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Suicide Case-Fatality Rates in the United States, 2007 to 2014

A Nationwide Population-Based Study

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Background: The suicide case-fatality rate (CFR)–the proportion of suicidal acts that are fatal–depends on the distribution of methods used in suicidal acts and the probability of death given a particular method (method-specific CFR).

Objective: To estimate overall and method-specific suicide CFRs and the distribution of methods used in suicidal acts by demographic characteristics.

Design: Cross-sectional study.

Setting: United States, 2007 to 2014.

Participants: Suicide deaths (n = 309 377 records from the National Vital Statistics System) and nonfatal suicide attempts requiring treatment in an emergency department (ED) (n = 1 791 638 records from the Nationwide Emergency Department Sample) or hospitalization (n = 1 556 871 records from the National [Nationwide] Inpatient Sample) among persons aged 5 years or older.

Measurements: Rates of suicide deaths and nonfatal suicide attempts, overall and method-specific CFRs, and distribution of methods used, by sex, age group, region, and urbanization.

Results: Overall, 8.5% of suicidal acts were fatal (14.7% for males vs. 3.3% for females; 3.4% for persons aged 15 to 24 years vs. 35.4% for those aged ≥65 years). Drug poisoning accounted for 59.4% of acts but only 13.5% of deaths; firearms and hanging accounted for only 8.8% of acts but 75.3% of deaths. Firearms were the most lethal method (89.6% of suicidal acts with a firearm resulted in death), followed by drowning (56.4%) and hanging (52.7%). Method-specific CFRs were higher for males and older persons. The distribution of methods varied across demographic groups.

Limitations: Results are based on suicidal acts resulting in an ED visit, a hospitalization, or death. Consequently, the reported CFRs are larger than they would have been had the data included nonfatal attempts that did not result in an ED visit.

Conclusion: Variation in overall suicide CFR between sexes and across age groups, regions, and urbanization is largely explained by the distribution of methods used in suicidal acts.

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In 2017, more than 47 000 persons in the United States died by suicide, making it the 10th leading cause of death (1). Suicide mortality rates increase with age, are higher among males than females, vary widely across states, and are highest in rural areas (1, 2). In contrast, nonfatal suicidal behavior varies less by geographic region, decreases with age, is higher among females, and occurs 10 times more often than suicide death (1, 3–15).

The case-fatality rate (CFR)–the proportion of all suicidal acts that are fatal in a given population–depends on the distribution of methods used and the proportion of acts with a given method that are fatal (method-specific CFR). Variation in method-specific CFRs and the methods used in suicidal acts determine the frequency and distribution of fatal and nonfatal suicidal behavior across demographic groups (16). A recent national study reported that male suicide attempters and attempters aged 45 years or older were roughly 5 times more likely to die by suicide than female attempters and attempters aged 18 to 44 years, respectively (9). However, because the reported suicide CFR was derived from death certificates and the number of people who reported having made an attempt in the National Survey on Drug Use and Health (NSDUH) rather than the number of nonfatal suicide attempts, these findings are not comparable to previous work that defined the CFR as the number of deaths per the number of suicidal acts. Moreover, because NSDUH does not collect information about methods used, method-specific CFRs were not reported.

Of the 3 largest U.S. studies to describe method-specific CFRs, 2 used comprehensive hospital discharge and death certificate data from a subset of states from the 1990s (6, 7). The third used national death certificate data and a small but nationally representative sample of nonfatal injuries treated in emergency departments (EDs) in 2001 from the National Electronic Injury Surveillance System (specifically, 66 hospital EDs for nonfatal nonfirearm injuries and 100 hospital EDs for nonfatal firearm injuries) (8). Results of these studies are broadly consistent: Suicidal acts involving firearms were most likely to be fatal (>80%), followed by those involving hanging (>60%), compared with a CFR less than 3% for drug or poison ingestion and cutting-related acts. All 3 studies found that for every method, CFRs were higher for males. The national study parsed data by method and sex only (8). However, both state-based studies found that for every suicide method, older age was associated with a higher CFR (6, 7).

To our knowledge, the current study is the only national-level U.S. study to describe the distribution of methods used in suicidal acts across demographic groups, calculate method-specific suicide CFRs overall and across demographic groups, and provide information about CFRs by level of urbanization.

Methods

Following prior work (6, 7, 16–18), we refer to intentional self-inflicted injuries, whether fatal or nonfatal, as *suicidal acts*. When the outcome is fatal, we refer to it

as a *suicide death*, and when the outcome is nonfatal, we refer to it as a *nonfatal suicide attempt*.

Data Sources

We used 3 sources to obtain data on suicide deaths and nonfatal suicide attempts in the United States from 2007 to 2014: the Nationwide Emergency Department Sample (NEDS), the National (Nationwide) Inpatient Sample (NIS), and the National Vital Statistics System ("Vital Statistics").

Nationwide Emergency Department Sample

One of several databases developed for the Healthcare Cost and Utilization Project (HCUP), NEDS is the largest publicly available all-payer ED database in the United States, consisting of approximately 30 million discharge records each year. In 2014, the most recent year in our study period, 945 hospitals from 33 states (Arizona, Arkansas, California, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Minnesota, Missouri, Montana, Nebraska, Nevada, New Jersey, New York, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Vermont, Wisconsin, and Wyoming) and the District of Columbia contributed data. The database, which is described fully elsewhere (19), represents a 20% stratified sample of U.S. hospital-owned EDs and captures encounter-level data on all visits that do not result in admission (treat-and-release visits and transfers to other hospitals) as well as discharge-level data on patients seen in the ED and admitted to the same hospital. Federal government hospitals (for example, Department of Veterans Affairs hospitals, military hospitals, and Indian Health Service facilities) are not included. Sample stratification for NEDS is based on 5 hospital characteristics: U.S. Census region, trauma center designation, urban or rural location, ownership, and teaching status.

Discharge records include patient demographic characteristics (such as sex, age, and urban or rural designation of county of residence), patient disposition (for example, died in the ED, transferred to another short-term hospital, or admitted to the same hospital), hospital characteristics (for example, U.S. Census region), and the nature of the visit (for example, International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM] diagnoses and external cause-of-injury codes [E-codes]). Discharge-level weights provided in NEDS allow nationally representative estimation of the number and rate of ED visits.

National (Nationwide) Inpatient Sample

The NIS, which also was developed for HCUP and is described fully elsewhere (20), is the largest publicly available all-payer inpatient database in the United States and contains data on approximately 8 million discharges each year. In 2014, a total of 4411 hospitals in the District of Columbia and all but 6 states (Alabama, Alaska, Delaware, Idaho, Mississippi, and New Hampshire) contributed data. The NIS is designed to provide a 20% stratified sample of hospital discharges from community hospitals, excluding rehabilitation and long-term acute care facilities. Sample stratification in NIS is based on hospital characteristics (U.S. Census division, ownership, urban or rural location, teaching status, and number of beds).

Before 2012, NIS data were derived from a sample of hospitals with all discharges included. Since 2012, data have been based on a sample of discharges from all participating hospitals. Revised weights for trend analyses using NIS data from 2011 and earlier allow estimates that are comparable to the new design in accordance with NIS guidance (21).

Each NIS discharge record contains data elements coded consistently with the NEDS, including patient demographic characteristics and disposition (for example, died in the hospital), hospital characteristics, and the nature of the stay. Discharge-level weights allow nationally representative estimation of the number and rate of inpatient stays.

Vital Statistics

The Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS) assembles Vital Statistics mortality data, which are derived from the death certificate coded at the state level. Each death certificate identifies a single underlying cause of death, in accordance with the ICD-10 and demographic data.

Sample and Classification of Methods Used in Suicidal Acts

We obtained Vital Statistics counts of deaths due to intentional self-harm for the nation by sex, age group, region, and NCHS county-level urbanization for 2007 to 2014 from the CDC's Wide-ranging Online Data for Epidemiologic Research (WONDER) Web site (https://wonder.cdc.gov/ucd-icd10.html). Deaths due to intentional self-harm were identified using ICD-10 E-codes X60 to X84.

Hospital discharge records for patients who presented to EDs for self-inflicted injuries at hospitals across the United States, including those who were and those who were not subsequently hospitalized, were obtained from NEDS and NIS data from 2007 to 2014, which we purchased and acquired on 23 September 2017. Records were included in our sample if at least 1 of the 4 E-code fields, which are included in all HCUP records, contained ICD-9-CM E-codes E950 to E959. Methods used in suicidal acts were grouped into 10 categories: 1) poisoning with drugs (E950.0 to E950.5 and X60 to X64); 2) poisoning with other solid or liquid substances (E950.6 to E950.9, X65, X66, X68, and X69); 3) poisoning with gases and vapors (E951.0, E951.1, E951.8, E952.0, E952.1, E952.8, E952.9, and X67); 4) hanging, strangulation, or suffocation (E953.0, E953.1, E953.8, E953.9, and X70); 5) submersion or drowning (E954 and X71); 6) firearms (E955.0 to E955.4 and X72 to X74); 7) cutting or piercing (E956 and X78); 8) jumping from a height (E957.0 to E957.2, E957.9, and X80);

9) jumping or lying before a moving object (E958.0 and X81); and 10) other means (for example, crashing a motor vehicle or self-immolation) (E955.5 to E955.7, E955.9, E958.1 to E958.8, X75 to X77, X79, X82, and X83) or unspecified means (E958.9 and X84).

To eliminate readmissions and double counting for the same nonfatal suicide attempt, we removed discharge records that were coded as late effects of a suicide attempt (E959) and excluded patients admitted to the same hospital or transferred to another short-term hospital from the NEDS sample of nonfatal suicide attempts because these incidents should have been captured in the NIS sample. To avoid double counting suicide deaths, we excluded suicidal acts that resulted in death during the ED visit or during hospitalization because these deaths should have been captured in Vital Statistics. We excluded persons younger than 5 years from analyses because suicide is not coded as a cause of death for this age group.

Statistical Analysis

Some people attempt suicide more than once (22–24). Following prior studies (6–8), we estimated the number of suicidal acts (suicide deaths and nonfatal suicide attempts) rather than the number of persons who attempted or completed suicide.

We calculated the number of suicide deaths and estimated the number of nonfatal suicide attempts and suicidal acts overall, by demographic characteristics (sex, age group, U.S. Census region, and county-level urbanization), and by the 10 method-specific categories. We calculated rates of suicide deaths, nonfatal suicide attempts, and suicidal acts per 100 000 persons for the nation as a whole and stratified by demographic characteristics using total and demographic-specific population figures obtained from the CDC's WONDER Web site. To classify the patient's county of residence, NEDS and NIS use the 2006 NCHS Urban–Rural Classification Scheme for Counties for 2007 to 2012 and the 2013 NCHS Urban–Rural Classification Scheme for Counties for 2013 and 2014. We accounted for this by using the 2006 version to classify urbanization for mortality and population data from 2007 to 2012 and the 2013 version for mortality and population data from 2013 and 2014 (25, 26).

We calculated the CFR for suicidal acts overall and by demographic characteristics and method. The CFR for a particular method or demographic group is defined as the number of suicide deaths with that method or in that demographic group divided by the number of suicidal acts with that method or in that demographic group [CFR = deaths/(deaths + nonfatal ED-only attempts + nonfatal attempts requiring hospitalization)]. In calculations of method-specific CFRs, nonfatal hospital discharge records with more than 1 E-code for intentional self-inflicted injury that fell into more than 1 of the 10 method categories were allowed to contribute to the denominator for each method-specific CFR. In calculations of all other CFRs (overall CFR for the population as a whole and by demographic group), records in which more than 1 method was associated with the discharge contributed 1 nonfatal attempt to the denominator of the appropriate CFR. We report the proportion of ED-only visits and hospitalizations for intentional self-inflicted injuries that involved more than 1 method (hospital discharge records that had >1 self-inflicted injury E-code that could be classified in >1 of our 10 method categories) and report the most prevalent multimethod combinations. We also report the distribution of methods used in suicidal acts and method-specific CFRs by demographic characteristics.

All descriptive analyses were done with the SVY suite in Stata IC 14 (StataCorp), using the weight variables provided by HCUP to generate national estimates of nonfatal suicide attempts. We followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for reporting (27).

Role of the Funding Source

This work was supported by the Joyce Foundation, which had no role in the design, conduct, or reporting of the research.

RESULTS

In the United States from 2007 to 2014, a total of 3 657 886 suicidal acts were identified (157.6 per 100 000 persons), of which 309 377 (8.5%) were fatal, a rate of 13.3 suicide deaths per 100 000 persons (**Tables 1** and **2**). There were 67.1 nonfatal suicide attempts resulting in hospitalization per 100 000 persons and 77.2 nonfatal suicide attempts that involved only an ED visit per 100 000 persons. Almost half (46.5%) of nonfatal suicide attempts resulted in hospitalization.

Compared with females, males were less likely to engage in suicidal acts but were 4 times more likely to die by suicide (**Tables 1** and **2**). Persons younger than 25 years accounted for more suicidal acts and fewer suicide deaths than those aged 65 years or older. Approximately 1 in 3 suicidal acts among persons aged 65 years or older was fatal, compared with approximately 1 in 32 among those younger than 25 years.

The rate of suicidal acts was lowest and the rate of suicide deaths was highest in the West (**Table 2**). The rate of suicide deaths was 33.1% higher in nonmetropolitan (rural) counties (micropolitan and noncore counties) than in metropolitan (urban) counties (large central metropolitan, large fringe metropolitan, medium metropolitan, and small metropolitan counties) (16.9 vs. 12.7 deaths per 100 000 persons), and the rate of suicidal acts was 22.1% higher (183.0 vs. 149.8 acts per 100 000 persons) (**Table 2**). A slightly higher all-method CFR was observed in nonmetropolitan counties compared with metropolitan counties.

The proportion of suicidal acts that were fatal varied widely by method (**Table 2**). Methods that most frequently were lethal were firearms (CFR, 89.6%), drowning (CFR, 56.4%), hanging (CFR, 52.7%), and poisoning with gases (CFR, 30.5%). Methods least frequently resulting in death were cutting or piercing (CFR, 0.7%), poisoning with nondrug solid and liquid substances (CFR, 1.1%), and poisoning with drugs (CFR, 1.9%).

Table 1. Suicide Deaths, Nonfatal Suicide Attempts, and Total Suicidal Acts, Overall and by Sex, Age Group, Region, County-Level Urbanization, Year, and Method

Variable	Suicide Deaths, *n* (%)*	Nonfatal Suicide Attempts, *n* (%)		Total Suicidal Acts, *n* (%)†
		Requiring Hospitalization‡	Requiring ED Visit Only§	
All	309 377 (100)	1 556 871 (100)	1 791 638 (100)	3 657 886 (100)
Sex				
Male	242 616 (78.4)	641 441 (41.2)	761 725 (42.5)	1 645 783 (45.0)
Female	66 761 (21.6)	914 244 (58.8)	1 029 517 (57.5)	2 010 522 (55.0)
Age group				
5–14 y	2364 (0.8)	47 301 (3.0)	121 794 (6.8)	171 458 (4.7)
15–24 y	37 015 (12.0)	367 011 (23.6)	680 694 (38.0)	1 084 720 (29.7)
25–34 y	46 787 (15.1)	343 768 (22.1)	397 941 (22.2)	788 496 (21.6)
35–44 y	53 198 (17.2)	308 161 (19.8)	287 627 (16.1)	648 986 (17.7)
45–54 y	68 437 (22.1)	296 146 (19.0)	208 554 (11.6)	573 137 (15.7)
55–64 y	50 759 (16.4)	126 784 (8.1)	69 969 (3.9)	247 512 (6.8)
≥65 y	50 817 (16.4)	67 700 (4.3)	25 060 (1.4)	143 577 (3.9)
Region				
Northeast	43 126 (13.9)	282 971 (18.2)	327 512 (18.3)	653 609 (17.9)
Midwest	66 199 (21.4)	399 597 (25.7)	406 867 (22.7)	872 663 (23.9)
South	120 272 (38.9)	597 521 (38.4)	642 691 (35.9)	1 360 484 (37.2)
West	79 780 (25.8)	276 782 (17.8)	414 569 (23.1)	771 131 (21.1)
County-level urbanization‖				
Large central metro	76 733 (24.8)	399 812 (26.4)	434 501 (24.5)	911 046 (25.3)
Large fringe metro	69 579 (22.5)	367 069 (24.2)	333 854 (18.8)	770 502 (21.4)
Medium metro	66 558 (21.5)	318 155 (21.0)	472 582 (26.6)	857 294 (23.8)
Small metro	33 595 (10.9)	164 997 (10.9)	179 266 (10.1)	377 858 (10.5)
Micropolitan	36 816 (11.9)	177 125 (11.7)	223 538 (12.6)	437 479 (12.2)
Noncore	26 096 (8.4)	90 077 (5.9)	129 677 (7.3)	245 850 (6.8)
Year				
2007	34 523 (11.2)	197 494 (11.9)	226 992 (12.3)	459 010 (12.0)
2008	35 964 (11.6)	207 031 (12.5)	248 588 (13.4)	491 583 (12.9)
2009	36 825 (11.9)	212 546 (12.8)	234 542 (12.7)	483 912 (12.7)
2010	38 300 (12.4)	219 183 (13.2)	237 441 (12.8)	494 924 (13.0)
2011	39 432 (12.7)	211 509 (12.8)	239 850 (13.0)	490 790 (12.9)
2012	40 527 (13.1)	209 575 (12.6)	208 084 (11.3)	458 186 (12.0)
2013	41 054 (13.3)	200 845 (12.1)	248 925 (13.5)	490 824 (12.9)
2014	42 752 (13.8)	199 535 (12.0)	204 933 (11.1)	447 220 (11.7)
Method				
Drug poisoning	41 758 (13.5)	1 191 096 (76.5)	938 628 (52.4)	2 171 482 (59.4)
Nondrug poisoning	2110 (0.7)	111 903 (7.2)	80 519 (4.5)	194 532 (5.3)
Gas	8659 (2.8)	9460 (0.6)	10 298 (0.6)	28 417 (0.8)
Hanging	76 688 (24.7)	27 121 (1.7)	41 759 (2.3)	145 568 (4.0)
Drowning	3115 (1.0)	1048 (0.1)	1364 (0.1)	5527 (0.2)
Firearm	156 901 (50.6)	12 965 (0.8)	5323 (0.3)	175 190 (4.8)
Cutting/piercing	5539 (1.8)	226 360 (14.5)	552 410 (30.8)	784 309 (21.4)
Jumping	6630 (2.1)	10 164 (0.7)	6952 (0.4)	23 746 (0.6)
Moving object	3245 (1.0)	3964 (0.3)	4881 (0.3)	12 090 (0.3)
Other¶	4732 (1.5)	63 636 (4.1)	207 221 (11.6)	275 589 (7.5)

ED = emergency department; MSA = metropolitan statistical area; NCHS = National Center for Health Statistics; NEDS = Nationwide Emergency Department Sample; NIS = National (Nationwide) Inpatient Sample.
* Based on National Vital Statistics System data from 2007 to 2014.
† Sum of suicide deaths and nonfatal suicide attempts.
‡ Based on 295 556 unweighted records from the 2007 to 2011 Nationwide Inpatient Sample and the 2012 to 2014 National Inpatient Sample.
§ Based on 382 818 unweighted records from the 2007 to 2014 NEDS.
‖ Classified according to the NCHS Urban–Rural Classification Scheme for Counties. "Large central metro" refers to counties in MSAs with a population of ≥1 million that contain the entire population of the largest principal city of the MSA, have their entire population contained in the largest principal city of the MSA, or contain ≥250 000 inhabitants of any principal city of the MSA. "Large fringe metro" refers to counties in MSAs with a population of ≥1 million that did not qualify as large central metro counties. "Medium metro" refers to counties in MSAs with a population of 250 000 to 999 999. "Small metro" refers to counties in MSAs with a population of <250 000. "Micropolitan" refers to counties in micropolitan statistical areas. "Noncore" refers to nonmetropolitan counties that did not qualify as micropolitan. For consistent classification of county-level urbanization with the NEDS and the NIS, mortality data from 2007 to 2012 use the 2006 NCHS Urban–Rural Classification Scheme for Counties, and mortality data from 2013 and 2014 use the 2013 NCHS Urban–Rural Classification Scheme for Counties.
¶ Includes suicide and self-inflicted injury involving explosives (E955.5, E955.9, and X75); air gun and paintball gun (E955.6 and E955.7); burns, fire, smoke, and flames (E958.1 and X76); scald, steam, hot vapors, and hot objects (E958.2 and X77); blunt object (X79); extremes of cold (E958.3); electrocution (E958.4); crashing of motor vehicle (E958.5 and X82); crashing of aircraft (E958.6); caustic substances, except poisoning (E958.7); other specified means (E958.8 and X83); and unspecified means (E958.9 and X84).

Differences in the all-method CFR between sexes and across age groups, regions, and county-level urbanization were largely explained by differences in methods used in suicidal acts across subgroups and, to a lesser extent, by differences in method-specific CFR across subgroups (Tables 3 and 4). For example, suicidal acts among males were 8 times more likely to involve firearms and 4 times more likely to involve

Table 2. Crude Annual Suicide Mortality Rates, Nonfatal Suicide Attempt Rates, Total Suicidal Act Rates, and Case-Fatality Rates, Overall and by Sex, Age Group, Region, County-Level Urbanization, Year, and Method

Variable	Suicide Deaths per 100 000 Persons*	Nonfatal Suicide Attempts per 100 000 Persons		Total Suicidal Acts per 100 000 Persons†	Case-Fatality Rate, %‡
		Requiring Hospitalization§	Requiring ED Visit Only‖		
All	13.3	67.1	77.2	157.6	8.5
Sex					
Male	21.3	56.3	66.9	144.6	14.7
Female	5.6	77.3	87.1	170.1	3.3
Age group					
5–14 y	0.7	14.4	37.2	52.3	1.4
15–24 y	10.6	105.0	194.8	310.4	3.4
25–34 y	14.1	103.5	119.8	237.4	5.9
35–44 y	16.1	93.5	87.3	196.9	8.2
45–54 y	19.3	83.5	58.8	161.7	11.9
55–64 y	17.2	42.9	23.7	83.8	20.5
≥65 y	15.3	20.4	7.5	43.2	35.4
Region					
Northeast	10.3	67.8	78.4	156.5	6.6
Midwest	13.2	79.6	81.0	173.8	7.6
South	14.0	69.4	74.6	158.0	8.8
West	14.8	51.3	76.8	142.9	10.3
County-level urbanization¶					
Large central metro	11.2	58.2	63.3	132.7	8.4
Large fringe metro	12.2	64.4	58.6	135.2	9.0
Medium metro	14.1	67.6	100.4	182.1	7.8
Small metro	15.3	75.0	81.5	171.7	8.9
Micropolitan	16.2	78.0	98.5	192.8	8.4
Noncore	17.8	61.5	88.5	167.8	10.6
Year					
2007	12.3	70.3	80.7	163.3	7.8
2008	12.7	72.9	87.6	173.2	7.6
2009	12.9	74.2	81.9	168.9	7.9
2010	13.3	76.0	82.3	171.5	8.1
2011	13.5	72.6	82.3	168.4	8.4
2012	13.8	71.3	70.8	155.9	9.3
2013	13.9	67.8	84.0	165.7	8.7
2014	14.3	66.7	68.5	149.6	10.0
Method					
Drug poisoning	1.8	51.3	40.4	93.6	1.9
Nondrug poisoning	0.1	4.8	3.5	8.4	1.1
Gas	0.4	0.4	0.4	1.2	30.5
Hanging	3.3	1.2	1.8	6.3	52.7
Drowning	0.1	0.0	0.1	0.2	56.4
Firearm	6.8	0.6	0.2	7.5	89.6
Cutting/piercing	0.2	9.8	23.8	33.8	0.7
Jumping	0.3	0.4	0.3	1.0	27.9
Moving object	0.1	0.2	0.2	0.5	26.8
Other**	0.2	2.7	8.9	11.9	1.7

ED = emergency department; MSA = metropolitan statistical area; NCHS = National Center for Health Statistics; NEDS = Nationwide Emergency Department Sample; NIS = National (Nationwide) Inpatient Sample.
* Based on National Vital Statistics System data from 2007 to 2014.
† Sum of suicide deaths and nonfatal suicide attempts.
‡ Suicide deaths divided by total suicidal acts.
§ Based on 295 556 unweighted records from the 2007 to 2011 Nationwide Inpatient Sample and the 2012 to 2014 National Inpatient Sample.
‖ Based on 382 818 unweighted records from the 2007 to 2014 NEDS.
¶ Classified according to the NCHS Urban–Rural Classification Scheme for Counties. "Large central metro" refers to counties in MSAs with a population of ≥1 million that contain the entire population of the largest principal city of the MSA, have their entire population contained in the largest principal city of the MSA, or contain ≥250 000 inhabitants of any principal city of the MSA. "Large fringe metro" refers to counties in MSAs with a population of ≥1 million that did not qualify as large central metro counties. "Medium metro" refers to counties in MSAs with a population of 250 000 to 999 999. "Small metro" refers to counties in MSAs with a population of <250 000. "Micropolitan" refers to counties in micropolitan statistical areas. "Noncore" refers to nonmetropolitan counties that did not qualify as micropolitan. For consistent classification of county-level urbanization with the NEDS and the NIS, mortality and population data from 2007 to 2012 use the 2006 NCHS Urban–Rural Classification Scheme for Counties, and mortality and population data from 2013 and 2014 use the 2013 NCHS Urban–Rural Classification Scheme for Counties.
** Includes suicide and self-inflicted injury involving explosives (E955.5, E955.9, and X75); air gun and paintball gun (E955.6 and E955.7); burns, fire, smoke, and flames (E958.1 and X76); scald, steam, hot vapors, and hot objects (E958.2 and X77); blunt object (X79); extremes of cold (E958.3); electrocution (E958.4); crashing of motor vehicle (E958.5 and X82); crashing of aircraft (E958.6); caustic substances, except poisoning (E958.7); other specified means (E958.8 and X83); and unspecified means (E958.9 and X84).

Table 3. Distribution of Suicidal Acts by Method, Overall and by Sex, Age Group, Region, County-Level Urbanization, and Year

Variable	Suicidal Acts, *n* (%)*							
	Firearm	Drowning	Hanging	Gas	Jumping	Moving Object	Nondrug Poisoning	Drug Poisoning
All	175 190 (4.8)	5527 (0.2)	145 568 (4.0)	28 417 (0.8)	23 746 (0.6)	12 090 (0.3)	194 532 (5.3)	2 171 482 (59.4)
Sex								
Male	150 714 (9.2)	3198 (0.2)	109 571 (6.7)	19 988 (1.2)	15 925 (1.0)	7950 (0.5)	89 995 (5.5)	797 058 (48.4)
Female	24 447 (1.2)	2329 (0.1)	35 911 (1.8)	8419 (0.4)	7802 (0.4)	4129 (0.2)	104 469 (5.2)	1 373 511 (68.3)
Age group								
5–14 y	918 (0.5)	122 (0.1)	7412 (4.3)	579 (0.3)	964 (0.6)	377 (0.2)	4542 (2.6)	79 354 (46.3)
15–24 y	20 319 (1.9)	1005 (0.1)	37 996 (3.5)	3610 (0.3)	5846 (0.5)	3333 (0.3)	42 986 (4.0)	600 577 (55.4)
25–34 y	24 642 (3.1)	887 (0.1)	32 463 (4.1)	4726 (0.6)	5521 (0.7)	2872 (0.4)	43 217 (5.5)	463 373 (58.8)
35–44 y	26 286 (4.1)	920 (0.1)	26 641 (4.1)	6231 (1.0)	4089 (0.6)	2172 (0.3)	41 531 (6.4)	419 761 (64.7)
45–54 y	35 451 (6.2)	1097 (0.2)	22 768 (4.0)	7205 (1.3)	4110 (0.7)	2164 (0.4)	41 460 (7.2)	381 580 (66.6)
55–64 y	29 439 (11.9)	761 (0.3)	10 969 (4.4)	3774 (1.5)	1928 (0.8)	855 (0.3)	15 445 (6.2)	156 844 (63.4)
≥65 y	38 135 (26.6)	736 (0.5)	7320 (5.1)	2293 (1.6)	1287 (0.9)	316 (0.2)	5351 (3.7)	69 993 (48.7)
Region								
Northeast	17 492 (2.7)	1166 (0.2)	26 852 (4.1)	4340 (0.7)	5734 (0.9)	1993 (0.3)	28 249 (4.3)	360 855 (55.2)
Midwest	36 139 (4.1)	1111 (0.1)	36 439 (4.2)	9148 (1.0)	4600 (0.5)	2290 (0.3)	49 228 (5.6)	524 516 (60.1)
South	80 707 (5.9)	1983 (0.1)	47 848 (3.5)	8739 (0.6)	7057 (0.5)	4833 (0.4)	70 137 (5.2)	826 524 (60.8)
West	40 852 (5.3)	1267 (0.2)	34 430 (4.5)	6191 (0.8)	6355 (0.8)	2973 (0.4)	46 918 (6.1)	459 587 (59.6)
County-level urbanization‡								
Large central metro	36 044 (4.0)	1733 (0.2)	37 180 (4.1)	6473 (0.7)	9591 (1.1)	3775 (0.4)	53 541 (5.9)	559 308 (61.4)
Large fringe metro	35 852 (4.7)	1322 (0.2)	32 577 (4.2)	6877 (0.9)	5156 (0.7)	2856 (0.4)	43 316 (5.6)	466 104 (60.5)
Medium metro	37 596 (4.4)	1087 (0.1)	31 913 (3.7)	6702 (0.8)	4457 (0.5)	2463 (0.3)	42 132 (4.9)	498 984 (58.2)
Small metro	20 961 (5.5)	527 (0.1)	14 750 (3.9)	3066 (0.8)	1670 (0.4)	1118 (0.3)	18 888 (5.0)	218 381 (57.8)
Micropolitan	24 959 (5.7)	524 (0.1)	17 212 (3.9)	3229 (0.7)	1579 (0.4)	1039 (0.2)	20 940 (4.8)	252 904 (57.8)
Noncore	19 620 (8.0)	270 (0.1)	10 606 (4.3)	1723 (0.7)	744 (0.3)	564 (0.2)	11 869 (4.8)	137 448 (55.9)
Year								
2007	19 457 (4.2)	702 (0.2)	15 400 (3.4)	3968 (0.9)	2570 (0.6)	1285 (0.3)	22 722 (5.0)	266 921 (58.2)
2008	20 349 (4.1)	738 (0.2)	16 607 (3.4)	3916 (0.8)	2722 (0.6)	1236 (0.3)	25 918 (5.3)	289 467 (58.9)
2009	20 919 (4.3)	677 (0.1)	17 004 (3.5)	3805 (0.8)	2967 (0.6)	1380 (0.3)	25 069 (5.2)	278 703 (57.6)
2010	22 138 (4.5)	704 (0.1)	18 969 (3.8)	3691 (0.7)	3123 (0.6)	1509 (0.3)	25 208 (5.1)	285 649 (57.7)
2011	22 357 (4.6)	620 (0.1)	18 898 (3.9)	3286 (0.7)	3019 (0.6)	1558 (0.3)	24 462 (5.0)	279 781 (57.0)
2012	22 972 (5.0)	761 (0.2)	18 579 (4.1)	3173 (0.7)	2962 (0.6)	1660 (0.4)	24 767 (5.4)	260 335 (56.8)
2013	23 443 (4.8)	717 (0.1)	19 426 (4.0)	3319 (0.7)	3333 (0.7)	1845 (0.4)	24 776 (5.0)	265 675 (54.1)
2014	23 555 (5.3)	607 (0.1)	20 686 (4.6)	3259 (0.7)	3051 (0.7)	1617 (0.4)	21 611 (4.8)	244 951 (54.8)

MSA = metropolitan statistical area; NCHS = National Center for Health Statistics; NEDS = Nationwide Emergency Department Sample; NIS = National (Nationwide) Inpatient Sample.

* Methods are ranked by overall method-specific suicide case-fatality rate (see Table 4).

† Includes suicide and self-inflicted injury involving explosives (E955.5, E955.9, and X75); air gun and paintball gun (E955.6 and E955.7); burns, fire, smoke, and flames (E958.1 and X76); scald, steam, hot vapors, and hot objects (E958.2 and X77); blunt object (X79); extremes of cold (E958.3); electrocution (E958.4); crashing of motor vehicle (E958.5 and X82); crashing of aircraft (E958.6); caustic substances, except poisoning (E958.7); other specified means (E958.8 and X83); and unspecified means (E958.9 and X84).

‡ Classified according to the NCHS Urban–Rural Classification Scheme for Counties. "Large central metro" refers to counties in MSAs with a population of ≥1 million that contain the entire population of the largest principal city of the MSA, have their entire population contained in the largest principal city of the MSA, or contain ≥250 000 inhabitants of any principal city of the MSA. "Large fringe metro" refers to counties in MSAs with a population of ≥1 million that did not qualify as large central metro counties. "Medium metro" refers to counties in MSAs with a population of 250 000 to 999 999. "Small metro" refers to counties in MSAs with a population of <250 000. "Micropolitan" refers to counties in micropolitan statistical areas. "Noncore" refers to nonmetropolitan counties that did not qualify as micropolitan. For consistent classification of county-level urbanization with the NEDS and the NIS, mortality data from 2007 to 2012 use the 2006 NCHS Urban–Rural Classification Scheme for Counties, and mortality data from 2013 and 2014 use the 2013 NCHS Urban–Rural Classification Scheme for Counties.

hanging than acts among females. Persons aged 65 years or older were approximately 5 times more likely than those younger than 35 years to use 1 of the 4 methods with the highest method-specific CFR (firearms, drowning, hanging, and poisoning by gas). Approximately 1 in 4 suicidal acts among persons aged 65 years or older involved a firearm, whereas 1 in 45 among those younger than 35 years involved a firearm. The use of firearms in suicidal acts also varied by region and county-level urbanization: Suicidal acts in the West and in noncore counties (the least urbanized counties) were roughly twice as likely to involve a firearm than those in the Northeast and in large central metropolitan counties (the most urbanized counties), respectively.

Although the age and sex distributions of suicides and suicidal acts were similar across regions (**Appendix Table 1**, available at Annals.org), some method-specific CFRs varied modestly by region (for example, the CFRs for jumping were 22.8% in the South, 22.1% in the Midwest, 29.8% in the Northeast, and 36.0% in the West). However, regardless of region, the vast majority of suicidal acts (around 80%) involved drug poisoning and

Table 3–Continued

Variable	Suicidal Acts, *n* (%)*		
	Cutting/ Piercing	Other†	All
All	784 309 (21.4)	275 589 (7.5)	3 657 886 (100)
Sex			
Male	344 448 (20.9)	172 679 (10.5)	1 645 783 (100)
Female	439 480 (21.9)	102 822 (5.1)	2 010 522 (100)
Age group			
5–14 y	59 797 (34.9)	21 284 (12.4)	171 458 (100)
15–24 y	296 900 (27.4)	108 020 (10.0)	1 084 720 (100)
25–34 y	184 741 (23.4)	63 012 (8.0)	788 496 (100)
35–44 y	117 231 (18.1)	38 120 (5.9)	648 986 (100)
45–54 y	83 325 (14.5)	26 307 (4.6)	573 137 (100)
55–64 y	28 829 (11.6)	10 429 (4.2)	247 512 (100)
≥65 y	13 488 (9.4)	8418 (5.9)	143 577 (100)
Region			
Northeast	155 728 (23.8)	67 878 (10.4)	653 609 (100)
Midwest	188 858 (21.6)	64 405 (7.4)	872 663 (100)
South	276 705 (20.3)	89 580 (6.6)	1 360 484 (100)
West	163 019 (21.1)	53 726 (7.0)	771 131 (100)
County-level urbanization‡			
Large central metro	176 458 (19.4)	69 723 (7.7)	911 046 (100)
Large fringe metro	162 646 (21.1)	49 082 (6.4)	770 502 (100)
Medium metro	199 338 (23.3)	67 654 (7.9)	857 294 (100)
Small metro	85 740 (22.7)	29 071 (7.7)	377 858 (100)
Micropolitan	95 339 (21.8)	36 608 (8.4)	437 479 (100)
Noncore	52 802 (21.5)	19 716 (8.0)	245 850 (100)
Year			
2007	95 435 (20.8)	30 549 (6.7)	459 010 (100)
2008	99 862 (20.3)	30 767 (6.3)	491 583 (100)
2009	99 614 (20.6)	33 774 (7.0)	483 912 (100)
2010	97 737 (19.7)	36 197 (7.3)	494 924 (100)
2011	99 689 (20.3)	37 122 (7.6)	490 790 (100)
2012	90 925 (19.8)	32 053 (7.0)	458 186 (100)
2013	108 639 (22.1)	39 652 (8.1)	490 824 (100)
2014	92 409 (20.7)	35 475 (7.9)	447 220 (100)

cutting, both of which had method-specific CFRs that were relatively stable within demographic subgroups across regions (Appendix Table 2, available at Annals.org).

Across all methods, including the most lethal, a higher method-specific CFR among males was observed, though the absolute differences in lethality were modest (Table 4). For example, the CFR for suicidal acts involving cutting or piercing was slightly higher among males (1.3%) than females (0.2%). Among all methods, the CFR increased with age. For example, the CFR for drug poisoning was less than 0.1% among our youngest age group (5 to 14 years) compared with 6.8% among our oldest age group. The all-method CFR increased slightly between 2007 and 2014; among the most common methods used in suicidal acts (poisoning, cutting, firearms, and hanging), method-specific CFRs and the proportion of suicidal acts involving each of these methods remained relatively stable over our study period (Tables 3 and 4).

We found that 3.2% of nonfatal suicide attempts in our ED-only sample and 6.3% of nonfatal attempts in our hospitalized sample involved more than 1 method (that is, hospital discharge records had >1 self-inflicted injury E-code that could be classified in >1 of our 10 method categories) (data not shown). Across nearly all methods, the most common multimethod nonfatal suicidal act involved drug poisoning. The most common combinations were drug plus nondrug poisoning and drug poisoning plus cutting, which represented 66.4% and 20.3%, respectively, of nonfatal suicide attempts involving more than 1 method and together accounted for 3.7% of all nonfatal suicidal acts. Of note, more than half (53.0%) of nonfatal suicidal acts involving poisoning by nondrug liquid or solid substances also involved poisoning by drugs.

DISCUSSION

In our study, the first in more than a decade to report method-specific suicide CFRs at the national level, we found that approximately 1 in 12 suicidal acts was fatal, a proportion similar to that reported by smaller studies limited to specific states (6, 7) and a national study that used 2001 data from the National

Table 4. Method-Specific Suicide Case-Fatality Rates, Overall and by Sex, Age Group, Region, County-Level Urbanization, and Year

Variable	Case-Fatality Rate, %*									
	Firearm	Drowning	Hanging	Gas	Jumping	Moving Object	Nondrug Poisoning	Drug Poisoning	Cutting/ Piercing	Other†
All	89.6	56.4	52.7	30.5	27.9	26.8	1.1	1.9	0.7	1.7
Sex										
Male	90.4	62.0	55.9	34.2	30.6	30.7	1.6	2.5	1.3	2.0
Female	84.6	48.7	43.0	21.6	22.6	19.6	0.7	1.6	0.2	1.2
Age group										
5–14 y	82.5	1.6	19.9	0.2	1.8	5.3	0.0	0.1	0.0	0.0
15–24 y	82.8	35.4	37.7	13.4	16.9	21.0	0.3	0.4	0.1	0.6
25–34 y	84.7	51.4	49.0	20.9	22.5	23.9	0.6	1.1	0.3	1.1
35–44 y	87.5	61.6	57.8	28.8	28.5	28.9	0.9	2.0	0.8	2.3
45–54 y	89.2	61.1	68.7	35.2	34.4	31.3	1.5	3.3	1.9	4.3
55–64 y	93.2	70.3	78.1	45.0	49.3	43.6	2.9	5.6	4.3	7.5
≥65 y	95.4	72.0	73.2	50.2	66.0	50.9	4.6	6.8	6.2	6.6
Region										
Northeast	90.1	62.8	52.7	31.6	29.8	40.7	1.4	1.7	0.7	1.2
Midwest	89.8	52.5	48.6	27.0	22.1	31.2	1.0	1.6	0.6	1.7
South	87.8	55.7	52.0	29.0	22.8	16.5	1.0	1.7	0.6	1.8
West	92.6	54.8	57.8	36.9	36.0	31.0	1.1	2.7	0.9	2.4
County-level urbanization‡										
Large central metro	90.6	60.2	56.8	29.6	35.2	29.1	1.2	2.1	1.0	1.9
Large fringe metro	90.7	62.8	56.8	32.6	27.5	33.6	1.2	2.2	0.8	2.3
Medium metro	90.2	54.8	51.4	30.8	24.9	23.0	1.0	1.9	0.6	1.4
Small metro	89.6	51.0	51.9	33.2	22.0	25.5	1.0	1.8	0.6	1.6
Micropolitan	87.4	48.1	46.9	28.6	16.9	21.2	1.0	1.6	0.5	1.4
Noncore	87.7	46.3	46.6	28.9	12.0	20.7	1.0	1.8	0.5	1.5
Year										
2007	89.2	50.8	53.0	32.7	28.4	25.4	1.3	1.8	0.6	2.0
2008	89.6	55.0	51.7	29.1	26.0	23.8	1.1	1.7	0.7	2.1
2009	89.5	57.4	52.9	28.7	23.1	23.8	1.1	1.8	0.7	1.9
2010	87.6	58.1	50.0	27.7	25.0	22.2	1.1	1.9	0.7	1.7
2011	89.4	57.1	52.4	30.7	26.7	28.0	1.1	1.9	0.7	1.9
2012	89.9	56.7	54.3	31.6	32.1	29.9	1.1	2.1	0.8	1.4
2013	90.3	55.4	51.8	29.0	29.3	28.1	1.0	2.0	0.7	1.3
2014	90.8	61.2	55.1	34.7	32.6	31.5	1.1	2.2	0.8	1.5

MSA = metropolitan statistical area; NCHS = National Center for Health Statistics; NEDS = Nationwide Emergency Department Sample; NIS = National (Nationwide) Inpatient Sample.

* Methods are ranked by overall method-specific case-fatality rate (the proportion of suicidal acts with a particular method that result in death).

† Includes suicide and self-inflicted injury involving explosives (E955.5, E955.9, and X75); air gun and paintball gun (E955.6 and E955.7); burns, fire, smoke, and flames (E958.1 and X76); scald, steam, hot vapors, and hot objects (E958.2 and X77); blunt object (X79); extremes of cold (E958.3); electrocution (E958.4); crashing of motor vehicle (E958.5 and X82); crashing of aircraft (E958.6); caustic substances, except poisoning (E958.7); other specified means (E958.8 and X83); and unspecified means (E958.9 and X84).

‡ Classified according to the NCHS Urban–Rural Classification Scheme for Counties. "Large central metro" refers to counties in MSAs with a population of ≥1 million that contain the entire population of the largest principal city of the MSA, have their entire population contained in the largest principal city of the MSA, or contain ≥250 000 inhabitants of any principal city of the MSA. "Large fringe metro" refers to counties in MSAs with a population of ≥1 million that did not qualify as large central metro counties. "Medium metro" refers to counties in MSAs with a population of 250 000 to 999 999. "Small metro" refers to counties in MSAs with a population of <250 000. "Micropolitan" refers to counties in micropolitan statistical areas. "Noncore" refers to nonmetropolitan counties that did not qualify as micropolitan. For consistent classification of county-level urbanization with the NEDS and the NIS, mortality data from 2007 to 2012 use the 2006 NCHS Urban–Rural Classification Scheme for Counties, and mortality data from 2013 and 2014 use the 2013 NCHS Urban–Rural Classification Scheme for Counties.

Electronic Injury Surveillance System in estimating rates of suicidal acts (8). Method-specific CFRs in our study were also similar to those previously reported (6–8, 28). For example, firearms accounted for the majority of suicide deaths and had the highest CFR of all methods we examined (approximately 9 out of 10 attempts with a firearm were fatal). In contrast, fewer than 1 in 20 suicidal acts involving drug poisoning and cutting, which together accounted for more than 80% of all acts, resulted in death. Although method-specific CFRs varied across demographic groups and geographic areas, differences in the overall CFRs between subpopulations were largely explained by the distribution of methods used in suicidal acts.

Consistent with earlier work (5–15), we found lower rates of suicidal acts but modestly higher method-specific CFRs regardless of the means used among men and older persons than among women and younger persons, respectively. One possible explanation for the sex- and age-related gradient in method-

specific CFRs is that men and older persons who attempt suicide may, on average, have a greater intent to die than their female and younger counterparts. Although few studies have examined the relationship between choice of suicide method and factors other than availability (29–32), 1 study involving psychological autopsies of suicide decedents in New York found that men did not seem to have greater intent to die, as assessed using a modified Suicide Intent Scale (30). Higher method-specific CFRs might also be observed among older adults because they are more likely than younger persons to have comorbidities and therefore might be less likely to survive a physiologic stress of similar magnitude (9, 28, 33). Consistent with this possibility, the age disparity in method-specific CFRs we and others (6, 7, 28) observed was more pronounced among less lethal methods, such as poisoning and cutting, than for highly lethal methods, such as firearms, which typically are fatal regardless of age.

Our study extends prior observations about disparities in suicide mortality rates across the urban–rural gradient (34–39) by reporting corresponding rates of nonfatal suicide attempts. We found, on average, modestly higher rates of total suicidal acts in nonmetropolitan counties compared with metropolitan counties. Overall, variation in the distribution of the methods used in suicidal acts across geographic areas seems to reflect differences in the availability of methods. For example, we found that firearms were more frequently used in suicidal acts in rural counties, whereas jumping and drug poisoning were more common in urban counties. Although our data did not allow us to directly examine this distribution, it likely reflects the greater availability of tall buildings from which to jump in urban areas and higher rates of firearm ownership in rural areas (40).

Differences in suicide CFRs across geographic areas and between demographic groups might reflect, to an indeterminate extent, the possibility that people seek and receive medical care at hospitals in ways that vary by geographic area, demographic characteristics, or method used (9, 33). For example, urban residents may be more likely to be hospitalized than others. This is reflected in our data on nonfatal attempts, where rates of ED-only visits varied more across levels of urbanization than did hospitalizations. Nonetheless, even if hospitalization data were used as the denominator, we would still see a higher CFR in the most rural counties (noncore) than in the most urban counties (large central metropolitan) (22.5% vs. 16.1%), which is largely accounted for by the fact that more suicidal acts per capita in rural areas involve firearms.

Our study has several limitations. First, our results underestimate the number of nonfatal suicide attempts and thus the number of suicidal acts. Our data do not include nonfatal attempts that led to hospitalization in veteran or psychiatric institutions or those that did not result in a hospital visit, even if they led to medical attention elsewhere. The number of nonfatal attempts that do not result in hospital care may be large. This is a reason that the rate of suicidal acts in our study was considerably lower than rates reported by studies using self-reported data on nonfatal suicide attempts (9, 10, 14, 15, 41, 42) but similar to rates reported in studies that used hospital data (5–8, 11–13, 43). Because people who engage in suicidal acts that result in serious injury are more likely to be seen in the ED or hospitalized than those who engage in acts that result in minor or no injury, we suspect that we missed few nonfatal attempts involving firearms and many more involving other methods, such as drug poisoning. Consequently, the actual difference between the firearm CFR and the CFR for other methods may be even greater than reported. Nevertheless, the CFRs we report used a reasonable denominator: suicidal acts that are serious enough for ED medical attention. The extent to which underestimates differ meaningfully across our characteristics of interest, such as age, sex, and region, is not known.

Second, as was the case in prior studies, our study may have inaccurately measured rates of nonfatal suicide attempts among hospital-treated patients if some suicide-related hospital discharges were missing E-codes. In our study, 8.6% of hospital discharges related to nonfatal injury (NEDS and NIS records with an ICD-9-CM injury diagnosis) were missing E-codes, an indeterminate number of which might have been nonfatal suicide attempts. If nonfatal injury–related discharges that lacked E-codes had the same distribution of injury intent as nonfatal injury–related discharges with E-codes, we would expect 1.6% of nonfatal injury–related discharges missing E-codes to be suicide-related, which would decrease our overall suicide CFR from 8.5% to 7.8%.

Third, the most recent year in our study period was 2014. After we had purchased data through 2014 but before final submission of this manuscript, 2 additional years of data became available from HCUP. However, given that our findings are consistent with work from 2 decades ago and that suicide CFRs and the distribution of methods used in suicidal acts did not change substantially over our study period, the addition of these data is unlikely to have significantly altered our findings. Finally, given the data sources we used, we could not examine how overall and method-specific CFRs varied by race and ethnicity.

Despite these limitations, our findings indicate that differences in the overall suicide CFR between sexes and across age groups, regions, and county-level urbanization are largely explained by the distribution of means used in suicidal acts. Future studies should evaluate why the methods used in suicidal acts differ between demographic groups beyond their availability and should further explore the relationship among demographic characteristics, intent to die by suicide, and the method used.

Given that 1 in 3 U.S. households contains firearms (40); firearms are highly lethal relative to other suicide methods; and reducing access to highly lethal, commonly used suicide methods can save lives (44–47), our findings underscore the potential benefit of suicide prevention approaches that not only aim to reduce underlying suicidal behavior but also seek to reduce access to firearms—a clinical practice that, despite being viewed by physicians

in various specialties as falling squarely within their professional responsibilities (48–53) and explicitly advocated for by several professional medical organizations (54), remains uncommon (48–50, 52, 55–59).

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References

1. **Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.** Web-based Injury Statistics Query and Reporting System (WISQARS). Accessed at www.cdc.gov/injury/wisqars on 10 July 2018.
2. **Centers for Disease Control and Prevention, National Center for Health Statistics.** Underlying Cause of Death 1999-2016. CDC WONDER Online Database. Accessed at http://wonder.cdc.gov/ucd-icd10.html on 10 July 2018.
3. **Kessler RC, Berglund P, Borges G, et al.** Trends in suicide ideation, plans, gestures, and attempts in the United States, 1990–1992 to 2001–2003. JAMA. 2005;293:2487-95. [PMID: 15914749]
4. **Miller M, Barber C, White RA, et al.** Firearms and suicide in the United States: is risk independent of underlying suicidal behavior? Am J Epidemiol. 2013;178:946-55. [PMID: 23975641] doi:10.1093/aje/kwt197
5. **Canner JK, Giuliano K, Selvarajah S, et al.** Emergency department visits for attempted suicide and self harm in the USA: 2006–2013. Epidemiol Psychiatr Sci. 2018;27:94-102. [PMID: 27852333] doi:10.1017/S2045796016000871
6. **Miller M, Azrael D, Hemenway D.** The epidemiology of case fatality rates for suicide in the Northeast. Ann Emerg Med. 2004;43:723-30. [PMID: 15159703]
7. **Spicer RS, Miller TR.** Suicide acts in 8 states: incidence and case fatality rates by demographics and method. Am J Public Health. 2000;90:1885-91. [PMID: 11111261]
8. **Vyrostek SB, Annest JL, Ryan GW.** Surveillance for fatal and nonfatal injuries—United States, 2001. MMWR Surveill Summ. 2004;53:1-57. [PMID: 15343143]
9. **Han B, Kott PS, Hughes A, et al.** Estimating the rates of deaths by suicide among adults who attempt suicide in the United States. J Psychiatr Res. 2016;77:125-33. [PMID: 27032110] doi:10.1016/j.jpsychires.2016.03.002
10. **Olfson M, Blanco C, Wall M, et al.** National trends in suicide attempts among adults in the United States. JAMA Psychiatry. 2017;74:1095-103. [PMID: 28903161] doi:10.1001/jamapsychiatry.2017.2582
11. **Ting SA, Sullivan AF, Boudreaux ED, et al.** Trends in US emergency department visits for attempted suicide and self-inflicted injury, 1993–2008. Gen Hosp Psychiatry. 2012;34:557-65. [PMID: 22554432] doi:10.1016/j.genhosppsych.2012.03.020
12. **Doshi A, Boudreaux ED, Wang N, et al.** National study of US emergency department visits for attempted suicide and self-inflicted injury, 1997–2001. Ann Emerg Med. 2005;46:369-75. [PMID: 16183394]
13. **Larkin GL, Smith RP, Beautrais AL.** Trends in US emergency department visits for suicide attempts, 1992–2001. Crisis. 2008;29:73-80. [PMID: 18664232]
14. **Baca-Garcia E, Perez-Rodriguez MM, Keyes KM, et al.** Suicidal ideation and suicide attempts in the United States: 1991–1992 and 2001–2002. Mol Psychiatry. 2010;15:250-9. [PMID: 18779820] doi:10.1038/mp.2008.98
15. **Han B, Compton WM, Gfroerer J, et al.** Prevalence and correlates of past 12-month suicide attempt among adults with past-year suicidal ideation in the United States. J Clin Psychiatry. 2015;76:295-302. [PMID: 25830449] doi:10.4088/JCP.14m09287
16. **Miller M, Azrael D, Barber C.** Suicide mortality in the United States: the importance of attending to method in understanding population-level disparities in the burden of suicide. Annu Rev Public Health. 2012;33:393-408. [PMID: 22224886] doi:10.1146/annurev-publhealth-031811-124636
17. **O'Carroll PW, Berman AL, Maris RW, et al.** Beyond the Tower of Babel: a nomenclature for suicidology. Suicide Life Threat Behav. 1996;26:237-52. [PMID: 8897663]
18. **Silverman MM, Berman AL, Sanddal ND, et al.** Rebuilding the Tower of Babel: a revised nomenclature for the study of suicide and suicidal behaviors. Part 2: Suicide-related ideations, communications, and behaviors. Suicide Life Threat Behav. 2007;37:264-77. [PMID: 17579539]
19. **Agency for Healthcare Research and Quality.** Introduction to the HCUP Nationwide Emergency Department Sample (NEDS) 2015. 2017. Accessed at www.hcup-us.ahrq.gov/db/nation/neds/NEDS2015Introduction.pdf on 18 March 2019.
20. **Agency for Healthcare Research and Quality.** Introduction to the HCUP National Inpatient Sample (NIS) 2016. 2018. Accessed at www.hcup-us.ahrq.gov/db/nation/nis/NIS_Introduction_2016.pdf on 18 March 2019.
21. **Houchens RL, Ross D, Elixhauser A.** Using the HCUP National Inpatient Sample to Estimate Trends. HCUP Methods Series Report #2006-05. Rockville, MD: Agency for Healthcare Research and Quality; 2015. Accessed at www.hcup-us.ahrq.gov/reports/methods/2006_05_NISTrendsReport_1988-2004.pdf on 18 March 2019.
22. **Centers for Disease Control and Prevention (CDC).** Fatal and nonfatal suicide attempts among adolescents—Oregon, 1988–1993. MMWR Morb Mortal Wkly Rep. 1995;44:312-5, 321-3. [PMID: 7715589]
23. **Schmidtke A, Bille-Brahe U, DeLeo D, et al.** Attempted suicide in Europe: rates, trends and sociodemographic characteristics of suicide attempters during the period 1989–1992. Results of the WHO/EURO Multicentre Study on Parasuicide. Acta Psychiatr Scand. 1996;93:327-38. [PMID: 8792901]
24. **Colorado Department of Public Health.** Injury Epidemiology Program: Suicide in Colorado. Denver: Colorado Department of Public Health; 1994.
25. **Ingram DD, Franco SJ.** NCHS Urban-Rural Classification Scheme for Counties. DHHS publication no. (PHS) 2012–1354. Hyattsville, MD: National Center for Health Statistics; 2012. Accessed at www.cdc.gov/nchs/data/series/sr_02/sr02_154.pdf on 18 March 2019.
26. **Ingram DD, Franco SJ.** 2013 NCHS Urban-Rural Classification Scheme for Counties. National Center for Health Statistics. DHHS publication no. 2014–1366. Hyattsville, MD: National Center for Health Statistics; 2014. Accessed at www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf on 18 March 2019.
27. **von Elm E, Altman DG, Egger M, et al; STROBE Initiative.** The Strengthening the Reporting of Observational Studies in Epidemiol-

ogy (STROBE) statement: guidelines for reporting observational studies. Ann Intern Med. 2007;147:573-7. [PMID: 17938396]
28. **Shenassa ED, Catlin SN, Buka SL.** Lethality of firearms relative to other suicide methods: a population based study. J Epidemiol Community Health. 2003;57:120-4. [PMID: 12540687]
29. **Dombrovski AY, Szanto K, Duberstein P, et al.** Sex differences in correlates of suicide attempt lethality in late life. Am J Geriatr Psychiatry. 2008;16:905-13. [PMID: 18978251] doi:10.1097/JGP.0b013e3181860034
30. **Denning DG, Conwell Y, King D, et al.** Method choice, intent, and gender in completed suicide. Suicide Life Threat Behav. 2000;30:282-8. [PMID: 11079640]
31. **Miller M, Hempstead K, Nguyen T, et al.** Method choice in nonfatal self-harm as a predictor of subsequent episodes of self-harm and suicide: implications for clinical practice. Am J Public Health. 2013;103:e61-8. [PMID: 23597351] doi:10.2105/AJPH.2013.301326
32. **Jamison EC, Bol KA.** Previous suicide attempt and its association with method used in a suicide death. Am J Prev Med. 2016;51:S226-S233. [PMID: 27745611] doi:10.1016/j.amepre.2016.07.023
33. **Nock MK, Borges G, Bromet EJ, et al.** Suicide and suicidal behavior. Epidemiol Rev. 2008;30:133-54. [PMID: 18653727] doi:10.1093/epirev/mxn002
34. **Kegler SR, Stone DM, Holland KM.** Trends in suicide by level of urbanization – United States, 1999–2015. MMWR Morb Mortal Wkly Rep. 2017;66:270-3. [PMID: 28301448] doi:10.15585/mmwr.mm6610a2
35. **Ivey-Stephenson AZ, Crosby AE, Jack SPD, et al.** Suicide trends among and within urbanization levels by sex, race/ethnicity, age group, and mechanism of death – United States, 2001–2015. MMWR Surveill Summ. 2017;66:1-16. [PMID: 28981481] doi:10.15585/mmwr.ss6618a1
36. **Nestadt PS, Triplett P, Fowler DR, et al.** Urban-rural differences in suicide in the state of Maryland: the role of firearms. Am J Public Health. 2017;107:1548-53. [PMID: 28817331] doi:10.2105/AJPH.2017.303865
37. **Fontanella CA, Hiance-Steelesmith DL, Phillips GS, et al.** Widening rural-urban disparities in youth suicides, United States, 1996–2010. JAMA Pediatr. 2015;169:466-73. [PMID: 25751611] doi:10.1001/jamapediatrics.2014.3561
38. **Branas CC, Nance ML, Elliott MR, et al.** Urban-rural shifts in intentional firearm death: different causes, same results. Am J Public Health. 2004;94:1750-5. [PMID: 15451745]
39. **Nance ML, Carr BG, Kallan MJ, et al.** Variation in pediatric and adolescent firearm mortality rates in rural and urban US counties. Pediatrics. 2010;125:1112-8. [PMID: 20498168] doi:10.1542/peds.2009-3219
40. **Azrael D, Hepburn L, Hemenway D, et al.** The stock and flow of U.S. firearms: results from the 2015 National Firearms Survey. RSF. 2017;3:38-57. doi:10.7758/rsf.2017.3.5.02.
41. **Moscicki EK, O'Carroll P, Rae DS, et al.** Suicide attempts in the Epidemiologic Catchment Area Study. Yale J Biol Med. 1988;61:259-68. [PMID: 3262956]
42. **Crosby AE, Han B, Ortega LA, et al; Centers for Disease Control and Prevention (CDC).** Suicidal thoughts and behaviors among adults aged ≥18 years—United States, 2008–2009. MMWR Surveill Summ. 2011;60:1-22. [PMID: 22012169]
43. **Claassen CA, Carmody T, Bossarte R, et al.** Do geographic regions with higher suicide rates also have higher rates of nonfatal intentional self-harm? Suicide Life Threat Behav. 2008;38:637-49. [PMID: 19152295] doi:10.1521/suli.2008.38.6.637
44. **Webster DW, Miller M, Azrael D, et al.** Firearms and violent death in the United States. In: Webster DW, Vernick J, eds. Reducing Gun Violence in America: Informing Policy with Evidence and Analysis. Baltimore: Johns Hopkins Univ Pr; 2013:3-20.
45. **Barber CW, Miller MJ.** Reducing a suicidal person's access to lethal means of suicide: a research agenda. Am J Prev Med. 2014;47:S264-72. [PMID: 25145749] doi:10.1016/j.amepre.2014.05.028
46. **Turecki G, Brent DA.** Suicide and suicidal behaviour. Lancet. 2016;387:1227-39. [PMID: 26385066] doi:10.1016/S0140-6736(15)00234-2
47. **Yip PS, Caine E, Yousuf S, et al.** Means restriction for suicide prevention. Lancet. 2012;379:2393-9. [PMID: 22726520] doi:10.1016/S0140-6736(12)60521-2
48. **Olson LM, Christoffel KK, O'Connor KG.** Pediatricians' involvement in gun injury prevention. Inj Prev. 2007;13:99-104. [PMID: 17446249]
49. **Betz ME, Miller M, Barber C, et al; ED-SAFE Investigators.** Lethal means restriction for suicide prevention: beliefs and behaviors of emergency department providers. Depress Anxiety. 2013;30:1013-20. [PMID: 23495002] doi:10.1002/da.22075
50. **Butkus R, Weissman A.** Internists' attitudes toward prevention of firearm injury. Ann Intern Med. 2014;160:821-7. [PMID: 24722784] doi:10.7326/M13-1960
51. **Beidas RS, Jager-Hyman S, Becker-Haimes EM, et al.** Acceptability and use of evidence-based practices for firearm storage in pediatric primary care. Acad Pediatr. 2019;19:670-6. [PMID: 30508600] doi:10.1016/j.acap.2018.11.007
52. **Hoops K, Crifasi C.** Pediatric resident firearm-related anticipatory guidance: why are we still not talking about guns? Prev Med. 2019;124:29-32. [PMID: 31047911] doi:10.1016/j.ypmed.2019.04.020
53. **Sellers FS.** 'Being silenced is not acceptable': Doctors express outrage after NRA tells them 'to stay in their lane'. The Washington Post. 11 November 2018. Accessed at www.washingtonpost.com/national/being-silenced-is-not-acceptable-doctors-express-outrage-after-nra-tells-them-to-stay-in-their-lane/2018/11/11/5a8beca0-e5d5-11e8-b8dc-66cca409c180_story.html?noredirect=on on 21 August 2019.
54. **Weinberger SE, Hoyt DB, Lawrence HC 3rd, et al.** Firearm-related injury and death in the United States: a call to action from 8 health professional organizations and the American Bar Association. Ann Intern Med. 2015;162:513-6. [PMID: 25706470] doi:10.7326/M15-0337
55. **Giggie MA, Olvera RL, Joshi MN.** Screening for risk factors associated with violence in pediatric patients presenting to a psychiatric emergency department. J Psychiatr Pract. 2007;13:246-52. [PMID: 17667737]
56. **Price JH, Kinnison A, Dake JA, et al.** Psychiatrists' practices and perceptions regarding anticipatory guidance on firearms. Am J Prev Med. 2007;33:370-3. [PMID: 17950401]
57. **Finch SA, Weiley V, Ip EH, et al.** Impact of pediatricians' perceived self-efficacy and confidence on violence prevention counseling: a national study. Matern Child Health J. 2008;12:75-82. [PMID: 17554613]
58. **Price JH, Thompson A, Khubchandani J, et al.** Perceived roles of emergency department physicians regarding anticipatory guidance on firearm safety. J Emerg Med. 2013;44:1007-16. [PMID: 23352862] doi:10.1016/j.jemermed.2012.11.010
59. **Betz ME, Miller M, Barber C, et al.** Lethal means access and assessment among suicidal emergency department patients. Depress Anxiety. 2016;33:502-11. [PMID: 26989850] doi:10.1002/da.22486

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Appendix Table 1. Number of Suicide Deaths, Number of Suicidal Acts, and Suicide Case-Fatality Rates, by Demographic Characteristics and Method, Stratified by Region

Variable	Suicide Deaths, *n* (%)					Total Suicidal Acts, *n* (%)*					Case-Fatality Rate, %†				
	US	Region				US	Region				US	Region			
		NE	MW	S	W		NE	MW	S	W		NE	MW	S	W
All	309 377 (100)	43 126 (100)	66 199 (100)	120 272 (100)	79 780 (100)	3 657 886 (100)	653 609 (100)	872 663 (100)	1 360 484 (100)	771 131 (100)	8.5	6.6	7.6	8.8	10.3
Sex															
Male	242 616 (78.4)	33 867 (78.5)	52 755 (79.7)	94 338 (78.4)	61 656 (77.3)	1 645 783 (45.0)	296 031 (45.3)	384 919 (44.1)	623 663 (45.8)	341 169 (44.2)	14.7	11.4	13.7	15.1	18.1
Female	66 761 (21.6)	9259 (21.5)	13 444 (20.3)	25 934 (21.6)	18 124 (22.7)	2 010 522 (55.0)	357 537 (54.7)	487 434 (55.9)	736 612 (54.2)	428 940 (55.7)	3.3	2.6	2.8	3.5	4.2
Age group															
5–14 y	2364 (0.8)	291 (0.7)	614 (0.9)	847 (0.7)	612 (0.8)	171 458 (4.7)	33 299 (5.1)	43 546 (5.0)	59 757 (4.4)	34 857 (4.5)	1.4	0.9	1.4	1.4	1.8
15–24 y	37 015 (12.0)	4921 (11.4)	8779 (13.3)	13 738 (11.4)	9577 (12.0)	1 084 720 (29.7)	209 191 (32.0)	284 479 (32.6)	362 570 (26.7)	228 480 (29.6)	3.4	2.4	3.1	3.8	4.2
25–34 y	46 787 (15.1)	6027 (14.0)	10 390 (15.7)	18 389 (15.3)	11 981 (15.0)	788 496 (21.6)	130 268 (19.9)	188 019 (21.5)	311 095 (22.9)	159 114 (20.6)	5.9	4.6	5.5	5.9	7.5
35–44 y	53 198 (17.2)	7508 (17.4)	11 701 (17.7)	20 878 (17.4)	13 111 (16.4)	648 986 (17.7)	111 595 (17.1)	152 506 (17.5)	250 924 (18.4)	133 961 (17.4)	8.2	6.7	7.7	8.3	9.8
45–54 y	68 437 (22.1)	10 340 (24.0)	14 752 (22.3)	26 215 (21.8)	17 130 (21.5)	573 137 (15.7)	100 720 (15.4)	127 354 (14.6)	224 581 (16.5)	120 482 (15.6)	11.9	10.3	11.6	11.7	14.2
55–64 y	50 759 (16.4)	7276 (16.9)	10 181 (15.4)	19 578 (16.3)	13 724 (17.2)	247 512 (6.8)	43 532 (6.7)	50 631 (5.8)	94 959 (7.0)	58 390 (7.6)	20.5	16.7	20.1	20.6	23.5
≥65 y	50 817 (16.4)	6763 (15.7)	9782 (14.8)	20 627 (17.2)	13 645 (17.1)	143 577 (3.9)	25 004 (3.8)	26 128 (3.0)	56 598 (4.2)	35 847 (4.6)	35.4	27.0	37.4	36.4	38.1
Urbanization															
Large central metro	76 733 (24.8)	9832 (22.8)	12 436 (18.8)	23 640 (19.7)	30 825 (38.6)	911 046 (25.3)	152 873 (24.7)	188 624 (21.7)	248 746 (18.4)	320 803 (42.1)	8.4	6.4	6.6	9.5	9.6
Large fringe metro	69 579 (22.5)	14 635 (33.9)	15 879 (24.0)	28 065 (23.3)	11 000 (13.8)	770 502 (21.4)	182 946 (29.6)	182 972 (21.0)	318 019 (23.6)	86 565 (11.4)	9.0	8.0	8.7	8.8	12.7
Medium metro	66 558 (21.5)	9952 (23.1)	11 661 (17.6)	28 258 (23.5)	16 687 (20.9)	857 294 (23.8)	164 548 (26.6)	166 548 (19.1)	351 866 (26.1)	174 333 (22.9)	7.8	6.0	7.0	8.0	9.6
Small metro	33 595 (10.9)	2680 (6.2)	8696 (13.1)	13 507 (11.2)	8712 (10.9)	377 858 (10.5)	35 063 (5.7)	123 222 (14.2)	141 606 (10.5)	77 968 (10.2)	8.9	7.6	7.1	9.5	11.2
Micropolitan	36 816 (11.9)	4166 (9.7)	9760 (14.7)	14 870 (12.4)	8020 (10.1)	437 479 (12.2)	60 059 (9.7)	131 188 (15.1)	178 039 (13.2)	68 193 (9.0)	8.4	6.9	7.4	8.4	11.8
Noncore	26 096 (8.4)	1861 (4.3)	7767 (11.7)	11 932 (9.9)	4536 (5.7)	245 850 (6.8)	23 354 (3.8)	77 578 (8.9)	111 357 (8.3)	33 561 (4.4)	10.6	8.0	10.0	10.7	13.5
Method															
Drug poisoning	41 758 (13.5)	6275 (14.6)	8547 (12.9)	14 405 (12.0)	12 531 (15.7)	2 171 482 (59.4)	360 855 (55.2)	524 516 (60.1)	826 524 (60.8)	459 587 (59.6)	1.9	1.7	1.6	1.7	2.7
Nondrug poisoning	2110 (0.7)	384 (0.9)	496 (0.7)	732 (0.6)	498 (0.6)	194 532 (5.3)	28 249 (4.3)	49 228 (5.6)	70 137 (5.2)	46 918 (6.1)	1.1	1.4	1.0	1.0	1.1
Gas	8659 (2.8)	1372 (3.2)	2472 (3.7)	2532 (2.1)	2283 (2.9)	28 417 (0.8)	4339 (0.7)	9148 (1.0)	8739 (0.6)	6191 (0.8)	30.5	31.6	27.0	29.0	36.9
Hanging	76 688 (24.7)	14 162 (32.8)	17 720 (26.8)	24 902 (20.7)	19 904 (24.9)	145 568 (4.0)	26 852 (4.1)	36 439 (4.2)	47 848 (3.5)	34 430 (4.5)	52.7	52.7	48.6	52.0	57.8
Drowning	3115 (1.0)	732 (1.7)	584 (0.9)	1104 (0.9)	695 (0.9)	5527 (0.2)	1166 (0.2)	1111 (0.1)	1983 (0.1)	1267 (0.2)	56.4	62.8	52.5	55.7	54.8
Firearm	156 901 (50.6)	15 768 (36.6)	32 444 (49.0)	70 848 (58.9)	37 841 (47.4)	175 190 (4.8)	17 492 (2.7)	36 139 (4.1)	80 707 (5.9)	40 852 (5.3)	89.6	90.1	89.8	87.8	92.6
Cutting/piercing	5539 (1.8)	1114 (2.6)	1108 (1.7)	1769 (1.5)	1548 (1.9)	784 309 (21.4)	155 728 (23.8)	188 858 (21.6)	276 705 (20.3)	163 019 (21.1)	0.7	0.7	0.6	0.6	0.9
Jumping	6630 (2.1)	1710 (4.0)	1018 (1.5)	1612 (1.3)	2290 (2.9)	23 746 (0.6)	5734 (0.9)	4600 (0.5)	7057 (0.5)	6355 (0.8)	27.9	29.8	22.1	22.8	36.0
Moving object	3245 (1.0)	811 (1.9)	714 (1.1)	797 (0.7)	923 (1.2)	12 090 (0.3)	1993 (0.3)	2290 (0.3)	4833 (0.4)	2973 (0.4)	26.8	40.7	31.2	16.5	31.0
Other	4732 (1.5)	798 (1.9)	1096 (1.7)	1571 (1.3)	1267 (1.6)	275 589 (7.5)	67 878 (10.4)	64 405 (7.4)	89 580 (6.6)	53 726 (7.0)	1.7	1.2	1.7	1.8	2.4

MW = Midwest; NE = Northeast; S = South; US = United States; W = West.
* Sum of suicide deaths and nonfatal suicide attempts.
† Suicide deaths divided by total suicidal acts.

Appendix Table 2. Method-Specific Suicide Case-Fatality Rates, by Demographic Characteristics, Stratified by Region

Variable	Case-Fatality Rate, %*																											
	Firearm					Drowning					Hanging					Gas					Jumping					Moving Object				
	US	Region				US	Region				US	Region				US	Region				US	Region				US	Region			
		NE	MW	S	W		NE	MW	S	W		NE	MW	S	W		NE	MW	S	W		NE	MW	S	W		NE	MW	S	W
All	89.6	90.1	89.8	87.8	92.6	56.4	62.8	52.5	55.7	54.8	52.7	52.7	48.6	52.0	57.8	30.5	31.6	27.0	29.0	36.9	27.9	29.8	22.1	22.8	36.0	26.8	40.7	31.2	16.5	31.0
Sex																														
Male	90.4	90.8	90.3	88.8	93.3	62.0	68.0	61.4	58.4	62.4	55.9	55.8	52.3	55.0	55.8	34.2	36.3	30.4	31.9	41.6	30.6	33.4	24.0	25.1	38.8	30.7	44.9	34.6	19.2	36.0
Female	84.6	84.9	85.3	82.6	88.7	48.7	55.0	40.4	51.8	46.0	43.0	43.5	38.2	42.1	43.5	21.6	19.2	19.5	21.6	26.1	22.6	23.5	18.1	18.5	30.0	19.6	31.6	24.8	11.6	21.4
Age group																														
5–14 y	82.5	75.0	78.0	82.2	90.4	1.6	0†	6.8†	0†	0†	19.9	21.1†	18.8	18.5	21.1	0.2	2.2	0†	0†	0†	1.8	2.1†	1.7†	0.6†	3.8†	5.3	17.7†	4.4†	3.0†	6.0†
15–24 y	82.8	83.3	81.3	81.3	87.2	35.4	43.4	26.1	34.3	38.5	37.7	35.2	34.3	38.9	35.2	13.4	18.4	9.6	13.2	16.7	16.9	16.9	14.6	13.1	23.1	21.0	32.1	24.6	13.7	23.9
25–34 y	84.7	85.9	87.6	81.3	88.5	51.4	55.4	39.5	50.5	61.6	49.0	46.3	45.8	49.5	46.3	20.9	22.9	18.1	18.7	27.7	22.5	23.7	17.6	17.4	31.1	23.9	37.7	26.4	15.1	28.1
35–44 y	87.5	88.4	88.5	85.7	90.2	61.6	66.8	60.0	64.4	54.4	57.8	55.2	55.3	57.8	55.2	28.8	25.8	23.9	28.8	41.0	28.5	29.9	22.2	23.7	36.9	28.9	43.3	34.1	16.1	36.5
45–54 y	89.2	89.5	89.8	86.7	93.8	61.1	73.5	60.1	60.7	51.8	68.7	67.7	67.5	66.7	67.7	35.2	36.2	32.5	33.7	40.5	34.4	37.6	28.8	27.5	43.1	31.3	41.9	41.6	18.2	40.1
55–64 y	93.2	92.2	92.6	92.5	95.5	70.3	70.9	74.8	67.0	71.6	78.1	77.3	79.0	75.9	77.3	45.0	41.8	40.8	46.4	51.6	49.3	51.3	48.3	41.6	55.3	43.6	52.1	51.7	33.8	43.2
≥65 y	95.4	96.1	95.7	94.6	96.2	72.0	79.9	86.9	68.8	61.9	73.2	76.3	72.1	67.1	76.3	50.2	45.2	53.7	47.7	53.2	66.0	70.0	54.1	69.5	65.2	50.9	66.5	60.4	37.4	44.2
Urbanization																														
Large central metro	90.6	88.0	88.0	89.7	93.1	60.2	76.8	58.1	59.9	53.3	56.8	58.0	49.6	58.3	58.0	29.6	28.9	25.8	29.5	32.3	35.2	41.4	26.4	30.7	37.9	29.1	45.0	28.6	17.0	30.8
Large fringe metro	90.7	92.5	89.8	89.9	93.2	62.8	65.3	56.7	62.8	65.4	56.8	59.7	51.4	54.8	59.7	32.6	33.2	28.6	29.6	50.7	27.5	30.0	22.8	24.1	37.9	33.6	50.2	35.9	21.0	38.4
Medium metro	90.2	91.9	91.4	88.2	92.9	54.8	63.1	45.5	53.0	58.1	51.4	45.8	51.4	52.0	45.8	30.8	32.2	27.9	29.2	36.5	24.9	20.1	19.4	21.8	37.6	23.0	30.6	30.0	13.0	35.2
Small metro	89.6	90.4	89.9	87.6	93.0	51.0	48.6	43.1	57.9	53.1	51.9	58.1	48.1	51.2	58.1	33.2	35.8	30.6	34.0	35.3	22.0	17.6	25.5	15.2	32.1	25.5	32.1	29.3	20.2	28.2
Micropolitan	87.4	88.5	89.8	84.6	90.6	48.1	45.0	49.0	48.0	49.3	46.9	48.9	43.9	44.7	48.9	28.6	34.2	24.3	27.1	39.2	16.9	18.2	14.6	11.6	28.3	21.2	27.4†	27.5	12.6	36.8
Noncore	87.7	85.9	90.8	84.9	92.3	46.3	15.5†	59.3†	38.7	18.0†	46.6	47.9	45.6	45.3	47.9	28.9	54.2	23.6	24.4	49.6	12.0	7.7†	8.8	10.6	30.5	20.7	11.7†	36.6†	17.0	14.6†

MW = Midwest; NE = Northeast; S = South; US = United States; W = West.
* Proportion of suicidal acts with a particular method that result in death.
† <21 suicides or <41 suicidal acts.

Appendix Table 2–Continued

Variable	Case-Fatality Rate, %*																								
	Nondrug Poisoning					Drug Poisoning					Cutting/Piercing					Other					All Methods				
	US	Region				US	Region				US	Region				US	Region				US	Region			
		NE	MW	S	W		NE	MW	S	W		NE	MW	S	W		NE	MW	S	W		NE	MW	S	W
All	1.1	1.4	1.0	1.0	1.1	1.9	1.7	1.6	1.7	2.7	0.7	0.7	0.6	0.6	0.9	1.7	1.2	1.7	1.8	2.4	8.5	6.6	7.6	8.8	10.3
Sex																									
Male	1.6	1.9	1.6	1.5	1.6	2.5	2.2	2.1	2.2	3.7	1.3	1.4	1.2	1.1	1.8	2.0	1.5	2.0	2.0	2.7	14.7	11.4	13.7	15.1	18.1
Female	0.7	0.8	0.5	0.6	0.7	1.6	1.4	1.4	1.5	2.2	0.2	0.2	0.2	0.2	0.3	1.2	0.7	1.2	1.4	1.7	3.3	2.6	2.8	3.5	4.2
Age group																									
5–14 y	0.0	0†	0.1†	0†	0†	0.1	0.1†	0.1†	0.1†	0.1	0.0	0†	0†	0†	0†	0.0	0†	0†	0†	0.1†	1.4	0.9	1.4	1.4	1.8
15–24 y	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.3	0.4	0.5	0.1	0.1	0.1	0.1	0.1	0.6	0.4	0.6	0.6	0.9	3.4	2.4	3.1	3.8	4.2
25–34 y	0.6	0.8	0.6	0.6	0.7	1.1	1.0	1.0	1.0	1.5	0.3	0.3	0.3	0.3	0.5	1.1	0.7	1.1	1.2	1.6	5.9	4.6	5.5	5.9	7.5
35–44 y	0.9	1.1	0.9	1.0	0.7	2.0	1.7	1.8	1.8	2.8	0.8	0.8	0.7	0.7	1.2	2.3	1.8	2.4	2.3	3.0	8.2	6.7	7.7	8.3	9.8
45–54 y	1.5	1.6	1.3	1.5	1.4	3.3	2.9	3.1	2.9	4.5	1.9	2.1	1.9	1.6	2.4	4.3	3.2	4.8	4.3	5.1	11.9	10.3	11.6	11.7	14.2
55–64 y	2.9	3.4	3.1	2.9	2.6	5.6	4.9	5.2	4.8	7.7	4.3	4.5	3.7	4.0	5.1	7.5	6.2	9.6	6.7	8.0	20.5	16.7	20.1	20.6	23.5
≥65 y	4.6	6.8	5.2	3.3	4.5	6.8	5.8	6.4	5.6	9.6	6.2	7.1	6.7	5.2	6.6	6.6	5.9	8.6	6.2	6.3	35.4	27.0	37.4	36.4	38.1
Urbanization																									
Large central metro	1.2	1.3	0.9	1.4	1.1	2.1	1.7	1.5	2.0	2.8	1.0	1.0	0.7	1.1	1.1	1.9	1.2	1.8	2.2	2.4	8.4	6.4	6.6	9.5	9.6
Large fringe metro	1.2	1.7	1.3	1.0	1.1	2.2	2.3	2.0	1.9	3.4	0.8	1.0	0.7	0.7	1.3	2.3	1.9	2.5	2.3	3.3	9.0	8.0	8.7	8.8	12.7
Medium metro	1.0	1.4	0.9	1.0	0.9	1.9	1.7	1.7	1.7	2.6	0.6	0.5	0.5	0.5	0.8	1.4	1.1	1.3	1.5	2.0	7.8	6.0	7.0	8.0	9.6
Small metro	1.0	2.1	1.0	0.9	0.9	1.8	2.0	1.5	1.6	2.6	0.6	0.5	0.5	0.6	0.8	1.6	1.0	1.3	1.5	3.2	8.9	7.6	7.1	9.5	11.2
Micropolitan	1.0	1.3	0.9	0.8	1.5	1.6	1.7	1.4	1.4	2.7	0.5	0.4	0.5	0.4	0.8	1.4	0.8	1.6	1.4	2.1	8.4	6.9	7.4	8.4	11.8
Noncore	1.0	0.6†	0.8	1.1	1.0†	1.8	1.8	1.7	1.7	2.3	0.5	0.1†	0.5	0.5	0.1†	1.5	0.5	1.9	1.8	1.6	10.6	8.0	10.0	10.7	13.5