focusing on subpopulations who are more at-risk for a given outcome (e.g., females living in rural communities); and highlighting intersecting identities of a population that may increase risks for an outcome (e.g., females living in rural communities in the South).[15] Focusing data analyses on under-resourced communities and groups who experience disadvantage can help to shed light on areas where inequities might be mitigated. This study can help to answer questions about who is disproportionately impacted and inform approaches for suicide prevention efforts.

METHODS

Study Sample

This study is an epidemiologic descriptive analysis using data covering the period 2004–2018 (2018 was the most recent year of data available at the time of analysis) obtained from the National Center for Health Statistics (NCHS) National Vital Statistics System (NVSS). NVSS is an intergovernmental data collection and sharing system for registration of vital life events, such as births and deaths. Deaths are recorded by all 50 states. These data do not involve research on human subjects. The data use agreement was approved by NCHS. IRB approval was not required for this study.

Measures

Annual counts of female suicides were tabulated by mechanism for county groupings defined in the 2013 NCHS 6-level urbanization classification scheme[5,16] and by U.S. Census Bureau divisions. The 6-level classification scheme for counties was collapsed into 3 levels for the current analysis: large metropolitan (including large central metropolitan and large fringe metropolitan counties), small/medium metropolitan (including medium metropolitan and small metropolitan counties), and nonmetropolitan (including micropolitan and noncore counties). The 9 U.S. Census Bureau divisions are defined as follows: New England (CT, ME, MA, NH, RI, VT), Middle Atlantic (NJ, NY, PA), East North Central (IL, IN, MI, OH, WI), West North Central (IA, KS, MN, MO, NE, ND, SD), South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, WV), East South Central (AL, KY, MS, TN), West South Central

(AR, LA, OK, TX), Mountain (AZ, CO, ID, MT, NM, NV, UT, WY), and Pacific (AK, CA, HI, OR, WA).

Suicides by any means were identified on the basis of underlying-cause-of-death codes U03, X60–84, and Y87.0 from the ICD-10. Specific suicide mechanisms considered in this study were firearms (codes X72–X74), suffocation (includes hanging and strangulation; code X70), and drug poisoning (codes X60–X64) because these are the 3 leading mechanisms of suicide in the U.S.[2] Suicides by other means were included in the overall suicide statistics but not included in the reported results by specific mechanism owing to very low rates. Decedents aged <10 years were excluded from this analysis because suicidal intent is difficult to ascertain in young children.[3]

Statistical Analysis

Age-adjusted rates per 100,000 persons per year were calculated across and within Census divisions and (collapsed) levels of urbanization. All rates represent only females and decedents aged 10 years. Accompanying 95% CIs were calculated under the assumption that suicide counts follow a Poisson distribution. Data were analyzed by individual year and by 3 successive 5-year timeframes: 2004–2008, 2009–2013, and 2014–2018. Rates and CIs were calculated using the SAS, version 9.4. Overall trends in annual female suicide rates by firearm, suffocation, and drug poisoning for the 3 urbanization levels were evaluated using Joinpoint Regression (version 4.7.0.0; National Cancer Institute, Bethesda, MD).[17] Annual percentage change (APC) estimates were obtained from the joinpoint analyses to identify and quantify significant changes in female age-adjusted suicide rates during the period 2004–2018. Statistical significance was determined by testing whether each APC estimate was different from zero at the α=0.05 level. For this analysis, a 2-sided *t*-test was employed, which is the default for the Joinpoint Regression program.

RESULTS

Table 1 shows age-adjusted female suicide rate estimates across the 3 successive 5-year periods; by Census division (all mechanisms of suicide combined); by level of urbanization (all mechanisms); and by major specific mechanism, accompanied by 95% CIs characterizing the statistical stability of the estimates. Rates are presented in chronological order from 2004 to 2008, 2009–2013, and 2014–2018 unless otherwise specified and are per 100,000 persons per year. The female suicide rate for all mechanisms combined increased over time in every Census division. For all time periods, the rate was highest in the Mountain Census division (8.32; 9.88; 11.15) and lowest in the Middle Atlantic Census division (3.48; 4.34; 5.35), where the rate was less than half of the rate in the Mountain Census division for all 3 time periods. The suicide rate for all mechanisms combined also increased over time across all urbanization levels and was highest in nonmetropolitan areas (5.91; 6.95; 8.70) across all time periods. By mechanism, firearm (1.63; 1.87; 2.17) and suffocation (1.09; 1.45; 2.01) suicide rates both increased over time, whereas the drug poisoning (1.82; 1.95; 1.94) suicide rate remained at a comparative level across the 3 time periods.

Assessing suicide mechanism by urbanization level, in large metropolitan areas, annual suffocation suicide rates significantly increased from 2004 to 2018 (APC=5.2; $p<0.05$), annual firearm suicide rates significantly increased from 2006 to 2018 (APC=2.6; $p<0.05$), and annual drug poisoning suicide rates significantly increased from 2004 to 2012 (APC=2.1; $p<0.05$) followed by a significant decrease from 2012 to 2018 (APC= −2.4; $p<0.05$) (Appendix Figure 1A, available online). In small/medium metropolitan areas, annual firearm and suffocation suicide rates significantly increased over the duration of the study period (APC=3.5; $p<0.05$ and APC=6.8; $p<0.05$, respectively), whereas annual drug poisoning suicide rates significantly increased from 2004 to 2015 (APC=1.6; $p<0.05$), followed by a nominal (nonsignificant) decrease from 2015 to 2018 (APC= −3.6) (Appendix Figure 1B, available online). In nonmetropolitan areas, annual suicide rates for all the 3 mechanisms increased over time, with suffocation rates showing the steepest relative increase over the duration of the study period (APC=8.9; $p<0.05$) (Appendix Figure 1C, available online).

Assessing suicide mechanism by Census division, differences between divisions within the same urbanization level were evident (Figures 1, 2, and 3). For example, across large metropolitan areas, the suicide rate by mechanism varied by Census division. In the New England Census division, the suffocation suicide rate (2.32) was higher than the drug poisoning (1.70) and firearm (0.42) suicide rates during 2014–2018, whereas in the East South Central Census division, the firearm suicide rate was the highest across all the 3 time periods (2.09, 2.25, 2.57) (Figure 1). In the Mountain Census division, the drug poisoning and firearm suicide rates were high compared with the suffocation suicide rate across all the 3 time periods (drug poisoning: 3.22, 3.42, 3.22; firearm: 2.51, 2.68, 3.18) (Figure 1). The same types of patterns were evident across small/medium metropolitan areas and nonmetro areas, where suicide rates by mechanism varied by Census division (Figures 2 and 3 and Appendix Table 2, available online). For instance, across nonmetropolitan areas in the East South Central, Mountain, South Atlantic, and West South Central Census divisions, the firearm suicide rate was highest during all time periods, whereas different patterns of suicide rates by mechanism occurred in the other divisions across time (Figure 3 and Appendix Table 2, available online).

Focusing on the most recent 5-year period, 2014 −2018, for most northern Census divisions (i.e., New England, Middle Atlantic, East North Central), in large metropolitan areas, female suicide rates by suffocation were highest than the rates of other mechanisms (Appendix Table 1, available online), whereas in the same period for southern Census divisions (i.e., South Atlantic, East South Central, West South Central), across all urbanization levels, firearm suicide rates were highest than the rates for other mechanisms (Appendix Table 1, available online). Rates for specific mechanisms varied by urbanization level for both the Pacific and Mountain Census divisions, with the firearm suicide rate in nonmetropolitan areas of the Mountain division (5.38) the highest across all divisions and urbanization levels (Appendix Table 1, available online).

DISCUSSION

Findings from this study show that female suicide rates by mechanism are not homogeneous within Census divisions or urbanization levels across the U.S. The intersectional lens applied in this study helps to explain how geographic differences impact suicide rates among females. Results showed diverse trends for suicide rates by mechanism across Census divisions within the same urbanization level. Previous literature suggests that a firearm is the most common mechanism for suicide across all urbanization levels in comparison with suffocation and drug poisoning.[5] However, previous findings also show suffocation rates increasing over the period 2001–2015[5] and becoming the leading method of suicide for females in urban areas by 2018.[10] The findings of this study identify the geographic areas, namely the New England, Middle Atlantic, and East North Central Census divisions, showing increasing rates of suffocation seen mostly within large metropolitan areas. Authors also identified large metropolitan areas within certain Census divisions where suicide rates by suffocation were not the highest, such as East South Central and West South Central. In these areas, rates of suicide by firearm were higher than rates by drug poisoning and suffocation. Similarly, in nonmetropolitan areas in the East South Central, Mountain, South Atlantic, and West South Central Census divisions, firearm suicide rates were highest across all time periods. Furthermore, these findings can inform intersectional suicide prevention strategies for areas with higher female suicide rates by certain mechanisms.

Underlying community-level risk factors for suicide, such as social isolation or barriers to health care, might help to explain the differences in suicide rates across geographic areas.[1] These risk factors might reflect social, cultural, and regional differences.[18] Community-level strategies to address various risk factors can help to prevent suicides.[1] For instance, strengthening economic support by improving household financial security, such as through state unemployment benefits, might help to prevent suicide.[19] In addition, strengthening access to and delivery of suicide care by ensuring coverage of mental health conditions in health insurance policies,[20] creating protective environments by reducing access to lethal means among persons at-risk for suicide,[21,22] and promoting connectedness through community engagement[23] can aid in community-wide suicide prevention.[1] Although these strategies are beneficial for all individuals, tailoring strategies by applying female-focused, culturally, and socially appropriate approaches might help to reach those who are at higher risk for suicide, especially in areas with high female suicide rates. Findings by urbanization level show that female suicide rates by suffocation had the steepest relative increase over time across all urbanization levels than firearm and drug poisoning suicide rates. Increased access to information on how to die by suicide available through the Internet or social media might have contributed to the increase in suicide rates by suffocation during the study period.[24] Similarly, a positive association has been observed between overall suicide rates and Internet use.[25] Nevertheless, research suggests that there are multiple reasons for the choice of method, especially accessibility, familiarity, and social acceptability, and choice of method is often influenced by cultural, religious, and social factors.[13,26,27] Future research might be warranted to understand the changes in mechanisms over time, including changes in access.

Female suicide rates by drug poisoning exhibited a relatively modest but statistically significant decrease during 2012–2018 in large metropolitan areas, with the 2018 rate comparable with the 2004 rate. Determining the possible reasons for the decline requires further investigation. It should be noted that annual rates of drug overdose death among females, involving all intents, have increased.[2] Because classifying a death as a suicide is not a straightforward process, some suicides by drug overdose might be misclassified as deaths of undetermined intent, leading to undercounting.[28]

From a gender-sensitive perspective, gender roles, such as females historically assuming caretaker roles, in conjunction with changing social and economic conditions might contribute to increased risk for suicide in females.[29,30] Risk factors such as feeling lonely or less socially connected, substance use, and mental health problems among other factors might have contributed to changes in female suicide rates across different geographic areas and urbanization levels in the U.S.[31,32] Promoting connectedness through community engagement[23] can aid in female suicide prevention, by specifically addressing risk factors.

This study found that female suicides predominantly involve firearms, suffocation, or drug poisoning. The study findings underscore the need for widespread adoption of a comprehensive public health approach to suicide prevention that helps people from becoming suicidal and lessens the immediate and long-term harms of people at increased risk.[1] A comprehensive approach involves multisectoral partnerships (e.g., public health, mental health, social services, schools, families), use of data for decision making, and implementation of strategies with the best available evidence to address the range of factors influencing suicide.[1,4,33] This study focused solely on suicide rates and did not consider suicide attempts; however, historically, the rate of suicide attempts is higher for females than for males.[34] This finding could have different implications for prevention strategies because they relate to females.[35] Although this trend might be changing,[36] additional research could be useful in assessing whether the rate of suicide attempts continues to remain higher among females. Public health professionals and other partners can use the study results to tailor prevention strategies, including counseling about access to lethal means, safe storage, and upstream strategies to prevent people from becoming suicidal.

Understanding localized differences in suicide mechanisms might support suicide prevention efforts through means restriction strategies.[37] Applying an intersectional lens to utilize nuanced data might help to improve tailored programs, policies, and resources for suicide prevention and to highlight the disparities and levers of change to advance health equity.

Limitations

The study findings are subject to at least 3 limitations. First, this analysis did not assess race/ethnicity or age because the sample would be too small for meaningful analysis given the level of stratification by other factors. Previous research has indicated that there are substantial differences in suicide rates among different race/ethnicity and age groups.[4,14] Second, the mechanism of death is dependent on classification by the coroner/medical examiner, and there may be variations in how this is reported.[38] Third, this analysis could reflect an underreporting of suicides because suicides might be undercounted in the NVSS

data.[38] However, more recent evidence suggests that the number of deaths classified as being of undetermined intent has decreased in recent years.[4,12]

CONCLUSIONS

The findings of this study highlight that female suicide mechanisms vary by urbanization level and that such variation differs across Census divisions of the U.S. These results could inform suicide prevention strategies for females on the basis of the intersecting factors of mechanism, urbanization, and geographic region.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGMENTS

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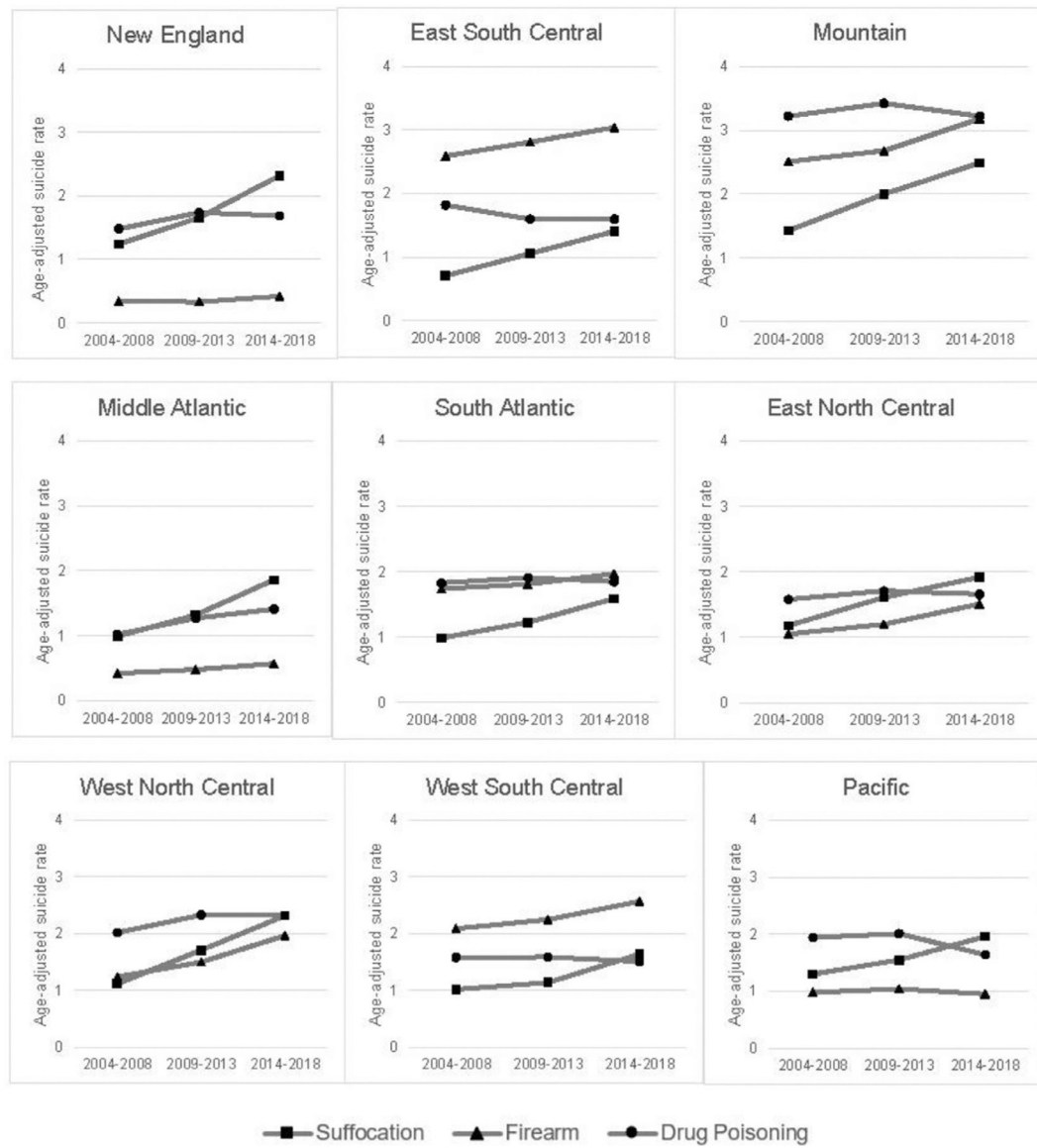
Figure 1.
Age-adjusted female suicide rates[a] by Census divisions[b] in large metropolitans[c] by mechanism,[d] 2004–2018.

[a]Age-adjusted rates per 100,000 person-years were calculated using the direct method and the 2000 U.S. standard population. Only residents aged 10 years were included in the data.
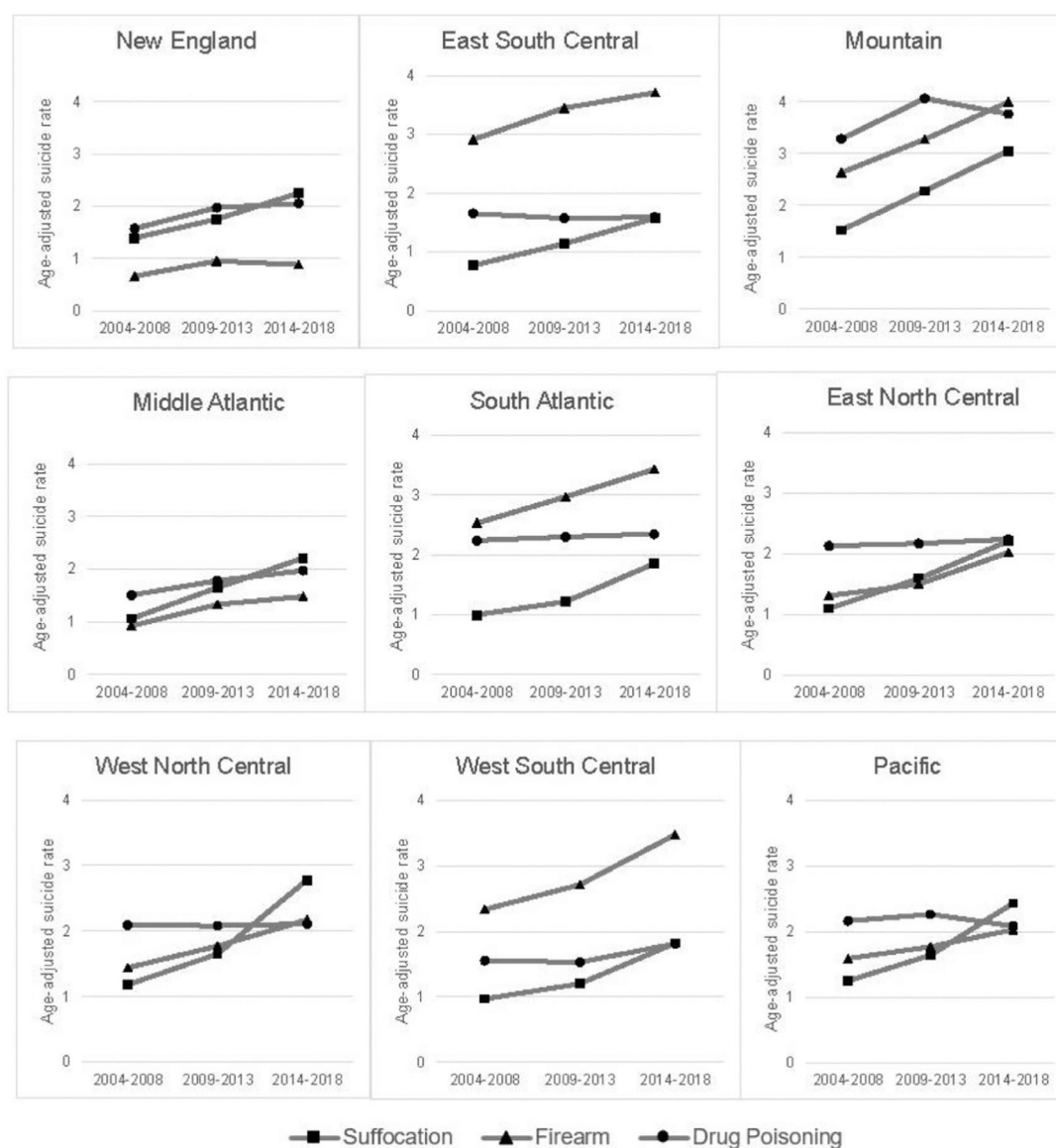
[b]The 9 U.S. Census Bureau divisions are defined as follows: New England (CT, ME, MA, NH, RI, VT), Middle Atlantic (NJ, NY, PA), East North Central (IL, IN, MI, OH, WI), West North Central (IA, KS, MN, MO, NE, ND, SD), South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, WV), East South Central (AL, KY, MS, TN), West South Central (AR, LA, OK, TX), Mountain (AZ, CO, ID, MT, NM, NV, UT, WY), and Pacific (AK, CA, HI, OR, WA).

[c]The 2013 National Center for Health Statistics 6-level urban−rural classification scheme for counties included large central metropolitan (part of a metropolitan statistical area with 1 million population and covers a principal city), large fringe metropolitan (part of

a metropolitan statistical area with 1 million population but does not cover a principal city), medium metropolitan (part of a metropolitan statistical area with 250,000 but <1 million population), small metropolitan (part of a metropolitan statistical area with <250,000 population), micropolitan (nonmetropolitan) (part of a micropolitan statistical area [has an urban cluster of 10,000 but <50,000 population]), and noncore (nonmetropolitan) (not part of a metropolitan or micropolitan statistical area). The 6-level urban−rural classification scheme was collapsed into 3 categories for this analysis. *Urbanization* was defined as large metropolitan (large central metropolitan and large fringe metropolitan), small/ medium metropolitan (medium metropolitan and small metropolitan), and nonmetropolitan (micropolitan and noncore).

[d]Suffocation suicides were identified by the ICD-10 underlying-cause-of-death code X70, firearm suicides were identified by the ICD-10 underlying-cause-of-death codes X72−X74, and drug poisoning suicides were identified by the ICD-10 underlying-cause-of-death codes X60−X64.

AK, Alaska; AL, Alabama; AR, Arkansas; AZ, Arizona; CA, California; CO, Colorado; CT, Connecticut; DC, District of California; DE, Delaware; FL, Florida; GA, Georgia; HI, Hawaii; IA, Iowa; ID, Idaho; IL, Illinois; IN, Indiana; KS, Kansas; KY, Kentucky; LA, Louisiana; MA, Massachusetts; MD, Maryland; ME, Maine; MI, Michigan; MN, Minnesota; MO, Missouri; MS, Mississippi; MT, Montana; NC, North Carolina; ND, North Dakota; NE, Nebraska; NH, New Hampshire; NJ, New Jersey; NM, New Mexico; NV, Nevada; NY, New York; OH, Ohio; OK, Oklahoma; OR, Oregon; PA, Pennsylvania; RI, Rhode Island; SC, South Carolina; SD, South Dakota; TN, Tennessee; TX, Texas; UT, Utah; VA, Virginia; VT, Vermont; WA, Washington; WI, Wisconsin; WV, West Virginia; WY, Wyoming.

Figure 2.

Age-adjusted female suicide rates[a] by Census divisions[b] in small/medium metropolitans[c] by mechanism,[d] 2004–2018.

[a]Age-adjusted rates per 100,000 person-years were calculated using the direct method and the 2000 U.S. standard population. Only residents aged 10 years were included in the data.

[b]The 9 U.S. Census Bureau divisions are defined as follows: New England (CT, ME, MA, NH, RI, VT), Middle Atlantic (NJ, NY, PA), East North Central (IL, IN, MI, OH, WI), West North Central (IA, KS, MN, MO, NE, ND, SD), South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, WV), East South Central (AL, KY, MS, TN), West South Central (AR, LA, OK, TX), Mountain (AZ, CO, ID, MT, NM, NV, UT, WY), and Pacific (AK, CA, HI, OR, WA).
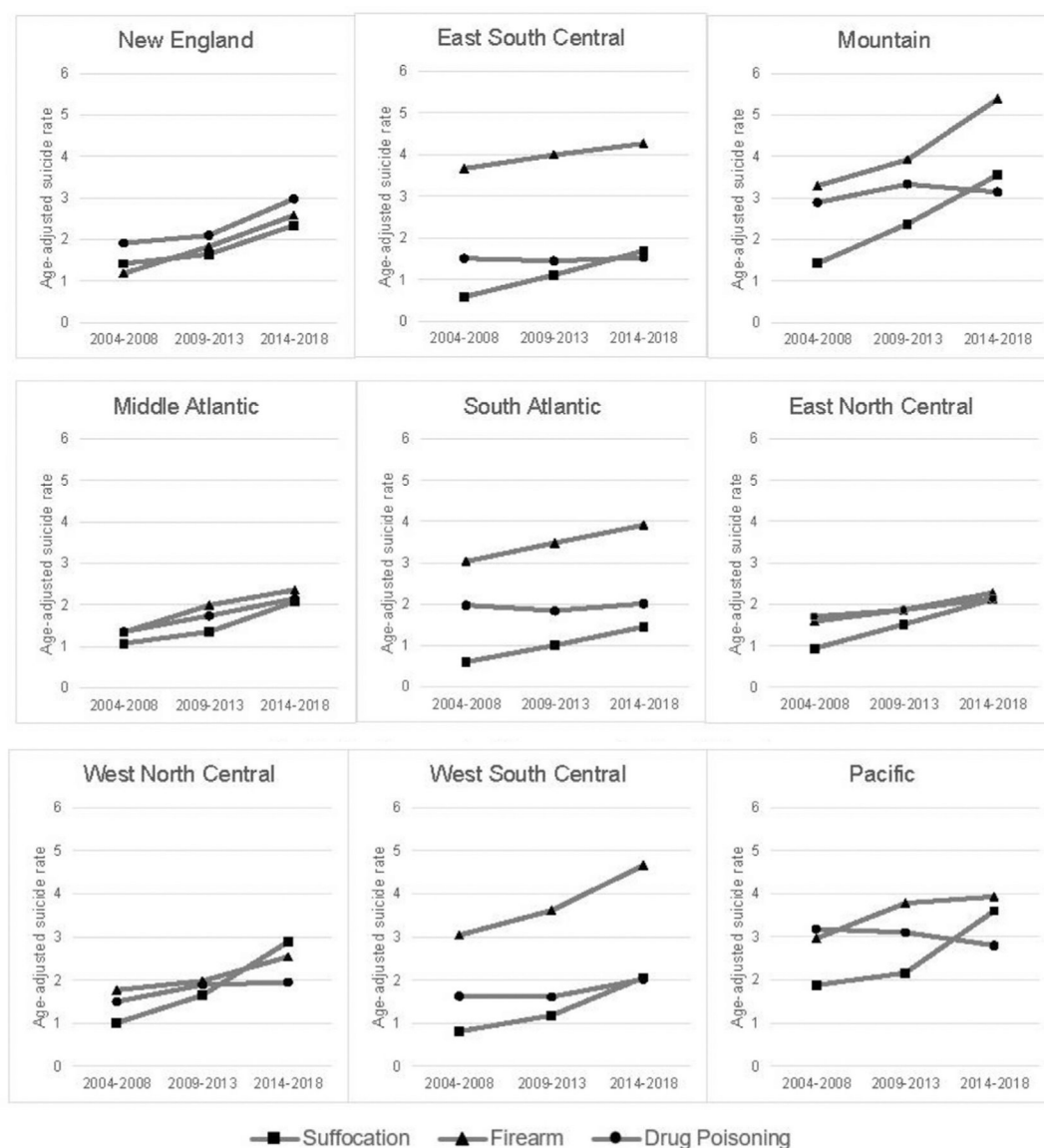
[c]The 2013 National Center for Health Statistics 6-level urban−rural classification scheme for counties included large central metropolitan (part of a metropolitan statistical area with 1 million population and covers a principal city), large fringe metropolitan (part of

a metropolitan statistical area with 1 million population but does not cover a principal city), medium metropolitan (part of a metropolitan statistical area with 250,000 but <1 million population), small metropolitan (part of a metropolitan statistical area with <250,000 population), micropolitan (nonmetropolitan) (part of a micropolitan statistical area has an urban cluster of 10,000 but <50,000 population), and noncore (nonmetropolitan) (not part of a metropolitan or micropolitan statistical area). The 6-level urban−rural classification scheme was collapsed into 3 categories for this analysis. *Urbanization* was defined as large metropolitan (large central metropolitan and large fringe metropolitan), small/ medium metropolitan (medium metropolitan and small metropolitan), and nonmetropolitan (micropolitan and noncore).

[d]Suffocation suicides were identified by the ICD-10 underlying-cause-of-death code X70, firearm suicides were identified by the ICD-10 underlying-cause-of-death codes X72−X74, and drug poisoning suicides were identified by the ICD-10 underlying-cause-of-death codes X60−X64.

AK, Alaska; AL, Alabama; AR, Arkansas; AZ, Arizona; CA, California; CO, Colorado; CT, Connecticut; DC, District of California; DE, Delaware; FL, Florida; GA, Georgia; HI, Hawaii; IA, Iowa; ID, Idaho; IL, Illinois; IN, Indiana; KS, Kansas; KY, Kentucky; LA, Louisiana; MA, Massachusetts; MD, Maryland; ME, Maine; MI, Michigan; MN, Minnesota; MO, Missouri; MS, Mississippi; MT, Montana; NC, North Carolina; ND, North Dakota; NE, Nebraska; NH, New Hampshire; NJ, New Jersey; NM, New Mexico; NV, Nevada; NY, New York; OH, Ohio; OK, Oklahoma; OR, Oregon; PA, Pennsylvania; RI, Rhode Island; SC, South Carolina; SD, South Dakota; TN, Tennessee; TX, Texas; UT, Utah; VA, Virginia; VT, Vermont; WA, Washington; WI, Wisconsin; WV, West Virginia; WY, Wyoming.

Figure 3.
Age-adjusted female suicide rates[a] by Census divisions[b] in nonmetropolitans[c] by mechanism,[d] 2004–2018.

[a]Age-adjusted rates per 100,000 person-years were calculated using the direct method and the 2000 U.S. standard population. Only residents aged 10 years were included in the data.

[b]The 9 U.S. Census Bureau divisions are defined as follows: New England (CT, ME, MA, NH, RI, VT), Middle Atlantic (NJ, NY, PA), East North Central (IL, IN, MI, OH, WI), West North Central (IA, KS, MN, MO, NE, ND, SD), South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, WV), East South Central (AL, KY, MS, TN), West South Central (AR, LA, OK, TX), Mountain (AZ, CO, ID, MT, NM, NV, UT, WY), and Pacific (AK, CA, HI, OR, WA).

[c]The 2013 National Center for Health Statistics 6-level urban−rural classification scheme for counties included large central metropolitan (part of a metropolitan statistical area with 1 million population and covers a principal city), large fringe metropolitan (part of

a metropolitan statistical area with 1 million population but does not cover a principal city), medium metropolitan (part of a metropolitan statistical area with 250,000 but <1 million population), small metropolitan (part of a metropolitan statistical area with <250,000 population), micropolitan (nonmetropolitan) (part of a micropolitan statistical area [has an urban cluster of 10,000 but <50,000 population]), and noncore (nonmetropolitan) (not part of a metropolitan or micropolitan statistical area). The 6-level urban–rural classification scheme was collapsed into 3 categories for this analysis. *Urbanization* was defined as large metropolitan (large central metropolitan and large fringe metropolitan), small/medium metropolitan (medium metropolitan and small metropolitan), and nonmetropolitan (micropolitan and noncore).

dSuffocation suicides were identified by the ICD-10 underlying-cause-of-death code X70, firearm suicides were identified by the ICD-10 underlying-cause-of-death codes X72–X74, and drug poisoning suicides were identified by the ICD-10 underlying-cause-of-death codes X60–X64.

AK, Alaska; AL, Alabama; AR, Arkansas; AZ, Arizona; CA, California; CO, Colorado; CT, Connecticut; DC, District of California; DE, Delaware; FL, Florida; GA, Georgia; HI, Hawaii; IA, Iowa; ID, Idaho; IL, Illinois; IN, Indiana; KS, Kansas; KY, Kentucky; LA, Louisiana; MA, Massachusetts; MD, Maryland; ME, Maine; MI, Michigan; MN, Minnesota; MO, Missouri; MS, Mississippi; MT, Montana; NC, North Carolina; ND, North Dakota; NE, Nebraska; NH, New Hampshire; NJ, New Jersey; NM, New Mexico; NV, Nevada; NY, New York; OH, Ohio; OK, Oklahoma; OR, Oregon; PA, Pennsylvania; RI, Rhode Island; SC, South Carolina; SD, South Dakota; TN, Tennessee; TX, Texas; UT, Utah; VA, Virginia; VT, Vermont; WA, Washington; WI, Wisconsin; WV, West Virginia; WY, Wyoming.

Table 1.

Age-Adjusted Female Suicide Rates by Time Period, Census Division, Urbanization Level, and Mechanism, 2004–2018

Variables Census division [b]	Age-adjusted suicide rate[a] (per 100,000 person-years) (95% CI)			
	2004–2008	2009–2013	2014–2018	
Mountain	8.32 (8.05, 8.59)	9.88 (9.60, 10.17)	11.15 (10.86, 11.45)	
West North Central	5.33 (5.11, 5.55)	6.23 (5.99, 6.47)	7.80 (7.53, 8.06)	
East South Central	5.91 (5.67, 6.16)	6.61 (6.36, 6.86)	7.45 (7.19, 7.72)	
West South Central	5.38 (5.21, 5.55)	5.86 (5.69, 6.03)	7.24 (7.05, 7.42)	
South Atlantic	5.81 (5.68, 5.94)	6.27 (6.14, 6.40)	7.14 (7.00, 7.29)	
East North Central	4.85 (4.72, 4.99)	5.58 (5.43, 5.72)	6.52 (6.36, 6.68)	
Pacific	5.57 (5.42, 5.71)	6.00 (5.86, 6.15)	6.46 (6.31, 6.60)	
New England	4.22 (4.00, 4.45)	5.02 (4.78, 5.27)	6.07 (5.80, 6.34)	
Middle Atlantic	3.48 (3.36, 3.60)	4.34 (4.21, 4.48)	5.35 (5.20, 5.51)	
Urbanization level[c]				
Large metropolitan	4.90 (4.82, 4.97)	5.44 (5.36, 5.51)	6.12 (6.04, 6.20)	
Small/Medium metropolitan	5.85 (5.74, 5.96)	6.74 (6.63, 6.86)	8.05 (7.93, 8.18)	
Nonmetropolitan	5.91 (5.75, 6.06)	6.95 (6.78, 7.12)	8.70 (8.51, 8.89)	
Mechanism[d]				
Firearm	1.63 (1.60, 1.66)	1.87 (1.83, 1.90)	2.17 (2.14, 2.21)	
Suffocation	1.09 (1.06, 1.11)	1.45 (1.42, 1.48)	2.01 (1.98, 2.04)	
Drug poisoning	1.82 (1.79, 1.85)	1.95 (1.92, 1.98)	1.94 (1.90, 1.97)	

AK, Alaska; AL, Alabama; AR, Arkansas; AZ, Arizona; CA, California; CO, Colorado; CT, Connecticut; DC, District of California; DE, Delaware; FL, Florida; GA, Georgia; HI, Hawaii; IA, Iowa; ID, Idaho; IL, Illinois; IN, Indiana; KS, Kansas; KY, Kentucky; LA, Louisiana; MA, Massachusetts; MD, Maryland; ME, Maine; MI, Michigan; MN, Minnesota; MO, Missouri; MS, Mississippi; MT, Montana; NC, North Carolina; ND, North Dakota; NE, Nebraska; NH, New Hampshire; NJ, New Jersey; NM, New Mexico; NV, Nevada; NY, New York; OH, Ohio; OK, Oklahoma; OR, Oregon; PA, Pennsylvania; RI, Rhode Island; SC, South Carolina; SD, South Dakota; TN, Tennessee; TX, Texas; UT, Utah; VA, Virginia; VT, Vermont; WA, Washington; WI, Wisconsin; WV, West Virginia; WY, Wyoming.

[a] Age-adjusted rates per 100,000 person-years were calculated using the direct method and the year 2000 U.S. standard population. Only residents aged ≥10 years were included in the data. Suicide rates include all causes of suicide (except when stratified by specific mechanism) identified by ICD-10 underlying-cause-of-death codes U03, X60–84, and Y87.0.

[b] The 9 U.S. Census Bureau divisions are defined as follows: New England (CT, ME, MA, NH, RI, VT), Middle Atlan4tic (NJ, NY, PA), East North Central (IL, IN, MI, OH, WI), West North Central (IA, KS, MN, MO, NE, ND, SD), South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, WV), East South Central (AL, KY, MS, TN), West South Central (AR, LA, OK, TX), Mountain (AZ, CO, ID, MT, NM, NV, UT, WY), and Pacific (AK, CA, HI, OR, WA).

[c] The 2013 National Center for Health Statistics 6-level urban–rural classification scheme for counties included large central metropolitan (part of a metropolitan statistical area with ≥1 million population and covers a principal city), large fringe metropolitan (part of a metropolitan statistical area with ≥1 million population but does not cover a principal city), medium metropolitan (part of a metropolitan statistical area with ≥250,000 but <1 million population), small metropolitan (part of a metropolitan statistical area with <250,000 population), micropolitan (nonmetropolitan) (part of a micropolitan statistical area [has an urban cluster of ≥10,000 but <50,000 population]), and noncore (nonmetropolitan) (not part of a metropolitan or micropolitan statistical area). The 6-level urban–rural classification scheme was collapsed into 3 categories for this analysis. *Urbanization* was defined as large metropolitan (large central metropolitan and large fringe metropolitan), small/medium metropolitan (medium metropolitan and small metropolitan), and nonmetropolitan (micropolitan and noncore).

[d] Firearm suicides were identified by the ICD-10 underlying-cause-of-death codes X72–X74, suffocation suicides were identified by the ICD-10 underlying-cause-of-death code X70, and drug poisoning suicides were identified by the ICD-10 underlying-cause-of-death codes X60–X64. These 3 specific mechanisms represent the 3 leading causes of suicide but do not cover all suicides.