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Evaluating the cause-of-death information needed for estimating the burden of injury mortality: United States, 2019

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Abstract

Objective—This study evaluated the quality of the cause-of-death information on death certificates for injury deaths, by determining the percentage of deaths for which the underlying cause was a nonspecific injury mechanism.

Methods—Injury deaths were identified from 2019 National Vital Statistics System mortality data using underlying-cause-of-death (UCOD) codes U01–U03, V01–Y36, Y85–Y87, and Y89. Deaths were categorized by intent and mechanism of injury using the ICD–10 External Cause of Injury Mortality Matrix. The percentage of injury deaths assigned a nonspecific injury mechanism UCOD code was determined for various intent and mechanism categories.

Results—In 2019, 246,041 injury deaths occurred, of which 173,040 were unintentional, 47,511 suicide and intentional self-harm, 19,141 homicide, 5,683 undetermined intent, and 666 resulting from legal intervention and war operations. The percentage of deaths assigned a nonspecific UCOD mechanism code varied from 0.2% for suicide and intentional self-harm deaths to 10.6% for injury deaths of undetermined intent. Within an intent-by-mechanism-of-injury category, more specific injury mechanism codes can be assigned if sufficient information is provided on the death certificate. Otherwise, a nonspecific injury mechanism is assigned. What is considered to be specific varies for each injury mechanism. For most unintentional injury mechanism categories, less than 15% of the deaths received a nonspecific mechanism code. Percentages were higher for unintentional falls (44.6%), motor vehicle traffic (31.1%), and firearm-related (75.9%) deaths. High percentages were also seen for firearm-related suicides (62.9%) and firearm-related homicides (89.5%). The percentage of deaths with a nonspecific injury mechanism UCOD code varied by state.

Conclusions—Death certificate documentation allowed assignment of a general mechanism of injury for the majority of injury deaths in 2019. Improvements in documentation are most needed for deaths involving falls, motor vehicles, and firearms. Study results can help inform medical examiners, coroners, and other death certifiers about the need to improve cause-of-death statements to enhance the usefulness of mortality data for public health.

Keywords: death certification • *International Classification of Diseases, 10th Revision* • National Vital Statistics System, Mortality

Introduction

Reliable estimates of the burden of deaths due to injury provide essential information for shaping national health priorities and identifying prevention strategies (1,2). Many estimates rely on data from the National Vital Statistics System, Mortality (NVSS–M) files, a data set that includes information from all death certificates filed in the 50 states and the District of Columbia (3).

In generating NVSS-M, the National Center for Health Statistics (NCHS) uses information from the cause-of-death statements in the death certificate literal text to assign underlying- and multiple-cause-of-death codes from the *International Classification of Diseases, 10th Revision* (ICD-10). ICD-10 is a classification system developed by the World Health Organization (WHO) to facilitate international comparison of mortality statistics (4). The literal text is the written information provided by the medical certifier, often a coroner or medical examiner in the case of an injury death, that describes the cause of death and other factors or circumstances contributing to the death (5). The literal text is captured in three fields of the U.S.





standard death certificate: the causes of death from Part I, the significant conditions contributing to death from Part II, and a description of how the injury occurred (6). NCHS uses the literal text in conjunction with standard practices, coding software, and WHO coding rules to assign the ICD–10 codes for underlying and multiple causes of death (3,7).

The ICD-10 codes for external causes of injury convey information about the intent and mechanism of the injury. Intent of injury describes whether the injury was inflicted purposefully (intentional injury) and, if purposeful, whether the injury was self-inflicted (suicide or self-harm) or inflicted by another person (homicide) (8). Injuries that were not purposefully inflicted are considered unintentional (accidental) injuries. Additional intent-of-injury categories include undetermined intent; and legal intervention and war operations. Mechanism of injury describes the source of the energy transfer that resulted in physical or physiological harm to the body. Examples of mechanisms of injury include falls, motor vehicle traffic crashes, burns, poisonings, and drownings (8).

Injury-related ICD-10 codes vary in their level of detail for describing an injury event, from being relatively nonspecific (such as W19, Unspecified fall) to more specific (such as W02, Fall involving ice-skates, skis, roller-skates or skateboards) (4). When a cause-of-death statement in the death certificate literal text provides sufficient detail, a more specific ICD-10 code can be assigned. For example, for fall-related deaths, when sufficient information is provided, specific ICD-10 codes can be used to distinguish falls that occurred on the same level due to slipping, tripping, and stumbling; falls from beds, chairs, and other furniture; falls on or from stairs, steps, ladders, and scaffolding; falls from a building, tree, or cliff; and other types of falls (Technical Notes). For drowning-related deaths, specific ICD-10 codes can be used to distinguish deaths based on where the drowning occurred (such as in a bathtub, swimming pool, or natural body of water). For firearm-related deaths, specific ICD-10 codes can be used to distinguish deaths based on the general type of firearm involved (such as handgun; or rifle, shotgun, or other larger firearms). When the cause-of-death statement lacks sufficient detail, however, a nonspecific ICD-10 code (for example, a code such as W19, Unspecified fall or W74, Unspecified drowning and submersion) is assigned to the death.

This study measured the percentage of injury deaths that received a nonspecific injury mechanism ICD-10 underlyingcause-of-death (UCOD) code, by intent and mechanism of injury. The study was conducted in two stages: 1) for each intent-ofinjury category, the percentage of deaths that did not specify a general injury mechanism in the cause of death was measured. and 2) for each general mechanism-of-injury category, the percentage of deaths that did not receive a more specific ICD-10 injury mechanism code was measured. As described above, what is considered a specific injury mechanism varies by mechanism category. For example, for falls, a specific injury mechanism is one in which specific information is provided on the type of fall; for drowning, a specific mechanism is one in which information is provided on the location of the drowning; for firearm-related deaths, a specific mechanism is one in which information is provided on the general type of firearm involved (handgun or long gun). Because states can vary in their medicolegal death investigation systems and processes, including the person or position responsible for completing the cause of death section of the death certificate (9), state differences were also examined.

Study results can help identify injury topic areas where improvements in cause-of-death statements on death certificates are needed. Improvements in cause-of-death statements can lead to improvements in the quality of the mortality data that are essential for public health surveillance and injury prevention efforts.

Methods

This study was conducted using 2019 NVSS-M data (10). Injury deaths were identified as those deaths with an ICD-10 UCOD code of U01-U03, V01-Y36, Y85-Y87, or Y89. Deaths were categorized using the ICD-10 External Cause of Injury Mortality Matrix, a standard categorization schema for grouping ICD-10 external cause of injury codes by intent and mechanism of injury (11). Intent-of-injury categories in the ICD-10 External Cause of Injury Mortality Matrix include unintentional, suicide and intentional self-harm, homicide, undetermined intent, and legal intervention and war operations. The mechanism-of-injury categories examined in this study included drowning, fall, fire and flames, hot objects and substances, suffocation, drug poisoning, nondrug poisoning, motor vehicle traffic, and firearm-related.

The proportion (percentage) of injury deaths assigned a nonspecific-injury-mechanism UCOD code was determined for the intent-by-mechanism-of-injury categories that include a nonspecific-injury-mechanism code (generally defined as a code where further information on the mechanism of injury is "unspecified") (Technical Notes). Many of the nonspecific-injury-mechanism UCOD codes used in this analysis were also identified in a recent *National Vital Statistics Report* on unsuitable underlying causes of death (12).

most intent-by-mechanism-of-iniury categories. a single code identified the nonspecific-injury-mechanism (Technical Notes). However, for drug and nondrug poisonings, a combination of underlying and multiple cause codes was needed to identify a death for which a specific drug or substance was not identified. For unintentional drug poisoning deaths (deaths with UCOD codes X40-X44) and for suicide drug poisoning deaths (deaths with UCOD codes X60-X64), the mechanism of injury was considered nonspecific (that is, a specific drug was not identified) if the underlying cause code was X44 (in the case of unintentional drug poisoning) or X64 (in the case of suicide by drug poisoning), and the only drug-related multiple cause code was T50.9, Other and unspecified drugs, medicaments and biological substances (Technical Notes). For unintentional nondrug poisoning deaths (deaths with UCOD codes X45-X49) and for suicide nondrug poisoning deaths (deaths with UCOD codes X65-X69), the mechanism of injury was considered nonspecific (that is, a specific substance was not identified) if the underlying cause was X49 (in the case of unintentional nondrug poisoning) or X69 (in the case of suicide by nondrug poisoning), and the only nondrug-related multiple cause code was T65.9. Toxic effect of unspecified substance (Technical Notes).

Some of the nonspecific injury mechanism UCOD codes capture "other and unspecified" mechanisms (for example, X19, Contact with other and unspecified heat and hot substances; W34, Discharge from other and unspecified firearms; X74, Intentional self-harm by other and unspecified firearm discharge; and X95, Assault by other and unspecified firearm discharge) (Technical Notes). For deaths assigned these codes, the literal text on a sample of cases was reviewed to determine the frequency with which an "other" mechanism was identified. This review indicated that for the majority of deaths assigned one of these "other and unspecified" codes, the details of the mechanism were unspecified (that is, an "other" mechanism was not identified).

The percentage of deaths assigned a nonspecific injury mechanism UCOD was examined by the decedent's state of residence for all unintentional injury deaths, all homicides, and for those intent-by-mechanism-of-injury categories that had more than 500 deaths and for which more than 15% of the deaths were assigned a nonspecific injury mechanism UCOD code (that is, unintentional fall deaths, unintentional motor vehicle traffic deaths, firearm-related suicides, and firearm-related homicides).

Results

Deaths by intent of injury

In 2019, 246,041 injury deaths occurred in the United States, of which 173,040 were categorized as unintentional (accidental), 47,511 as suicide and intentional self-harm, 19,141 as homicide, 5,683 as undetermined intent, and 666 as resulting from legal intervention or war operations. Table A shows the percentage of deaths assigned a nonspecific injury mechanism UCOD code for each intent-of-injury category. The percentage varied from 0.2% for suicide and intentional self-harm deaths to 10.6% for injury deaths of undetermined intent.

Figures 1 and 2 and Tables 1 and 2 show the percentage of deaths with a UCOD code indicating a nonspecific mechanism for unintentional injury deaths and homicides, respectively, by state. Due to small numbers, results by state are not shown for deaths from suicide and intentional self-harm, injury deaths of undetermined intent, and deaths resulting from legal intervention and war operations. Nationally, 3.7% of unintentional injury deaths had an ICD-10 UCOD code for nonspecific injury mechanism. Percentages by state ranged from 0.8% (South Dakota) to 8.3% (Alabama) (Figure 1, Table 1). For homicides, 6.5% nationally had a nonspecific mechanism code, with percentages by state ranging from 2.2% (New Mexico) to 56.5% (Maine) (Figure 2, Table 2).

Specificity of mechanism for unintentional injury deaths

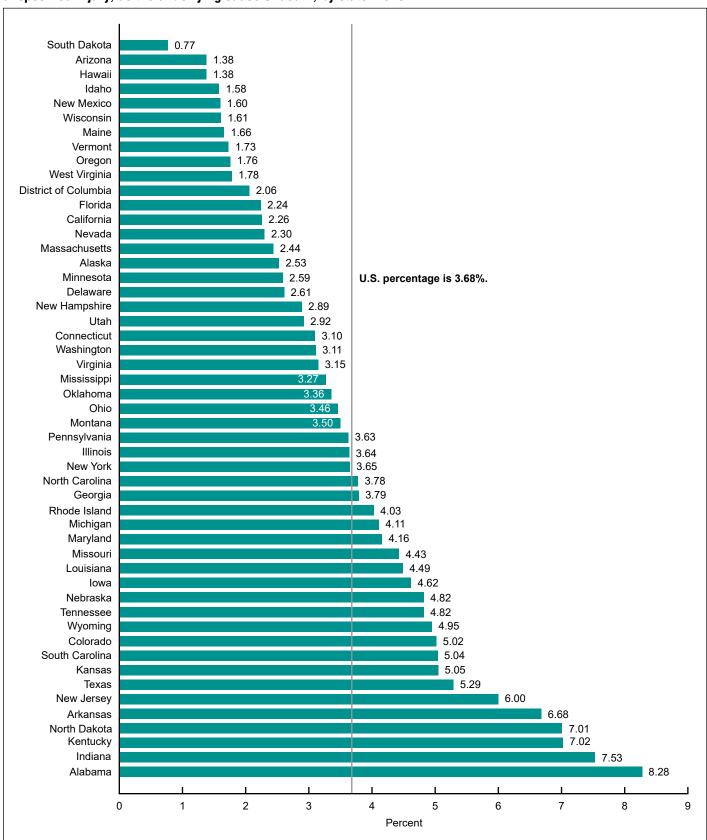
As described in the Introduction, ICD-10 codes provide different levels of specificity within a mechanism-of-injury category. Table B shows the percentage of deaths assigned a nonspecific injury mechanism UCOD code for various intentby-mechanism-of-injury categories. For example, of the 3,692 unintentional drowning deaths identified by ICD-10 UCOD codes W65-W74, 11.1% received a UCOD code of W74, Unspecified drowning and submersion (Table B). For most injury mechanism categories, the percentage of deaths receiving a nonspecific-injury-mechanism code was less than 15%. For three unintentional injury categories (fall, motor vehicle traffic, and firearm-related), the percentage of deaths assigned a nonspecific-injury-mechanism code was greater than 15% (44.6%, 31.1%, and 75.9%, respectively). The definition of "nonspecific" varies for each mechanism. For falls, "nonspecific" indicates that information on the details of the fall (for example, on the same level or from one level to another) were not identified; for motor vehicle traffic, that information on the role of the decedent (for example, vehicle occupant or

Table A. Percentage of deaths with a nonspecific-injury-mechanism underlying cause, by intent of injury: United States, 2019

Intent of injury and <i>International</i> Classification of Diseases, 10th Revision codes for intent	Total number of deaths	Code(s) indicating a nonspecific-injury-mechanism underlying cause	Number of deaths with a nonspecific- injury-mechanism underlying cause	Percent of deaths with a nonspecific- injury-mechanism underlying cause
Unintentional	173,040	X59.0, Exposure to unspecified factor causing fracture; X59.9, Exposure to unspecified factor causing other and unspecified injury	6,369	3.7
Suicide and intentional self-harm	47,511	X84, Intentional self-harm by unspecified means	80	0.2
Homicide	19,141	Y09, Assault by unspecified means	1,247	6.5
Undetermined intent	5,683	Y34, Unspecified event; Y89.9, Sequelae of unspecified external cause	600	10.6
Legal intervention or war operations Y35–Y36, Y89 (.0–.1)	666	Y35.7, Legal intervention, means unspecified; Y36.9, War operations, unspecified	Suppressed	Not calculated

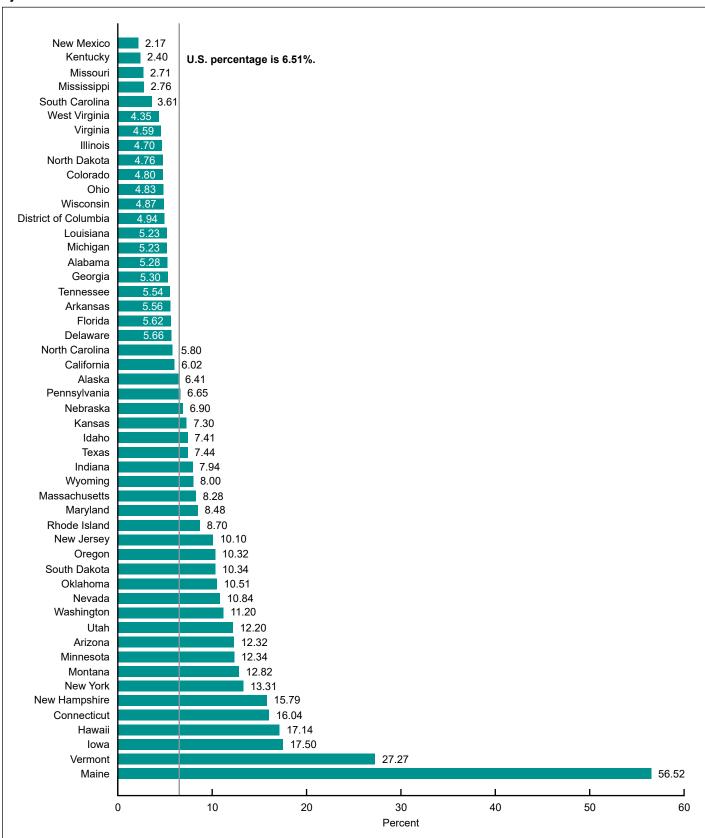
NOTES: Injury deaths are identified using the International Classification of Diseases, 10th Revision underlying-cause-of-death codes U01–U03, V01–Y36, Y85–Y87, and Y89. Deaths were categorized by intent and mechanism of death using the Injury Mortality Matrix, available from: https://www.cdc.gov/nchs/injury/injury_tools.htm. Cells with fewer than 10 deaths are suppressed.

Figure 1. Percentage of unintentional injury deaths with X59, Exposure to unspecified factor causing other or unspecified injury, as the underlying cause of death, by state: 2019



NOTES: Deaths from unintentional injury are identified using *International Classification of Diseases*, 10th Revision codes V01–X59 and Y85–Y86. X59, Exposure to unspecified factor causing other or unspecified injury, is a nonspecific mechanism code. A high value for the percentage of unintentional injury deaths with X59 indicates that a higher percentage of deaths lack sufficient information to assign a more specific injury mechanism code. SOURCE: National Vital Statistics System, Mortality (NVSS–M), 2019.

Figure 2. Percentage of homicide deaths with Y09, Assault by unspecified means, as the underlying cause of death, by state: 2019



NOTES: Homicides are identified using *International Classification of Diseases*, 10th Revision codes U01–U02, X85–Y09, and Y87.1. Y09, Assault by unspecified means, is a nonspecific mechanism code. A high value for the percentage of homicides with Y09 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific injury mechanism code.

Table B. Percentage of deaths with a nonspecific-injury-mechanism underlying cause, by intent and mechanism of injury: United States, 2019

Intent and mechanism of injury and International Classification of Diseases, 10th Revision codes for intent and mechanism	Total number of deaths	Code(s) indicating a nonspecific-injury-mechanism underlying cause	Number of deaths with a nonspecific-injury- mechanism underlying cause	Percent of deaths with a nonspecific-injury- mechanism underlying cause
Unintentional				
Drowning	3,692	W74, Unspecified drowning and submersion	408	11.1
Fall	39,443	W19, Unspecified fall	17,576	44.6
Fire and flames	2,692	X09, Exposure to unspecified smoke, fire and flames	136	5.1
Hot object and substance	66	X19, Contact with other and unspecified heat and hot substances	Suppressed	Not calculated
Firearm-relatedW32-W34	486	W34, Discharge from other and unspecified firearms	369	75.9
Suffocation	7,076	W84, Unspecified threat to breathing	459	6.5
Drug poisoningX40–X44	62,172	X44, Accidental poisoning by and exposure to other and unspecified drugs, medicaments and biological substances and the only drug-related multiple cause code is T50.9, Other and unspecified drugs, medicaments and biological substances	3,574	5.7
Nondrug poisoning	3,601	X49, Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances and the only nondrug poisoning-related multiple cause code is T65.9, Toxic effect of unspecified substance	180	5.0
Motor vehicle traffic	37,595	V89.2, Person injured in unspecified motor-vehicle accident, traffic	11,704	31.1
Suicide and intentional self-harm				
Firearm-related	23,941	X74, Intentional self-harm by other and unspecified firearm discharge	15,060	62.9
Drug poisoningX60–X64	4,777	X64, Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances and the only drug-related multiple cause code is T50.9, Other and unspecified drugs, medicaments and biological substances	440	9.2
Nondrug poisoningX65–X69	1,348	X69, Intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances and the only nondrug poisoning-related multiple cause code is T65.9, Toxic effect of unspecified substance	34	2.5
Homicide				
Firearm-related	14, 414	X95, Assault by other and unspecified firearm discharge	12,906	89.5

NOTES: Deaths were categorized by intent and mechanism of injury using the International Classification of Diseases, 10th Revision External Cause of Injury Mortality Matrix, available from: https://www.cdc.gov/nchs/data/ice/icd10_transcode.pdf. Cells with fewer than 10 deaths are suppressed.

motorcyclist) and types of vehicles involved in the crash were not identified; for firearm-related, that the type of firearm (handgun or long gun) was not identified. Figures 3 and 4 and Tables 3 and 4 show the percentage of deaths with a nonspecific-injury-mechanism code for unintentional fall deaths and unintentional motor vehicle traffic deaths, respectively, by state. Results by state for unintentional firearm-related deaths are not shown due to small numbers. Nationally, 44.6% of unintentional fall deaths had a nonspecific-injury-mechanism code, with percentages by state ranging from 6.0% (West Virginia) to 95.2% (Oklahoma) (Figure 3, Table 3). For unintentional motor vehicle traffic deaths, 31.1% of deaths nationally had a nonspecific mechanism code, with state percentages ranging from 4.8% (Florida) to 53.7% (Tennessee) (Figure 4, Table 4).

Specificity of mechanism for suicide and intentional self-harm deaths

The percentage of deaths assigned a nonspecific injury mechanism UCOD code for suicide and intentional self-harm deaths is shown in Table B. The percentage varied by mechanism: 2.5% for suicides by nondrug poisoning, 9.2% for suicides by drug poisoning (overdose), and 62.9% for firearm-related suicides. The definition of nonspecific varies for each mechanism. For nondrug poisoning, nonspecific indicates that the specific substance(s) involved were not identified; for drug poisoning, that the specific drug(s) involved were not identified; for firearm-related, that the type of firearm (handgun or long gun) was not identified. Figure 5 and Table 5 show the percentage of deaths with a nonspecific mechanism code for firearm-related suicide deaths by state. The percentage of firearm-related suicides with a nonspecific mechanism code ranged from 2.7% (Idaho) to 100% (District of Columbia).

Specificity of mechanism for homicide deaths

The percentage of deaths assigned a nonspecific injury mechanism UCOD code for firearm-related homicides is shown in Table B. The majority (89.5%) of firearm-related homicides were assigned a nonspecific mechanism code: X95, Assault by other and unspecified firearm discharge. Figure 6 and Table 6 show the percentage of deaths with a nonspecific mechanism code for firearm-related homicides by state. The percentage of firearm-related homicides with a nonspecific mechanism code ranged from 16.7% (Idaho) to 100% (Delaware, Hawaii, and Rhode Island).

Discussion

Overall, information provided in cause-of-death statements in the literal text of death certificates allowed assignment of a general mechanism of injury for the majority of injury deaths in 2019. However, the level of specificity in the injury mechanism UCOD code varied by intent and mechanism of injury. The percentage of deaths with a nonspecific code for an injury mechanism varied by intent from 0.2% for suicide and intentional self-harm deaths to 10.6% for injury deaths

of undetermined intent. Differences were also observed for various intent-by-mechanism-of-injury categories and by state. Three unintentional injury categories (fall, motor vehicle traffic, and firearm-related) had high percentages of deaths assigned a nonspecific mechanism code (44.6%, 31.1%, and 75.9%, respectively). Higher percentages were also seen for firearm-related suicides (62.9%) and firearm-related homicides (89.5%).

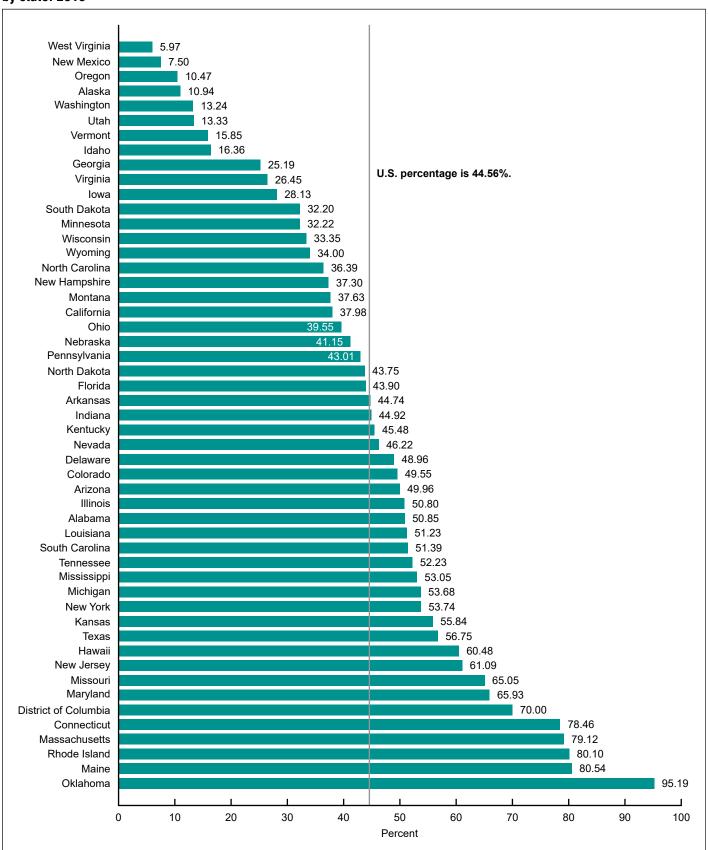
The differences by state have several implications. First, the wide range by state in the percentage of injury deaths with a nonspecific injury mechanism UCOD code make it difficult to conduct state-to-state comparisons for certain intent-by-mechanism-of-injury subcategories, particularly for fall, motor vehicle traffic, and firearm-related deaths. State rates for specific mechanism-of-injury subcategories might appear artificially low if a high percentage of deaths are assigned a nonspecific mechanism code. State differences in specificity should be considered when comparing rates of intent-by-mechanism-of-injury subcategories by state. Second, understanding the practices and protocols used in states with low percentages of nonspecific mechanism codes might help inform strategies for improving cause-of-death statements and death certificate documentation in other states and jurisdictions.

Improvements in death certificate documentation. particularly providing specific details in the cause-of-death statements, could help lower the percentage of deaths assigned a nonspecific injury mechanism UCOD code. For example, for fall deaths, details such as whether the fall occurred on the same level or from one level to another (for example, from bed. chairs, or other furniture; from stairs, steps, or ladders; or from a building, scaffolding, tree, or cliff) would provide the information needed by NCHS to assign a more specific mechanism code. For motor vehicle traffic deaths, key information needed in the cause-of-death statement includes the role of the decedent (vehicle occupant, motorcyclist, bicyclist, pedestrian, or other) as well as the type of event (such as collision or roll-over) and the type of vehicles involved (such as car, truck, motorcycle, van, bus, or 3-wheeled vehicle) (5,13). The terms "MVA," "MVC," and "MCA" (motor vehicle accident, motor vehicle crash, and motorcycle accident, respectively) often used in cause-of-death statements do not provide sufficient detail for assignment of a specific injury mechanism code, which is more useful for public health purposes. In these instances, V89.2, Person injured in unspecified motor-vehicle accident, in traffic is often assigned. Nearly one-third (31.1%) of motor vehicle traffic deaths in 2019 received this code. This lack of specificity reduces the usefulness of vital statistics data for monitoring and informing public health efforts in injury prevention.

The injury mechanism category with the highest percentage of deaths assigned a nonspecific injury mechanism UCOD code is firearm-related deaths (75.9% of unintentional firearm-related deaths, 62.9% of firearm-related suicides and intentional self-harm deaths, and 89.5% of firearm-related homicides). ICD-10 includes unique codes that can distinguish between deaths involving handguns (W32, X72, and X93) and deaths involving long guns, such as rifles, shotguns, and other larger guns (W33, X73, and X94). For many deaths, the firearm involved might not be determined during the death investigation. However, when the

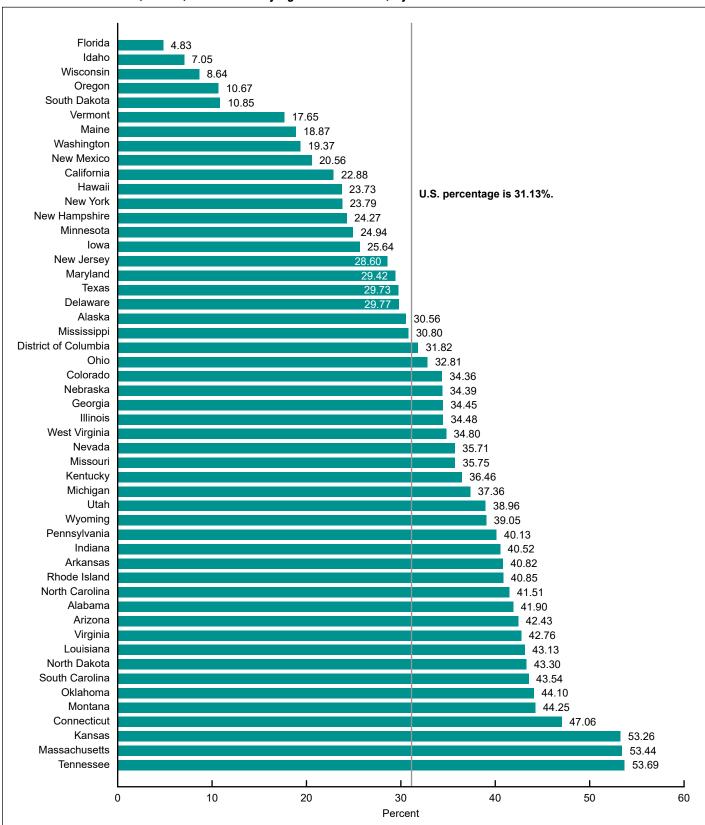
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Figure 3. Percentage of unintentional fall deaths with W19, Unspecified fall, as the underlying cause of death, by state: 2019



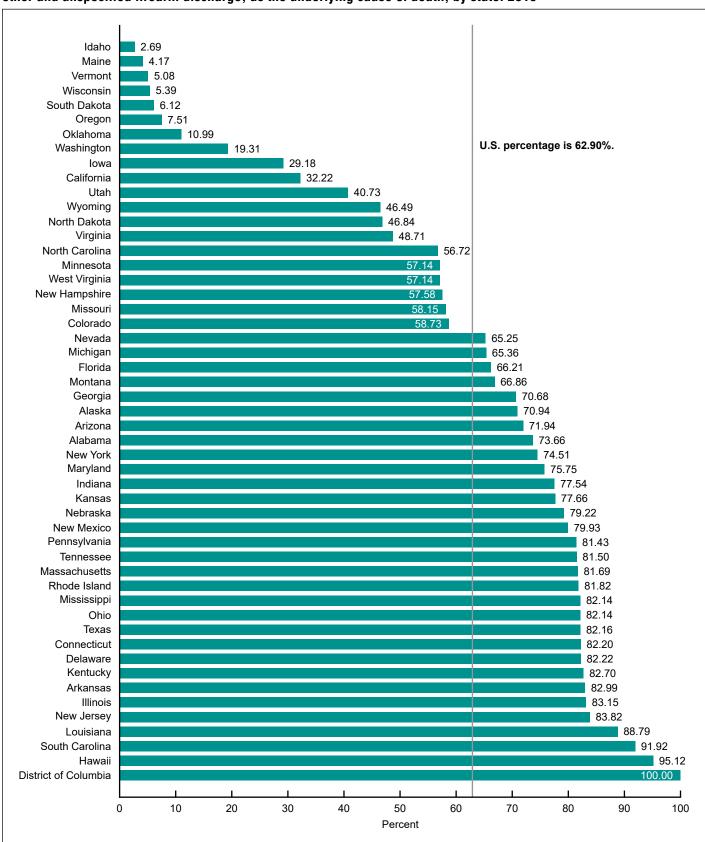
NOTES: Deaths from unintentional falls are identified using *International Classification of Diseases, 10th Revision* codes W00–W19. W19, Unspecified fall, is a less specific mechanism code. A high value for the percentage of unintentional fall deaths with W19 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific fall code. SOURCE: National Vital Statistics System, Mortality (NVSS–M), 2019.

Figure 4. Percentage of unintentional motor vehicle traffic-related deaths with V89.2, Person injured in unspecified motor-vehicle accident, traffic, as the underlying cause of death, by state: 2019



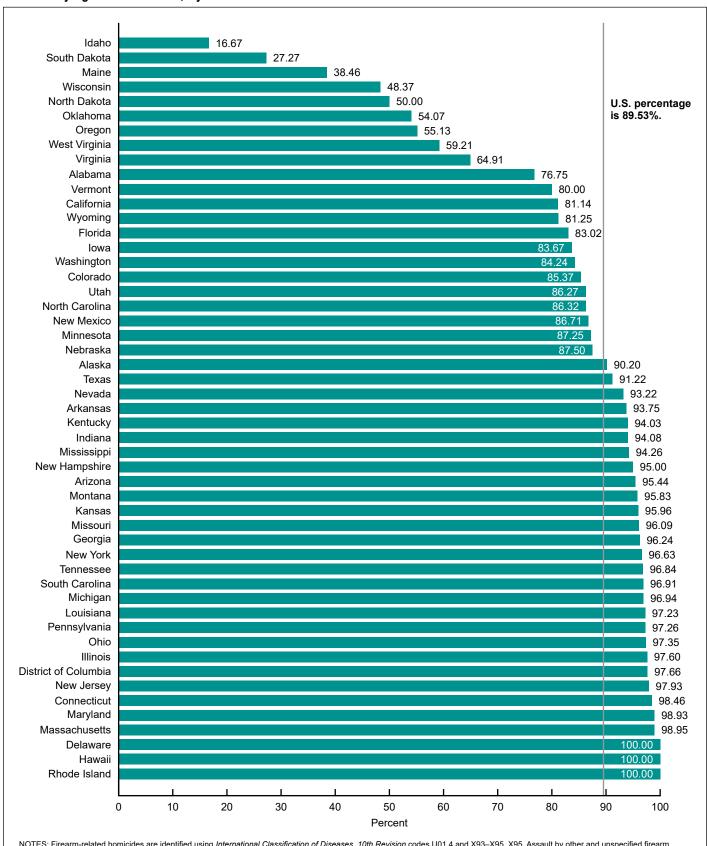
NOTES: Unintentional motor vehicle traffic-related deaths are identified using International Classification of Diseases, 10th Revision codes V02–V04 (.1,.9), V09.2, V12–V14 (.3–.9), V19 (.4–.6), V20–V29 (.3–.9), V29–V79 (.4–.9), V80 (.3–.5),V81.1, V82.1, V83–V86 (.0–.3), V87 (.0–.8), V89.2, and W00–W19. V89.2, Person injured in unspecified motor-vehicle accident, traffic, is a less specific mechanism code. A high value for the percentage of unintentional motor vehicle traffic-related deaths with V89.2 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific motor vehicle traffic-related code. SOURCE: National Vital Statistics System, Mortality (NVSS–M), 2019.

Figure 5. Percentage of firearm-related suicide and intentional self-harm deaths with X74, Intentional self-harm by other and unspecified firearm discharge, as the underlying cause of death, by state: 2019



NOTES: Firearm-related suicide and intentional self-harm deaths are identified using International Classification of Diseases, 10th Revision codes X72–X74. X74, Intentional self-harm by other and unspecified firearm discharge, is a less specific mechanism code. A high value for the percentage of firearm-related suicide and intentional self-harm deaths with X74 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific firearm code. SOURCE: National Vital Statistics System, Mortality (NVSS–M), 2019.

Figure 6. Percentage of firearm-related homicides with X95, Assault by other and unspecified firearm discharge, as the underlying cause of death, by state: 2019



NOTES: Firearm-related homicides are identified using *International Classification of Diseases, 10th Revision* codes U01.4 and X93–X95. X95, Assault by other and unspecified firearm discharge, is a less specific mechanism code. A high value for the percentage of firearm-related homicides with X95 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific firearm code.

general type of firearm (such as handgun, rifle, shotgun, or long gun) is known, documentation of this information on the death certificate would allow assignment of a more specific ICD-10 code. Other details, such as the make and model of the firearm, are not needed or required (5,13). The term "GSW" for gunshot wound, often found in cause-of-death statements for firearm-related deaths, is not sufficient for assigning a more specific code for the type of firearm involved.

Recent efforts to improve cause-of-death statements on death certificates for other causes of death have resulted in substantial improvements in the specificity of information available in mortality data. For example, the quality of mortality data on the drugs involved in overdose deaths improved substantially after examining completeness in drug reporting by state, identifying possible solutions, and working with state and local medical examiners and coroners to implement improvements (14-16). As a result of multiple collaborative efforts, the percentage of overdose deaths that identified at least one specific drug on the death certificate increased from 45% of deaths in 2013 to 80% in 2017 (17). In 2019, the percentage increased to 94% (18). NCHS has developed a new series of Vital Statistics Reference Guides to provide instructions and guidance to medical certifiers on completing the death certificate for specific causes of death (19,20). A similar multipronged collaborative approach, including the creation of reference guides, might be useful for improving documentation and causeof-death statements for other injury topics.

Conclusions

Improvements in the cause-of-death statements on the death certificate can result in more specific coding of the mechanism and intent-of-injury deaths. Efforts to improve death certificate documentation and increase the specificity of cause-of-death coding, particularly for fall, motor vehicle, and firearm-related deaths, will enhance the usefulness of mortality data for understanding the burden of injury death in the United States and for informing public health prevention efforts.

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Table 1. Percentage of unintentional injury deaths with X59, Exposure to unspecified factor causing other or unspecified injury, as the underlying cause of death, by state: 2019

Area	All unintentional injury deaths	Deaths with X59 as the underlying cause	Percent of unintentional injury deaths with X59 as the underlying cause
Alabama	2,755	228	8.28
Alaska	434	11	2.53
rizona	4,558	63	1.38
rkansas	1,527	102	6.68
alifornia	15,116	342	2.26
	,		
olorado	3,085	155	5.02
onnecticut	2,197	68	3.10
elaware	728	19	2.61
istrict of Columbia	437	9	2.06
orida	13,348	299	2.24
eorgia	4,563	173	3.79
awaii	651	9	1.38
laho	948	15	1.58
linois	6,095	222	3.64
ıdiana	3,876	292	7.53
wa	1,538	71	4.62
ansas	1,524	77	5.05
	,		
entucky	3,121	219	7.02
ouisiana	2,916	131	4.49
laine	1,027	17	1.66
laryland	2,425	101	4.16
lassachusetts	4,052	99	2.44
lichigan	5,422	223	4.11
linnesota	2,859	74	2.59
lississippi	1,894	62	3.27
lissouri	3,950	175	4.43
Iontana	657	23	3.50
ebraska	851	41	4.82
evada	1,437	33	2.30
ew Hampshire	864	25	2.89
ew Jersey	4,650	279	6.00
ew Mexico	1,687	27	1.60
ew York	7,390	270	3.65
orth Carolina	6,190	234	3.78
orth Dakota	371	26	7.01
hio	8,287	287	3.46
klahoma	2,439	82	3.36
	*		
regon	2,213	39	1.76
ennsylvania	8,596	312	3.63
hode Island	670	27	4.03
outh Carolina	3,336	168	5.04
outh Dakota	517	4	0.77
ennessee	4,856	234	4.82
exas	11,384	602	5.29
tah	1,301	38	2.92
ermont	405	7	1.73
irginia	3,994	, 126	3.15
/ashington	3,569	111	3.11
/est Virginia	1,859	33	1.78
/isconsin	4,087	66	1.61
/yoming	384	19	4.95

NOTES: Deaths from unintentional injury are identified using *International Classification of Diseases*, 10th Revision codes V01–X59 and Y85–Y86. X59, Exposure to unspecified factor causing other or unspecified injury, is a nonspecific mechanism code. A high value for the percentage of unintentional injury deaths with X59 indicates that a higher percentage of deaths lack sufficient information to assign a more specific injury mechanism code.

Table 2. Percentage of homicide deaths with Y09, Assault by unspecified means, as the underlying cause of death, by state: 2019

Area	All homicide deaths	Homicide deaths with Y09 as the underlying cause	Percent of homicide deaths with Y09 as the underlying cause
Alabama	587	31	5.28
Alaska	78	5	6.41
Arizona	414	51	12.32
Arkansas	270	15	5.56
California	1,794	108	6.02
	250	12	4.80
Connecticut			
Connecticut	106	17	16.04
Delaware	53	3	5.66
District of Columbia	162	8	4.94
Florida	1,334	75	5.62
Georgia	849	45	5.30
Hawaii	35	6	17.14
Idaho	27	2	7.41
Illinois	979	46	4.70
Indiana	466	37	7.94
lowa	80	14	17.50
Kansas	137	10	7.30
	250	6	2.40
Kentucky	650	34	5.23
Louisiana	23	13	56.52
	578	49	8.48
Maryland			
Massachusetts	157	13	8.28
Michigan	612	32	5.23
Minnesota	154	19	12.34
Mississippi	434	12	2.76
Missouri	628	17	2.71
Montana	39	5	12.82
Nebraska	58	4	6.90
Nevada	166	18	10.84
New Hampshire	38	6	15.79
New Jersey	287	29	10.10
New Mexico	230	5	2.17
New York	601	80	13.31
North Carolina	707	41	5.80
	21	1	4.76
North Dakota			
Ohio	724	35	4.83
Oklahoma	333	35	10.51
Oregon	126	13	10.32
Pennsylvania	722	48	6.65
Rhode Island	23	2	8.70
South Carolina	527	19	3.61
South Dakota	29	3	10.34
Tennessee	596	33	5.54
Texas	1,694	126	7.44
Utah	82	10	12.20
Vermont	11	3	27.27
Virginia	436	20	4.59
Washington	241	27	11.20
West Virginia	92	4	4.35
9	226	11	4.87
Wisconsin			
Wyoming	25	2	8.00
United States	19,141	1,247	6.51

NOTES: Homicide deaths are identified using International Classification of Diseases, 10th Revision codes U01–U02, X85–Y09, and Y87.1. Y09, Assault by unspecified means, is a nonspecific mechanism code. A high value for the percentage of homicides with Y09 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific injury mechanism code.

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Table 3. Percentage of unintentional fall deaths with W19, Unspecified fall, as the underlying cause of death, by state: 2019

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Visconsin 1,823 608 33.35 Vyoming 100 34 34.00	Vashington	1,103	146	13.24
Visconsin 1,823 608 33.35 Vyoming 100 34 34.00	Vest Virginia	452	27	5.97
Vyoming		1,823	608	33.35
		·		
Jnited States			17,576	44.56

NOTES: Unintentional fall deaths are identified using *International Classification of Diseases, 10th Revision* codes W00–W19. W19, Unspecified fall, is a less specific mechanism code. A high value for the percentage of unintentional fall deaths with W19 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific fall code.

SOURCE: National Vital Statistics System, Mortality (NVSS–M), 2019.

Table 4. Percentage of unintentional motor vehicle traffic-related deaths with V89.2, Person injured in unspecified motor-vehicle accident, traffic, as the underlying cause of death, by state: 2019

Area	All unintentional motor vehicle traffic-related deaths	Unintentional motor vehicle traffic-related deaths with V89.2 as the underlying cause	Percent of unintentional motor vehicle traffic-related deaths with V89.2 as the underlying cause
Alabama	981	411	41.90
Alaska	72	22	30.56
Arizona	945	401	42.43
Arkansas	534	218	40.82
California	3,885	889	22.88
Colorado	614	211	34.36
Connecticut	255	120	47.06
Delaware	131	39	29.77
District of Columbia	44	14	31.82
Florida	3,206	155	4.83
Georgia	1,492	514	34.45
Hawaii	118	28	23.73
ldaho	241	17	7.05
Illinois	1,102	380	34.48
Indiana	839	340	40.52
_			25.64
lowa	351	90	
Kansas	383	204	53.26
Kentucky	735	268	36.46
Louisiana	728	314	43.13
Maine	159	30	18.87
Maryland	537	158	29.42
Massachusetts	378	202	53.44
Michigan	1,017	380	37.36
	421	105	24.94
Minnesota			
Mississippi	724	223	30.80
Missouri	926	331	35.75
Montana	174	77	44.25
Nebraska	253	87	34.39
Nevada	294	105	35.71
New Hampshire	103	25	24.27
New Jersey	584	167	28.60
New Mexico	394	81	20.56
New York	1,072	255	23.79
North Carolina	1,561	648	41.51
North Dakota	97	42	43.30
			32.81
Ohio	1,219	400	
Oklahoma	669	295	44.10
Oregon	506	54	10.67
Pennsylvania	1,079	433	40.13
Rhode Island	71	29	40.85
South Carolina	983	428	43.54
South Dakota	129	14	10.85
Tennessee	1,138	611	53.69
Texas	3,727	1,108	29.73
	•	· · · · · · · · · · · · · · · · · · ·	
Utah	231	90	38.96
Vermont	51	9	17.65
Virginia	870	372	42.76
Washington	604	117	19.37
West Virginia	296	103	34.80
Wisconsin	567	49	8.64
Wyoming	105	41	39.05
•			

NOTES: Unintentional motor vehicle traffic-related deaths are identified using *International Classification of Diseases*, 10th Revision codes V02–V04 (.1,.9), V09.2, V12–V14 (.3–.9), V19 (.4–.6), V20–V28 (.3–.9), V29–V79 (.4–.9), V80 (.3–.5), V81.1, V82.1, V83–V86 (.0–.3), V87 (.0–.8), and V89.2. V89.2, Person injured in unspecified motor-vehicle accident, traffic, is a less specific mechanism code. A high value for the percentage of unintentional motor vehicle traffic-related deaths with V89.2 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific motor vehicle traffic-related code.

Table 5. Percentage of firearm-related suicide and intentional self-harm deaths with X74, Intentional self-harm by other and unspecified firearm discharge, as the underlying cause of death, by state: 2019

Area	All firearm-related suicide and intentional self-harm deaths	Firearm-related suicide and intentional self-harm deaths with X74 as the underlying cause	Percent of firearm-related suicide and intentional self-harm deaths with X74 as the underlying cause
Alabama	543	400	73.66
Alaska	117	83	70.94
Arizona	809	582	71.94
	341	283	82.99
Arkansas			
California	1,586	511	32.22
Colorado	647	380	58.73
Connecticut	118	97	82.20
Delaware	45	37	82.22
District of Columbia	12	12	100.00
Florida	1,808	1,197	66.21
Georgia	955	675	70.68
Hawaii	41	39	95.12
Idaho	223	6	2.69
Illinois	540	449	83.15
	570		77.54
Indiana		442	
lowa	233	68	29.18
Kansas	291	226	77.66
Kentucky	445	368	82.70
Louisiana	446	396	88.79
Maine	144	6	4.17
Maryland	268	203	75.75
Massachusetts	142	116	81.69
Michigan	742	485	65.36
Minnesota	350	200	57.14
	308	253	82.14
Mississippi			
Missouri	681	396	58.15
Montana	172	115	66.86
Nebraska	154	122	79.22
Nevada	354	231	65.25
New Hampshire	132	76	57.58
New Jersey	173	145	83.82
New Mexico	284	227	79.93
New York	455	339	74.51
North Carolina	781	443	56.72
North Dakota	701 79	37	46.84
Ohio	980	805	82.14
Oklahoma	473	52	10.99
Oregon	466	35	7.51
Pennsylvania	964	785	81.43
Rhode Island	33	27	81.82
South Carolina	532	489	91.92
South Dakota	98	6	6.12
Tennessee	746	608	81.50
_	2,237		82.16
Texas	· ·	1,838	
Utah	329	134	40.73
Vermont	59	3	5.08
Virginia	661	322	48.71
Washington	637	123	19.31
West Virginia	196	112	57.14
Wisconsin	427	23	5.39
Wyoming	114	53	46.49
	23,941	15,060	62.90

NOTES: Firearm-related suicide and intentional self-harm deaths are identified using *International Classification of Diseases*, 10th Revision codes X72–X74. X74, Intentional self-harm by other and unspecified firearm discharge, is a less specific mechanism code. A high value for the percentage of firearm-related suicide and intentional self-harm deaths with X74 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific firearm code.

Table 6. Percentage of firearm-related homicides with X95, Assault by other and unspecified firearm discharge, as the underlying cause of death, by state: 2019

Area	All firearm-related homicides	Firearm-related homicides with X95 as the underlying cause	Percent of firearm-related homicides with X95 as the underlying cause
Alabama	486	373	76.75
Alaska	51	46	90.20
Arizona	285	272	95.44
Arkansas	208	195	93.75
California	1,246	1,011	81.14
olorado	164	140	85.37
onnecticut	65	64	98.46
elaware	45	45	100.00
vistrict of Columbia	128	125	97.66
lorida	1,013	841	83.02
eorgia	691	665	96.24
awaii	14	14	100.00
daho	18	3	16.67
linois	791	772	97.60
ndiana	355	334	94.08
			83.67
Owa	49	41	
ansas	99	95	95.96
entucky	201	189	94.03
ouisiana	542	527	97.23
faine	13	5	38.46
laryland	468	463	98.93
Nassachusetts	95	94	98.95
lichiaan	458	444	96.94
1innesota	102	89	87.25
	366		
1ississippi		345	94.26
Aissouri	537	516	96.09
Iontana	24	23	95.83
lebraska	40	35	87.50
levada	118	110	93.22
ew Hampshire	20	19	95.00
lew Jersey	193	189	97.93
lew Mexico	158	137	86.71
lew York	326	315	96.63
orth Carolina	541	467	86.32
lorth Dakota	10	5	50.00
hio	565	550	97.35
klahoma	246	133	54.07
regon	78	43	55.13
ennsylvania	548	533	97.26
hode Island	12	12	100.00
outh Carolina	453	439	96.91
outh Dakota	11	3	27.27
ennessee	474	459	96.84
exas	1,299	1,185	91.22
tah	51	44	86.27
ermont	5	тт Л	80.00
		200	64.91
'irginia	342	222	
Vashington	165	139	84.24
Vest Virginia	76	45	59.21
Visconsin	153	74	48.37
/yoming	16	13	81.25
Inited States	14,414	12,906	89.53

NOTES: Firearm-related homicides are identified using International Classification of Diseases, 10th Revision codes X93–X95. X95, Assault by other and unspecified firearm discharge, is a less specific mechanism code. A high value for the percentage of firearm-related homicides with X95 indicates that a higher percentage of deaths lacked sufficient information to assign a more specific firearm code.

Technical Notes

The Table provides a list of the *International Classification of Diseases*, 10th Revision underlying cause-of-death codes for the intent-by-mechanism-of-injury categories included in Table B.

Table. International Classification of Diseases, 10th Revision underlying cause codes for selected intent and mechanism of injury groups

Intent and mechanism of injury and International Classification of Diseases, 10th Revision underlying-cause-of-death code Description Unintentional drowning W67 Drowning and submersion while in swimming-pool W73...... Other specified drowning and submersion Unintentional fall W00 Fall on same level involving ice and snow W01 Fall on same level from slipping, tripping and stumbling W02 Fall involving ice-skates, skis, roller-skates or skateboards W04 Fall while being carried or supported by other persons W05..... Fall involving wheelchair W06 Fall involving bed W07..... Fall involving chair W08 Fall involving other furniture W09..... Fall involving playground equipment W10..... Fall on and from stairs and steps W11..... Fall on and from ladder W12 Fall on and from scaffolding W13 Fall from, out of or through building or structure W14..... Fall from tree W15 Fall from cliff W17...... Other fall from one level to another W18..... Other fall on same level W19¹ Unspecified fall Unintentional fire or flames X00 Exposure to uncontrolled fire in building or structure X01 Exposure to uncontrolled fire, not in building or structure X02 Exposure to controlled fire in building or structure X03 Exposure to controlled fire, not in building or structure X04 Exposure to ignition of highly flammable material Exposure to ignition or melting of nightwear X06 Exposure to ignition or melting of other clothing and apparel X08 Exposure to other specified smoke, fire and flames X09¹..... Exposure to unspecified smoke, fire and flames Unintentional hot object or substance X11 Contact with hot tap-water X12 Contact with other hot fluids X13 Contact with steam and hot vapours X14 Contact with hot air and gases X15 Contact with hot household appliances X16 Contact with hot heating appliances, radiators and pipes X17 Contact with hot engines, machinery and tools X18 Contact with other hot metals

Table. International Classification of Diseases, 10th Revision underlying cause codes for selected intent and mechanism of injury groups—Con.

Intent and mechanism of injury and
International Classification of Diseases, 10th Revision
underlying-cause-of-death code

Description

underlying-cause-of-death code	Description
Unintentional firearm-related	
W32	
W33	
W34 ¹	. Discharge from other and unspecified firearms
Unintentional suffocation	
W75	. Accidental suffocation and strangulation in bed
W76	
	. Threat to breathing due to cave-in, falling earth and other substances
W78	
	. Inhalation and ingestion of food causing obstruction of respiratory tract
	. Inhalation and ingestion of other objects causing obstruction of respiratory tract
W81	
W83	
W84 ¹	. Unspecified threat to breatning
Unintentional drug poisoning	. Accidental poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics
	. Accidental poisoning by and exposure to nonopiola analysics, antipyretics and antimedinatics . Accidental poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and
A-1	psychotropic drugs, not elsewhere classified
X42	. Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere
712 · · · · · · · · · · · · · · · · · · ·	classified
X43	. Accidental poisoning by and exposure to other drugs acting on the autonomic nervous system
	. Accidental poisoning by and exposure to other and unspecified drugs, medicaments and biological substances
Unintentional nondrug poisoning	
X45	. Accidental poisoning by and exposure to alcohol
X46	. Accidental poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours
	. Accidental poisoning by and exposure to other gases and vapours
X48	
X49 ³	. Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances
Unintentional motor vehicle traffic	
V02–V04 (.1,.9)	. Pedestrian injured in collision with motor vehicle, in traffic accident or unspecified whether traffic or non-traffic accident
V09.2	Pedestrian injured in traffic accident involving other and unspecified motor vehicles
	. Pedal cyclist injured in collision with motor vehicle in traffic accident
V19 (.4–.6)	. Pedal cyclist injured in collision with other and unspecified motor vehicles in traffic accident
V20–28 (.3–.9)	
	. Motorcycle rider injured in collision with other and unspecified motor vehicles, in traffic accident
	. Occupant of three-wheeled motor vehicle injured in traffic accident
V40–V49 (.4–.9)	
V50–V59 (.4–.9)	Occupant of pick-up truck or van injured in traffic accident
	Occupant of heavy transport vehicle injured in traffic accident
V70–V79 (.4–.9)	. Bus occupant injured in traffic accident . Animal rider or occupant of animal-drawn vehicle injured in collision with motor vehicle
` '	. Occupant of railway train or railway vehicle injured in collision with motor vehicle in traffic accident
	. Occupant of ranway train of ranway venicle injured in comision with motor venicle in traffic accident
V83–V86 (.0–.3)	
,	. Traffic accident of specified type but victim's mode of transport unknown
	Person injured in unspecified motor-vehicle accident, in traffic
Suicide and intentional self-harm	
firearm-related	
X72	
	. Intentional self-harm by rifle, shotgun and larger firearm discharge
X/4'	. Intentional self-harm by other and unspecified firearm discharge

Table. International Classification of Diseases, 10th Revision underlying cause codes for selected intent and mechanism of injury groups—Con.

Intent and mechanism of injury and International Classification of Diseases, 10th Revision underlying-cause-of-death code Description Suicide and intentional self-harm drug poisoning psychotropic drugs, not elsewhere classified elsewhere classified substances Suicide and intentional self-harm nondrug poisoning X65 Intentional self-poisoning by and exposure to alcohol vapours X68 Intentional self-poisoning by and exposure to pesticides

NOTE: Code groupings are based on the International Classification of Diseases, 10th Revision External Cause of Injury Mortality Matrix, available from: https://www.cdc.gov/nchs/injury/injury_tools.htm.

SOURCE: National Center for Health Statistics, 2021.

Homicide firearm-related

U01.4 Terrorism involving firearms
X93 Assault by handgun discharge

¹Nonspecific-injury-mechanism code.

²Nonspecific-injury-mechanism code, when the only associated drug-related multiple cause code is T50.9, Other and unspecified drugs, medicaments and biological substances.

Nonspecific-injury-mechanism code, when the only associated nondrug-related multiple cause code is T65.9, Toxic effect of unspecified substance.

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