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# State-Level Lifetime Medical and Work-Loss Costs of Fatal Injuries — United States, 2014

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Injury-associated deaths have substantial economic consequences in the United States. The total estimated lifetime medical and work-loss costs associated with fatal injuries in 2013 were $214 billion (*1*). In 2014, unintentional injury, suicide, and homicide (the fourth, tenth, and seventeenth leading causes of death, respectively) accounted for 194,635 deaths in the United States (*2*). In 2014, a total of 199,756 fatal injuries occurred in the United States, and the associated lifetime medical and work-loss costs were $227 billion (*3*). This report examines the state-level economic burdens of fatal injuries by extending a previous national-level study (*1*). Numbers and rates of fatal injuries, lifetime costs, and lifetime costs per capita were calculated for each of the 50 states and the District of Columbia (DC) and for four injury intent categories (all intents, unintentional, suicide, and homicide). During 2014, injury mortality rates and economic burdens varied widely among the states and DC. Among fatal injuries of all intents, the mortality rate and lifetime costs per capita ranged from 101.9 per 100,000 and $1,233, respectively (New Mexico) to 40.2 per 100,000 and $491 (New York). States can engage more effectively and efficiently in injury prevention if they are aware of the economic burden of injuries, identify areas for immediate improvement, and devote necessary resources to those areas.

The numbers of injury-associated deaths in each of the 50 states and DC in 2014 were obtained from the National Vital Statistics System, and state-level lifetime costs were obtained from the Web-based Injury Statistics Query and Reporting System database (*3*). Injury death rates were calculated using the U.S. Census Bureau's bridged race population estimates for 2014. Lifetime costs, which include lifetime medical and work-loss costs, were computed by multiplying the number of injury deaths by average costs of treating injuries and earnings in 2010, adjusted to 2014 prices. Medical costs were derived from various sources that measure the costs of transport, health care in multiple settings, including emergency departments, hospitals, and nursing homes, and examination by a coroner or medical examiner (*4*). Work-loss costs were developed using earnings data from the U.S. Census Bureau's Current Population Survey and life expectancy data from CDC's National Center for Health Statistics. Numbers

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of deaths, rates, lifetime costs, and lifetime costs per capita (lifetime costs divided by the state population) were examined for each state and DC. Lifetime costs per capita were used for comparisons across states. Four intents of fatal injuries were considered: all intents,* unintentional, suicide, and homicide. For each intent, state-level lifetime costs were estimated for the total population, for males and females, and for all intents. State-level lifetime costs were also estimated for three age groups: young (0–24 years), middle (25–64 years), and older (≥65 years). State-level lifetime costs per capita were provided for the total population for each intent. In some state-intent-population combinations, average medical costs were statistically unstable, but these costs accounted for <1% or <5% of average lifetime costs. When both average medical costs and average work-loss costs were statistically unstable or when the mortality rates were unstable or missing, lifetime costs or lifetime costs per capita were not presented.

## Injuries from All Intents

Injury mortality rates (per 100,000), lifetime costs (in 2014 U.S. dollars), and lifetime costs per capita (in 2014 U.S. dollars) varied widely among the 50 states and DC for each of the four intents. Overall, total injury-related mortality rate and lifetime costs per capita ranged from 101.9 per 100,000 and $1,233, respectively (New Mexico) to 40.2 and $491 (New York) (Table 1). The rates of overall male and female injury mortality were highest in New Mexico (141.1 and 63.7, respectively), and lowest in New York (58.9 and 23.1, respectively). New York also had the lowest injury mortality rate among persons aged ≥65 years (87.1). The states with the highest and lowest lifetime fatal injury costs were California ($20.9 billion) and Vermont ($406 million), respectively. California had the highest number of injury deaths (18,152) and DC the lowest number of injury deaths (385). The lifetime costs per capita for injuries of all intents ranged from $491 to $1,233 (Figure). The five states with the highest lifetime fatal injury costs per capita were New Mexico ($1,233), West Virginia ($1,162), Alaska ($1,091), Louisiana ($1,041), and Oklahoma ($1,040); states with the lowest lifetime costs per capita were New York ($491), New Jersey ($533), California ($538), Massachusetts ($550), and Minnesota ($557).

## Unintentional Injuries

West Virginia had the highest lifetime costs per capita for fatal unintentional injuries ($815), the highest unintentional injury mortality rate among males (95.2), and the highest unintentional injury mortality rate among persons aged 25–64 years (88.5) (Table 1). Maryland had the lowest lifetime costs per capita for fatal unintentional injuries ($261), the lowest total unintentional injury mortality rate (26.4), the lowest male unintentional injury mortality rate (36.9), and the lowest unintentional injury mortality rate among persons

*All intents category includes legal intervention and undetermined intent of injury, in addition to unintentional, suicide, and homicide.

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aged 25–64 years (23.3). New Mexico had the highest total unintentional injury mortality rate (71.9) and the highest female unintentional injury mortality rate (49.9). California had the highest lifetime costs for fatal unintentional injuries ($12.2 billion) and the highest number of unintentional injury deaths (11,804).

## Suicides

Alaska and New Jersey had the highest and lowest lifetime suicide costs per capita ($338 and $107, respectively) (Table 2). Montana had the highest total suicide rate (23.8), the highest male suicide rate (36.8), and the highest female suicide rate (11.4). DC had the lowest number of suicides (52), total suicide rate (7.7), male suicide rate (12.3), and lifetime costs ($73 million). California had the highest lifetime costs ($4.9 billion) and the highest number of suicides (4,214).

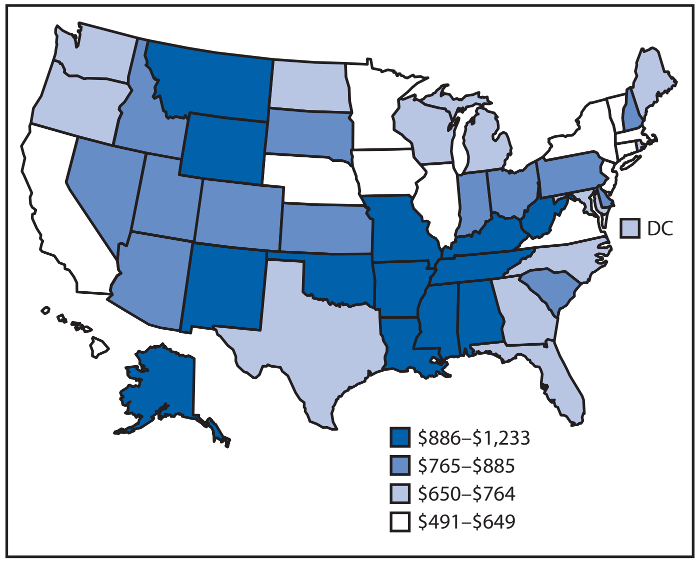
## Homicides

The highest and lowest lifetime homicide-related mortality costs per capita were in DC ($273) and Hawaii ($24), respectively (Table 2).† DC had the highest total homicide rate (13.2), the highest male homicide rate (22.3), and the highest female homicide rate (4.8). New Hampshire, Maine, and Massachusetts had the lowest total homicide rate (1.3), the lowest male homicide rate (2.6), and the lowest female homicide rate (0.5), respectively. California had the highest lifetime homicide-related costs ($3.1 billion) and the highest number of homicides (1,813).

## Discussion

Economic burdens of fatal injuries varied widely in the 50 states and DC for each of the four categories of intent. Across all the four fatal injury intents, some states consistently had lower lifetime costs per capita than most other states. For example, New York, New Jersey, and California ranked among the five lowest states in terms of lifetime costs per capita for injuries of all intents, unintentional injuries, and suicides. In contrast, New Mexico ranked among the five highest states in terms of lifetime costs per capita for injuries of all intents, unintentional injuries, and suicides. Varying economic burdens of fatal injuries in the 50 states and DC might be attributed to the different injury mortality rates, the different medical costs resulting from different medical procedures, and the different

**FIGURE. Costs per capita* of fatal injuries of all intents — United States, 2014**




* In 2014 U.S. dollars.

demographic characteristics of injury decedents, such as sex and age.

Implementation of effective injury prevention strategies is needed to help reduce the substantial lifetime medical and work-loss costs associated with fatal injuries. The differing state-level lifetime costs per capita for fatal injuries suggests an urgent need in some states to prevent injuries. States that consistently have lower lifetime costs per capita across different intents of injuries might have successful injury prevention experiences that could be shared with states with higher per capita costs.

The findings in this report are subject to at least four limitations. First, the costs account for medical and work-loss costs associated with decedents. Other societal costs, such as criminal justice costs and the pain and suffering of family members, were not considered. Second, work-loss costs, based on the mean earnings of the general population by sex and specific age groups, might be over- or underestimated because the mean earnings of decedents might differ from those of the general population. Third, intent of fatal injury, as determined from the manner of death assigned on death certificates by coroners or medical examiners, might differ across jurisdictions (*5*). Finally, unintentional fatal injuries were not broken down into more specific categories such as motor vehicle crashes, drug overdoses, traumatic brain injuries, and older adult falls, so that this report cannot indicate the economic burdens of those specific categories of unintentional injuries.

During 2005–2014, the number of unintentional fatal injuries increased 15%, from 117,809 to 136,053, and

† Lifetime costs or lifetime costs per capita of homicides were not presented for New Hampshire, North Dakota, South Dakota, Vermont, and Wyoming because those states had unstable average medical and work loss costs or unstable homicide rates.

**Summary**

What is already known about this topic?

Injuries are a leading cause of death in the United States. Injury-associated deaths result in a substantial economic burden to the United States: the total estimated lifetime medical and work-loss costs were $214 billion in 2013. Injury and violence prevention strategies can save lives and reduce costs.

What is added by this report?

Lifetime costs and lifetime costs per capita were calculated for each of the 50 states and the District of Columbia (DC) and for each of four injury intent categories (all intents, unintentional, suicide, and homicide) for 2014. Economic burdens varied widely among the states and DC. Lifetime costs per capita ranged from $1,233 (New Mexico) to $491 (New York) among fatal injuries of all intents, from $815 (West Virginia) to $261 (Maryland) among unintentional injuries, from $338 (Alaska) to $107 (New Jersey) among suicides, and from $273 (DC) to $24 (Hawaii) for homicides.

What are the implications for public health practice?

States can engage more effectively and efficiently in injury prevention if they are aware of the economic burden of injuries, identify areas for immediate improvement, and devote necessary resources to those areas. States that consistently have lower lifetime costs per capita across different intents of injuries might have successful injury prevention experiences that could be shared with states with higher per capita costs.

unintentional injury moved from the fifth to the fourth leading cause of death; the number of suicides rose 31%, from 32,637 to 42,773, and suicide moved from the eleventh to the tenth leading cause of death (*2*,*6*). The increasing incidence and economic burden of injuries, particularly unintentional injuries and suicides, call for effective prevention programs and strategies. For example, the CDC Guideline for Prescribing Opioids for Chronic Pain provides prescribing recommendations for opioid pain medication to patients aged ≥18 years with chronic pain in primary care settings (*7*), which could be adopted by states and might reduce the number of persons who overdose prescribed opioid medications. To reduce motor vehicle crash fatalities, states could increase seatbelt use with primary enforcement seatbelt laws that cover everyone in the vehicle (*8*) or consider requiring car seats and booster seats for children through at least age 8 years or until seatbelts fit properly (*9*). The 2012 Surgeon General's *National Strategy for Suicide Prevention* suggests that strategies enhancing social support, community connectedness, and access to mental health and preventive services and measures to reduce stigma and barriers associated with seeking help might alleviate suicide risk across the lifespan (*10*). The estimates of state-level economic burdens of fatal injuries will permit policy makers to compare the costs of implementing prevention programs and strategies with the cost savings garnered from the aversion of fatal injuries.

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**TABLE 1. Deaths from injuries of all intents and unintentional injuries, rates per 100,000 population, lifetime medical and work-loss costs, and lifetime medical and work-loss costs per capita, by state — United States, 2014**

| | All intents | | | | | | Unintentional injuries | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sex | | Age group (yrs) | | | | Sex | | Age group (yrs) | | |
| State | Total | Male | Female | 0–24 | 25–64 | ≥65 | Total | Male | Female | 0–24 | 25–64 | ≥65 |
| **Alabama** | | | | | | | | | | | | |
| No. of deaths (rate) | **3,625 (73.2)** | 2,440 (105.3) | 1,185 (44.1) | 534 (31.6) | 2,224 (89.6) | 867 (121.9) | **2,463 (49.2)** | 1,525 (65.9) | 938 (34.4) | 360 (21.5) | 1,396 (55.6) | 707 (100.5) |
| Costs, million USD (per capita, USD*) | **4,372 (902)** | 3,317 | 1,038 | 983 | 3,138 | 163 | **2,767 (571)** | 1,967 | 784 | 642 | 1,943 | 130 |
| **Alaska** | | | | | | | | | | | | |
| No. of deaths (rate) | **615 (85.8)** | 441 (119.9) | 174 (50.4) | 105 (36.3) | 427 (106.1) | 83 (141.0) | **379 (54.9)** | 260 (74.2) | 119 (35.6) | 54 (18.5) | 259 (64.7) | 66 (116.2) |
| Costs, million USD (per capita, USD*) | **804 (1,091)** | 634 | 170 | 193 | 592 | 17 | **448 (608)** | 341 | 109 | 94[a] | 349 | 13 |
| **Arizona** | | | | | | | | | | | | |
| No. of deaths (rate) | **5,079 (72.6)** | 3,387 (100.4) | 1,692 (45.5) | 603 (25.1) | 2,900 (85.4) | 1,575 (152.7) | **3,322 (46.8)** | 2,077 (61.5) | 1,245 (32.5) | 357 (14.9) | 1,710 (50.0) | 1,254 (122.9) |
| Costs, million USD (per capita, USD*) | **5,604 (832)** | 4,326 | 1,259 | 1,129 | 3,942 | 260 | **3,226 (479)** | 2,425 | 816 | 652 | 2,247 | 201 |
| **Arkansas** | | | | | | | | | | | | |
| No. of deaths (rate) | **2,280 (75.2)** | 1,522 (105.7) | 758 (46.4) | 316 (30.7) | 1,330 (89.6) | 634 (140.9) | **1,458 (47.2)** | 907 (62.8) | 551 (32.6) | 189 (18.4) | 757 (50.4) | 512 (114.8) |
| Costs, million USD (per capita, USD*) | **2,719 (917)** | 2,052 | 642 | 587 | 1,904 | 117 | **1,623 (547)** | 1,180 | 420 | 347 | 1,080 | 91 |
| **California** | | | | | | | | | | | | |
| No. of deaths (rate) | **18,152 (44.9)** | 12,820 (66.0) | 5,332 (25.0) | 2,495 (17.6) | 11,109 (52.5) | 4,544 (90.2) | **11,804 (29.1)** | 7,847 (40.6) | 3,957 (18.3) | 1,437 (10.2) | 6,832 (32.0) | 3,531 (69.8) |
| Costs, million USD (per capita, USD*) | **20,894 (538)** | 16,746 | 4,209 | 4,760 | 14,766 | 803 | **12,171 (314)** | 9,450 | 2,808 | 2,686 | 8,765 | 601 |
| **Colorado** | | | | | | | | | | | | |
| No. of deaths (rate) | **3,883 (72.2)** | 2,543 (98.1) | 1,340 (46.9) | 471 (25.3) | 2,168 (74.5) | 1,243 (193.4) | **2,517 (47.1)** | 1,513 (60.1) | 1,004 (34.4) | 254 (13.6) | 1,221 (41.7) | 1,042 (163.2) |
| Costs, million USD (per capita, USD*) | **4,175 (779)** | 3,202 | 989 | 873 | 2,915 | 194 | **2,317 (433)** | 1,691 | 640 | 459 | 1,602 | 154 |
| **Connecticut** | | | | | | | | | | | | |
| No. of deaths (rate) | **2,140 (53.9)** | 1,373 (76.7) | 767 (33.0) | 205 (16.6) | 1,152 (60.8) | 783 (129.5) | **1,642 (40.8)** | 1,005 (56.8) | 637 (26.4) | 120 (9.7) | 824 (44.2) | 698 (114.1) |
| Costs, million USD (per capita, USD*) | **2,186 (608)** | 1,682 | 464 | 405 | 1,584 | 117 | **1,446 (402)** | 1,100 | 330 | 234 | 1,126 | 100 |
| **Delaware** | | | | | | | | | | | | |
| No. of deaths (rate) | **629 (65.8)** | 433 (97.0) | 196 (37.4) | 79 (25.0) | 383 (81.5) | 167 (114.8) | **425 (43.9)** | 270 (60.2) | 155 (29.1) | 50 (15.8) | 239 (50.6) | 136 (94.8) |
| Costs, million USD (per capita, USD*) | **775 (829)** | 592 | 184 | 146 | 549 | 31 | **472 (505)** | 334 | 139 | 88[†] | 338 | 24 |
| **District of Columbia** | | | | | | | | | | | | |
| No. of deaths (rate) | **385 (56.2)** | 264 (81.7) | 121 (33.7) | 50 (19.8) | 250 (67.6) | 85 (111.1) | **217 (32.7)** | 130 (42.4) | 87 (24.0) | 12 (4.8[§]) | 133 (36.8) | 72 (94.0) |
| Costs, million USD (per capita, USD*) | **479 (726)** | 370 | 97 | 97 | 357 | 13 | **194 (294)** | 130 | 61 | —[¶] | 163 | 11 |
| **Florida** | | | | | | | | | | | | |
| No. of deaths (rate) | **13,673 (61.5)** | 9,216 (88.4) | 4,457 (35.8) | 1,672 (26.7) | 7,363 (71) | 4,636 (119.5) | **9,433 (41.2)** | 5,932 (56.2) | 3,501 (27) | 1,025 (16.5) | 4,610 (44.3) | 3,796 (97.5) |
| Costs, million USD (per capita, USD*) | **14,763 (742)** | 11,411 | 3,326 | 3,111 | 9,992 | 773 | **9,478 (476)** | 7,055 | 2,386 | 1,859 | 6,301 | 608 |
| **Georgia** | | | | | | | | | | | | |
| No. of deaths (rate) | **6,002 (60.1)** | 4,061 (85.8) | 1,941 (36.5) | 946 (25.8) | 3,589 (66.8) | 1,467 (128.1) | **3,964 (40.1)** | 2,491 (53.8) | 1,473 (27.6) | 561 (15.4) | 2,197 (40.6) | 1,206 (106.9) |
| Costs, million USD (per capita, USD*) | **7,055 (699)** | 5,452 | 1,582 | 1,755 | 4,910 | 271 | **4,232 (419)** | 3,117 | 1,104 | 1,009 | 2,927 | 214 |
| **Hawaii** | | | | | | | | | | | | |
| No. of deaths (rate) | **733 (47.3)** | 527 (70.6) | 206 (24.0) | 79 (16.1) | 428 (57.5) | 226 (92.5) | **476 (29.9)** | 327 (43.9) | 149 (16.3) | 47 (9.6) | 246 (32.9) | 183 (73.8) |
| Costs, million USD (per capita, USD*) | **825 (581)** | 684 | 148 | 149 | 588 | 39 | **482 (340)** | 389 | 86 | 86 | 340 | 30 |
| **Idaho** | | | | | | | | | | | | |
| No. of deaths (rate) | **1,156 (71.2)** | 742 (95.2) | 414 (48.4) | 172 (29.4) | 607 (75.0) | 377 (172.7) | **765 (46.5)** | 457 (58.8) | 308 (35.0) | 100 (17.1) | 341 (41.6) | 324 (149.2) |
| Costs, million USD (per capita, USD*) | **1,274 (780)** | 916 | 350 | 311 | 814 | 63 | **785 (480)** | 547 | 238 | 177 | 458 | 52 |
| **Illinois** | | | | | | | | | | | | |
| No. of deaths (rate) | **6,983 (52.0)** | 4,808 (75.9) | 2,175 (29.6) | 1,123 (25.0) | 4,006 (58.3) | 1,853 (101.7) | **4,644 (34.2)** | 2,918 (46.5) | 1,726 (22.9) | 557 (12.4) | 2,506 (36.3) | 1,581 (86.5) |
| Costs, million USD (per capita, USD*) | **8,297 (644)** | 6,550 | 1,697 | 2,104 | 5,759 | 311 | **4,833 (375)** | 3,579 | 1,206 | 1,015 | 3,502 | 256 |
| **Indiana** | | | | | | | | | | | | |
| No. of deaths (rate) | **4,462 (66.5)** | 3,007 (94.1) | 1,455 (40.1) | 687 (29.0) | 2,685 (79.9) | 1,088 (115.6) | **2,974 (43.8)** | 1,853 (58.3) | 1,121 (30.0) | 390 (16.6) | 1,665 (49.2) | 919 (97.3) |
| Costs, million USD (per capita, USD*) | **5,240 (794)** | 4,059 | 1,190 | 1,288 | 3,718 | 196 | **3,166 (480)** | 2,339 | 823 | 716 | 2,279 | 160 |
| **Iowa** | | | | | | | | | | | | |
| No. of deaths (rate) | **2,045 (58.4)** | 1,300 (81.2) | 745 (37.4) | 237 (21.5) | 936 (58.4) | 872 (161.7) | **1,517 (41.9)** | 898 (55.8) | 619 (29.3) | 135 (12.4) | 586 (36.3) | 796 (146.9) |
| Costs, million USD (per capita, USD*) | **1,987 (639)** | 1,493 | 479 | 435 | 1,242 | 140 | **1,292 (416)** | 937 | 343 | 243 | 756 | 123 |

See table footnotes on page 8.

**TABLE 1. (*Continued*) Deaths from injuries of all intents and unintentional injuries, rates per 100,000 population, lifetime medical and work-loss costs, and lifetime medical and work-loss costs per capita, by state — United States, 2014**

| | All intents | | | | | | Unintentional injuries | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sex | | Age group (yrs) | | | | Sex | | Age group (yrs) | | |
| **State** | **Total** | **Male** | **Female** | **0–24** | **25–64** | **≥65** | **Total** | **Male** | **Female** | **0–24** | **25–64** | **≥65** |
| **Kansas** | | | | | | | | | | | | |
| No. of deaths (rate) | **1,987 (65.2)** | 1,292 (89.8) | 695 (41.7) | 266 (24.7) | 1,046 (71.2) | 675 (154) | **1,377 (44.1)** | 829 (57.4) | 548 (31.5) | 157 (14.6) | 634 (42.7) | 586 (132.3) |
| Costs, million USD (per capita, USD*) | **2,223 (765)** | 1,697 | 505 | 491 | 1,438 | 115 | **1,367 (471)** | 1,004 | 339 | 284 | 855 | 97 |
| **Kentucky** | | | | | | | | | | | | |
| No. of deaths (rate) | **3,634 (80.7)** | 2,466 (114.5) | 1,168 (48.8) | 427 (27.8) | 2,343 (102.7) | 864 (138.4) | **2,622 (58.3)** | 1,677 (78.8) | 945 (39.1) | 296 (19.3) | 1,616 (71) | 710 (114.9) |
| Costs, million USD (per capita, USD*) | **4,296 (973)** | 3,300 | 1,010 | 767 | 3,314 | 164 | **2,966 (672)** | 2,196 | 775 | 523 | 2,293 | 131 |
| **Louisiana** | | | | | | | | | | | | |
| No. of deaths (rate) | **3,654 (77.5)** | 2,576 (113.8) | 1,078 (43.7) | 659 (39.6) | 2,334 (95.9) | 659 (107.8) | **2,344 (49.6)** | 1,584 (70.5) | 760 (30.4) | 381 (22.9) | 1,440 (58.9) | 522 (86.1) |
| Costs, million USD (per capita, USD*) | **4,839 (1,041)** | 3,805 | 1,008 | 1,233 | 3,430 | 127 | **2,855 (614)** | 2,203 | 666 | 685 | 2,045 | 97 |
| **Maine** | | | | | | | | | | | | |
| No. of deaths (rate) | **952 (65.0)** | 633 (93.4) | 319 (38.5) | 105 (26.5) | 492 (71.3) | 354 (146.8) | **690 (45.9)** | 429 (63.1) | 261 (30.0) | 63 (15.9) | 320 (46.7) | 306 (126.7) |
| Costs, million USD (per capita, USD*) | **960 (722)** | 736 | 215 | 200[a] | 649 | 60 | **626 (470)** | 467 | 152 | 117[†] | 423 | 50 |
| **Maryland** | | | | | | | | | | | | |
| No. of deaths (rate) | **3,482 (56.1)** | 2,426 (83.7) | 1,056 (31.0) | 462 (22.6) | 2,129 (65.9) | 891 (109.3) | **1,674 (26.4)** | 1,046 (36.9) | 628 (17.3) | 183 (9) | 772 (23.3) | 719 (88.3) |
| Costs, million USD (per capita, USD*) | **4,233 (708)** | 3,376 | 838 | 888 | 3,049 | 149 | **1,560 (261)** | 1,183 | 363 | 340 | 1,039 | 114 |
| **Massachusetts** | | | | | | | | | | | | |
| No. of deaths (rate) | **3,452 (47.4)** | 2,361 (70.4) | 1,091 (26.4) | 335 (13.8) | 2,132 (59.4) | 984 (92.1) | **2,692 (36.8)** | 1,767 (53.2) | 925 (21.9) | 230 (9.4) | 1,577 (44.3) | 884 (82.4) |
| Costs, million USD (per capita, USD*) | **3,707 (550)** | 3,032 | 711 | 648 | 2,936 | 158 | **2,508 (372)** | 2,059 | 503 | 444 | 2,143 | 138 |
| **Michigan** | | | | | | | | | | | | |
| No. of deaths (rate) | **6,652 (63.8)** | 4,392 (89.2) | 2,260 (39.9) | 967 (27.6) | 3,807 (74.2) | 1,878 (122.5) | **4,422 (41.5)** | 2,714 (55.0) | 1,708 (28.9) | 532 (15.4) | 2,283 (43.9) | 1,607 (104.6) |
| Costs, million USD (per capita, USD*) | **7,539 (761)** | 5,766 | 1,749 | 1,780 | 5,194 | 322 | **4,338 (438)** | 3,168 | 1,172 | 943 | 3,014 | 264 |
| **Minnesota** | | | | | | | | | | | | |
| No. of deaths (rate) | **3,226 (54.3)** | 1,956 (71.6) | 1,270 (37.4) | 361 (19.6) | 1,465 (50.0) | 1,400 (168.8) | **2,385 (39.2)** | 1,327 (49.0) | 1,058 (29.8) | 197 (10.7) | 888 (30.3) | 1,300 (155.9) |
| Costs, million USD (per capita, USD*) | **3,041 (557)** | 2,227 | 771 | 670 | 1,953 | 210 | **1,855 (340)** | 1,296 | 526 | 358 | 1,137 | 190 |
| **Mississippi** | | | | | | | | | | | | |
| No. of deaths (rate) | **2,477 (81.8)** | 1,702 (120.0) | 775 (47.4) | 443 (40.7) | 1,421 (93.4) | 612 (149) | **1,712 (56.2)** | 1,085 (77.0) | 627 (37.8) | 288 (26.9) | 903 (58.7) | 520 (127.4) |
| Costs, million USD (per capita, USD*) | **2,872 (959)** | 2,306 | 601 | 807 | 1,963 | 110 | **1,816 (607)** | 1,379 | 447 | 512 | 1,215 | 92 |
| **Missouri** | | | | | | | | | | | | |
| No. of deaths (rate) | **4,672 (74.1)** | 3,142 (105.9) | 1,530 (43.9) | 675 (32.2) | 2,658 (85.7) | 1,339 (143.6) | **3,110 (48.5)** | 1,911 (64.3) | 1,199 (33.4) | 407 (19.6) | 1,585 (50.9) | 1,118 (119.7) |
| Costs, million USD (per capita, USD*) | **5,371 (886)** | 4,213 | 1,159 | 1,249 | 3,767 | 230 | **3,203 (528)** | 2,379 | 830 | 731 | 2,185 | 186 |
| **Montana** | | | | | | | | | | | | |
| No. of deaths (rate) | **902 (83.1)** | 586 (110.5) | 316 (56.2) | 121 (34.9) | 475 (91.4) | 306 (183.8) | **581 (52.6)** | 343 (64.8) | 238 (40.5) | 75 (21.8) | 253 (49.1) | 253 (153.3) |
| Costs, million USD (per capita, USD*) | **973 (950)** | 729 | 239 | 219 | 653 | 55 | **579 (566)** | 411 | 160 | 133 | 359 | 44 |
| **Nebraska** | | | | | | | | | | | | |
| No. of deaths (rate) | **1,116 (56.0)** | 752 (80.6) | 364 (32.9) | 161 (23.7) | 563 (58.9) | 392 (134.7) | **781 (38.2)** | 492 (52.8) | 289 (24.7) | 95 (13.9) | 338 (35.1) | 348 (118.5) |
| Costs, million USD (per capita, USD*) | **1,139 (605)** | 913 | 245 | 296 | 754 | 61 | **697 (370)** | 543 | 169 | 172 | 446 | 52 |
| **Nevada** | | | | | | | | | | | | |
| No. of deaths (rate) | **1,948 (67.0)** | 1,359 (94.6) | 589 (39.7) | 251 (26.6) | 1251 (81.2) | 446 (121.7) | **1,166 (40.1)** | 750 (52.1) | 416 (28.1) | 144 (15.3) | 722 (46.4) | 300 (83.6) |
| Costs, million USD (per capita, USD*) | **2,294 (808)** | 1,781 | 534 | 464 | 1,665 | 85 | **1,319 (465)** | 975 | 359 | 265 | 949 | 54 |
| **New Hampshire** | | | | | | | | | | | | |
| No. of deaths (rate) | **1,001 (70.8)** | 645 (97.9) | 356 (44.6) | 92 (20.1) | 584 (84.9) | 325 (154.8) | **716 (50.4)** | 435 (67.2) | 281 (34.2) | 56 (12.1) | 376 (55.7) | 284 (135.6) |
| Costs, million USD (per capita, USD*) | **1,022 (771)** | 800 | 226 | 174 | 798 | 55 | **664 (500)** | 515 | 156 | 104 | 522 | 46 |
| **New Jersey** | | | | | | | | | | | | |
| No. of deaths (rate) | **4,210 (44.4)** | 2,881 (65.2) | 1,329 (25.4) | 555 (18.8) | 2,454 (51.1) | 1,200 (88.4) | **2,970 (30.8)** | 1,935 (43.9) | 1,035 (19.1) | 319 (10.8) | 1,597 (33.1) | 1,053 (77.2) |
| Costs, million USD (per capita, USD*) | **4,765 (533)** | 3,806 | 961 | 1,074 | 3,465 | 201 | **2,991 (335)** | 2,368 | 657 | 607 | 2,238 | 171 |
| **New Mexico** | | | | | | | | | | | | |
| No. of deaths (rate) | **2,163 (101.9)** | 1,443 (141.1) | 720 (63.7) | 291 (38.5) | 1,303 (124.7) | 569 (185.9) | **1,534 (71.9)** | 958 (94.3) | 576 (49.9) | 173 (22.8) | 899 (85.7) | 462 (152.4) |
| Costs, million USD (per capita, USD*) | **2,573 (1,233)** | 1,965 | 603 | 542 | 1,844 | 101 | **1,659 (796)** | 1,214 | 445 | 315 | 1,250 | 79 |

See table footnotes on page 8.

**TABLE 1. (*Continued*) Deaths from injuries of all intents and unintentional injuries, rates per 100,000 population, lifetime medical and work-loss costs, and lifetime medical and work-loss costs per capita, by state — United States, 2014**

| | All intents | | | | | | Unintentional injuries | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sex | | Age group (yrs) | | | | Sex | | Age group (yrs) | | |
| **State** | **Total** | **Male** | **Female** | **0–24** | **25–64** | **≥65** | **Total** | **Male** | **Female** | **0–24** | **25–64** | **≥65** |
| **New York** | | | | | | | | | | | | |
| No. of deaths (rate) | **8,585 (40.2)** | 5,801 (58.9) | 2,784 (23.1) | 1,046 (15.1) | 4,934 (45.9) | 2,600 (87.1) | **5,945 (27.5)** | 3,799 (38.8) | 2,146 (17.2) | 587 (8.5) | 3,095 (28.7) | 2,259 (75.5) |
| Costs, million USD (per capita, USD*) | **9,689 (491)** | 7,594 | 1,987 | 1,987 | 6,858 | 436 | **5,772 (292)** | 4,443 | 1,302 | 1,095 | 4,158 | 363 |
| **North Carolina** | | | | | | | | | | | | |
| No. of deaths (rate) | **6,541 (63.7)** | 4,358 (90.8) | 2,183 (39.2) | 890 (25.6) | 3,709 (71.0) | 1,940 (140.2) | **4,558 (44.3)** | 2,881 (60.9) | 1,677 (29.5) | 552 (16.0) | 2,378 (45.4) | 1,626 (118.7) |
| Costs, million USD (per capita, USD*) | **7,310 (735)** | 5,674 | 1,607 | 1,681 | 5,148 | 334 | **4,620 (465)** | 3,517 | 1,093 | 1,021 | 3,255 | 270 |
| **North Dakota** | | | | | | | | | | | | |
| No. of deaths (rate) | **514 (64.1)** | 353 (89.5) | 161 (38.6) | 82 (27.0) | 258 (68.6) | 174 (149.1) | **349 (42.8)** | 219 (56.8) | 130 (29.4) | 44 (14.6) | 146 (39.3) | 159 (135.8) |
| Costs, million USD (per capita, USD*) | **545 (737)** | 447 | 100 | 158[†] | 367 | 30 | **312 (422)** | 245 | 69 | 82[†] | 205 | 26 |
| **Ohio** | | | | | | | | | | | | |
| No. of deaths (rate) | **8,366 (69.4)** | 5,541 (97.9) | 2,825 (42.9) | 984 (24.8) | 5,062 (85.5) | 2,320 (128.0) | **6,178 (50.6)** | 3,828 (68.0) | 2,350 (34.6) | 576 (14.5) | 3,595 (60.6) | 2,007 (110.6) |
| Costs, million USD (per capita, USD*) | **9,370 (808)** | 7,217 | 2,143 | 1,820 | 7,038 | 403 | **6,200 (535)** | 4,607 | 1,609 | 1,041 | 4,874 | 338 |
| **Oklahoma** | | | | | | | | | | | | |
| No. of deaths (rate) | **3,522 (88.8)** | 2,277 (119.9) | 1,245 (59.6) | 485 (34.6) | 2,069 (104.3) | 968 (176.8) | **2,421 (60.3)** | 1,465 (77.3) | 956 (44.5) | 283 (20.3) | 1,308 (65.0) | 830 (152.5) |
| Costs, million USD (per capita, USD*) | **4,035 (1,040)** | 3,024 | 981 | 893 | 2,841 | 171 | **2,508 (647)** | 1,812 | 686 | 511 | 1,747 | 141 |
| **Oregon** | | | | | | | | | | | | |
| No. of deaths (rate) | **2,773 (64.1)** | 1,805 (88.6) | 968 (40.8) | 286 (22.1) | 1,477 (69.0) | 1,010 (161.8) | **1,803 (40.8)** | 1,072 (52.7) | 731 (29.5) | 156 (12.1) | 826 (38.3) | 821 (131.8) |
| Costs, million USD (per capita, USD*) | **2,704 (681)** | 2,075 | 624 | 530 | 1,932 | 159 | **1,504 (379)** | 1,111 | 383 | 285 | 1,068 | 122 |
| **Pennsylvania** | | | | | | | | | | | | |
| No. of deaths (rate) | **9,224 (66.1)** | 6,111 (94.1) | 3,113 (40.0) | 1,102 (25.4) | 5,245 (78.8) | 2,875 (127.4) | **6,640 (46.6)** | 4,091 (63.0) | 2,549 (31.5) | 683 (15.8) | 3,454 (52.1) | 2,503 (109.7) |
| Costs, million USD (per capita, USD*) | **10,089 (789)** | 7,874 | 2,229 | 2,085 | 7,225 | 477 | **6,420 (502)** | 4,820 | 1,633 | 1,256 | 4,687 | 404 |
| **Rhode Island** | | | | | | | | | | | | |
| No. of deaths (rate) | **748 (62.8)** | 475 (88.8) | 273 (40.0) | 59 (15.2) | 422 (75.6) | 267 (143.4) | **592 (49.0)** | 360 (67.9) | 232 (32.7) | 33 (8.6) | 316 (57.0) | 243 (129.3) |
| Costs, million USD (per capita, USD*) | **771 (731)** | 576 | 179 | 113 | 578 | 41 | **526 (498)** | 387 | 134 | 62[†] | 420 | 36 |
| **South Carolina** | | | | | | | | | | | | |
| No. of deaths (rate) | **3,608 (72.0)** | 2,422 (103.1) | 1,186 (44.0) | 564 (33.8) | 2,111 (83.4) | 933 (132.2) | **2,436 (48.2)** | 1,519 (65.0) | 917 (33.4) | 334 (20.3) | 1,333 (52.1) | 769 (110.0) |
| Costs, million USD (per capita, USD*) | **4,279 (885)** | 3,309 | 962 | 1,054 | 2,925 | 169 | **2,693 (557)** | 1,984 | 695 | 615 | 1,821 | 136 |
| **South Dakota** | | | | | | | | | | | | |
| No. of deaths (rate) | **642 (71.1)** | 415 (97.4) | 227 (45.9) | 110 (35.9) | 320 (75.8) | 212 (149.9) | **462 (49.2)** | 282 (65.6) | 180 (34.3) | 67 (22.1) | 195 (45.6) | 200 (139.9) |
| Costs, million USD (per capita, USD*) | **687 (805)** | 505 | 172 | 197 | 448 | 35 | **422 (495)** | 302 | 111 | 119[†] | 270 | 31 |
| **Tennessee** | | | | | | | | | | | | |
| No. of deaths (rate) | **5,237 (77.4)** | 3,489 (110.5) | 1,748 (47.2) | 631 (27.9) | 3,093 (90.2) | 1,512 (163.1) | **3,781 (55.5)** | 2,361 (75.3) | 1,420 (37.6) | 361 (16.0) | 2,116 (61.4) | 1,304 (141.7) |
| Costs, million USD (per capita, USD*) | **5,947 (908)** | 4,556 | 1,396 | 1,162 | 4,262 | 273 | **3,900 (595)** | 2,871 | 1,030 | 650 | 2,843 | 228 |
| **Texas** | | | | | | | | | | | | |
| No. of deaths (rate) | **14,652 (55.6)** | 10,164 (79.8) | 4,488 (32.8) | 2,454 (24.4) | 8,777 (62.2) | 3,419 (115.9) | **9,723 (37.2)** | 6,398 (51.2) | 3,325 (24.2) | 1,498 (14.9) | 5,434 (38.3) | 2,789 (95.4) |
| Costs, million USD (per capita, USD*) | **17,522 (650)** | 13,869 | 3,740 | 4,549 | 12,340 | 615 | **10,648 (395)** | 8,237 | 2,512 | 2,720 | 7,485 | 486 |
| **Utah** | | | | | | | | | | | | |
| No. of deaths (rate) | **1,924 (73.0)** | 1,265 (97.1) | 659 (49.7) | 286 (23.5) | 1,190 (85.7) | 446 (158.9) | **1,167 (45.3)** | 726 (57.5) | 441 (33.5) | 141 (11.5) | 662 (47.6) | 364 (130.0) |
| Costs, million USD (per capita, USD*) | **2,362 (803)** | 1,794 | 564 | 525 | 1,726 | 78 | **1,251 (425)** | 937 | 315 | 250 | 942 | 61 |
| **Vermont** | | | | | | | | | | | | |
| No. of deaths (rate) | **478 (68.2)** | 291 (91.0) | 187 (45.4) | 54 (24.6) | 208 (64.2) | 216 (207.0) | **322 (44.4)** | 168 (53.3) | 154 (34.9) | 25 (10.9) | 112 (34.5) | 185 (179.2) |
| Costs, million USD (per capita, USD*) | **406 (648)** | 314 | 88 | 102[†] | 265 | 32 | **228 (365)** | 161 | 62 | 46[†] | 140 | 27 |
| **Virginia** | | | | | | | | | | | | |
| No. of deaths (rate) | **4,701 (54.7)** | 3,141 (77.2) | 1,560 (33.7) | 634 (21.9) | 2,618 (57.9) | 1,449 (132.9) | **3,147 (36.7)** | 1,962 (49.2) | 1,185 (25.2) | 362 (12.5) | 1,577 (34.9) | 1,208 (111.6) |
| Costs, million USD (per capita, USD*) | **5,166 (620)** | 3,996 | 1,128 | 1,196 | 3,655 | 244 | **3,004 (361)** | 2,265 | 720 | 671 | 2,163 | 194 |
| **Washington** | | | | | | | | | | | | |
| No. of deaths (rate) | **4,428 (59.6)** | 2,909 (81.9) | 1,519 (38.2) | 530 (22.0) | 2,446 (63.3) | 1,451 (149.5) | **2,997 (39.9)** | 1,821 (51.8) | 1,176 (28.8) | 304 (12.6) | 1,451 (37.0) | 1,242 (128.6) |
| Costs, million USD (per capita, USD*) | **4,600 (651)** | 3,550 | 1,052 | 1,004 | 3,262 | 240 | **2,727 (386)** | 2,020 | 708 | 564 | 1,873 | 197 |

See table footnotes on page 8.

**TABLE 1. (*Continued*) Deaths from injuries of all intents and unintentional injuries, rates per 100,000 population, lifetime medical and work-loss costs, and lifetime medical and work-loss costs per capita, by state — United States, 2014**

| | All intents | | | | | | Unintentional injuries | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sex | | Age group (yrs) | | | | Sex | | Age group (yrs) | | |
| State | Total | Male | Female | 0–24 | 25–64 | ≥65 | Total | Male | Female | 0–24 | 25–64 | ≥65 |
| **West Virginia** | | | | | | | | | | | | |
| No. of deaths (rate) | **1,897 (98.0)** | 1,253 (134.8) | 644 (62.6) | 201 (33.9) | 1,170 (125.0) | 526 (166.2) | **1,380 (71.1)** | 874 (95.2) | 506 (47.9) | 122 (20.6) | 818 (88.5) | 440 (140.5) |
| Costs, million USD (per capita, USD*) | **2,149 (1,162)** | 1,599 | 530 | 369 | 1,618 | 94 | **1,507 (815)** | 1,099 | 393 | 225 | 1,133 | 77 |
| **Wisconsin** | | | | | | | | | | | | |
| No. of deaths (rate) | **4,032 (64.2)** | 2,463 (85.0) | 1,569 (43.7) | 480 (24.1) | 1,965 (64.8) | 1,587 (174.2) | **3,015 (46.7)** | 1,696 (58.4) | 1,319 (35.1) | 275 (13.8) | 1,279 (41.6) | 1,461 (159.6) |
| Costs, million USD (per capita, USD*) | **3,934 (683)** | 2,895 | 967 | 906 | 2,617 | 229 | **2,499 (434)** | 1,765 | 700 | 508 | 1,665 | 203 |
| **Wyoming** | | | | | | | | | | | | |
| No. of deaths (rate) | **514 (86.6)** | 355 (119.2) | 159 (52.2) | 81 (39.6) | 322 (105.3) | 111 (141.4) | **361 (60.2)** | 234 (78.4) | 127 (40.8) | 46 (22.3) | 225 (72.4) | 90 (116.0) |
| Costs, million USD (per capita, USD*) | **581 (995)** | 454 | 134 | 149[†] | 415 | 21 | **384 (658)** | 286 | 103 | 83[†] | 291 | 17 |

* Costs per capita calculated only for totals.
† Average medical cost was statistically unstable; however, it accounted for less than 1% of combined average cost.
§ Rates based on ≤20 deaths might be unstable.
¶ Both average medical cost and average work loss cost were statistically unstable.

**TABLE 2. Suicide and homicide deaths, rates per 100,000 population, lifetime medical and work-loss costs, and lifetime medical and work-loss costs per capita, by state — United States, 2014**

| | Suicides | | | Homicides | | |
|---|---|---|---|---|---|---|
| | | Sex | | | Sex | |
| State | Total | Male | Female | Total | Male | Female |
| **Alabama** | | | | | | |
| No. deaths (rate) | **715 (14.5)** | 569 (24.3) | 146 (5.6) | **374 (8.0)** | 304 (13.4) | 70 (2.8) |
| Costs, million USD (per capita, USD*) | **897 (185)** | 755 | 143 | **606 (125)** | 532 | 76[†] |
| **Alaska** | | | | | | |
| No. deaths (rate) | **167 (22.0)** | 138 (34.8) | 29 (7.9) | **37 (4.7)** | 22 (5.3) | 15 (4.1) |
| Costs, million USD (per capita, USD*) | **249[†] (338)** | 220[†] | 32[†] | **61[†] (83)** | 38[†] | —[**] |
| **Arizona** | | | | | | |
| No. deaths (rate) | **1,244 (18.0)** | 945 (27.7) | 299 (8.7) | **322 (5.0)** | 249 (7.7) | 73 (2.2) |
| Costs, million USD (per capita, USD*) | **1,528 (227)** | 1,222 | 293 | **538 (80)** | 448 | 82[†] |
| **Arkansas** | | | | | | |
| No. deaths (rate) | **515 (17.2)** | 406 (27.9) | 109 (7.2) | **217 (7.6)** | 158 (11.3) | 59 (4.1) |
| Costs, million USD (per capita, USD*) | **671 (226)** | 550 | 119[†] | **323 (109)** | 258 | 62[†] |
| **California** | | | | | | |
| No. deaths (rate) | **4,214 (10.5)** | 3,234 (16.7) | 980 (4.7) | **1,813 (4.6)** | 1,514 (7.6) | 299 (1.5) |
| Costs, million USD (per capita, USD*) | **4,927 (127)** | 3,986 | 933 | **3,103 (80)** | 2,794 | 337 |
| **Colorado** | | | | | | |
| No. deaths (rate) | **1,083 (19.8)** | 843 (31.3) | 240 (8.7) | **177 (3.3)** | 124 (4.5) | 53 (2.1) |
| Costs, million USD (per capita, USD*) | **1,421 (265)** | 1,174 | 252 | **282 (53)** | 215 | 58[†] |
| **Connecticut** | | | | | | |
| No. deaths (rate) | **379 (9.7)** | 276 (14.8) | 103 (5.1) | **99 (2.8)** | 75 (4.3) | 24 (1.3) |
| Costs, million USD (per capita, USD*) | **475 (132)** | 368 | 98[†] | **170 (47)** | 142 | 25[†] |
| **Delaware** | | | | | | |
| No. deaths (rate) | **126 (13.2)** | 100 (22.3) | 26 (5.3) | **57 (6.5)** | 47 (10.9) | 10 (2.2) |
| Costs, million USD (per capita, USD*) | **168[†] (179)** | 140[†] | —[**] | **98 (105)** | 87[†] | —[**] |
| **District of Columbia** | | | | | | |
| No. deaths (rate) | **52 (7.7)** | 39 (12.3) | 13 (4.0) | **97 (13.2)** | 79 (22.3) | 18 (4.8) |
| Costs, million USD (per capita, USD*) | **73[†] (110)** | 59[†] | —[**] | **180 (273)** | 152 | —[**] |
| **Florida** | | | | | | |
| No. deaths (rate) | **3,035 (13.8)** | 2,328 (21.9) | 707 (6.3) | **1,158 (6.2)** | 915 (9.8) | 243 (2.5) |
| Costs, million USD (per capita, USD*) | **3,332 (167)** | 2,701 | 624 | **1,852 (93)** | 1,584 | 282 |
| **Georgia** | | | | | | |
| No. deaths (rate) | **1,294 (12.6)** | 998 (20.6) | 296 (5.6) | **658 (6.5)** | 518 (10.2) | 140 (2.8) |
| Costs, million USD (per capita, USD*) | **1,622 (161)** | 1,323 | 292 | **1,087 (108)** | 933 | 155 |

See table footnotes on page 11.

**TABLE 2. (*Continued*) Suicide and homicide deaths, rates per 100,000 population, lifetime medical and work-loss costs, and lifetime medical and work-loss costs per capita, by state — United States, 2014**

| | Suicides | | | Homicides | | |
|---|---|---|---|---|---|---|
| | | Sex | | | Sex | |
| **State** | **Total** | **Male** | **Female** | **Total** | **Male** | **Female** |
| **Hawaii** | | | | | | |
| No. deaths (rate) | **204 (13.6)** | 163 (21.5) | 41 (5.4) | **30 (2.3)** | 21 (3.0) | [††] |
| Costs, million USD (per capita, USD*) | **283 (199)** | 243 | 43[†] | **34[§] (24)** | —[**] | —[**] |
| **Idaho** | | | | | | |
| No. deaths (rate) | **320 (20.1)** | 240 (30.5) | 80 (10.1) | **36 (2.4)** | 22 (3.0) | 14 (1.7) |
| Costs, million USD (per capita, USD*) | **391[†] (239)** | 299[†] | 89[†] | **49[§] (30)** | —[**] | —[**] |
| **Illinois** | | | | | | |
| No. deaths (rate) | **1,398 (10.4)** | 1,110 (17.1) | 288 (4.2) | **792 (6.2)** | 679 (10.6) | 113 (1.8) |
| Costs, million USD (per capita, USD*) | **1,780 (138)** | 1,474 | 304 | **1,409 (109)** | 1,307 | 123 |
| **Indiana** | | | | | | |
| No. deaths (rate) | **948 (14.3)** | 756 (23.4) | 192 (5.6) | **364 (5.7)** | 290 (9.0) | 74 (2.3) |
| Costs, million USD (per capita, USD*) | **1,210 (183)** | 1,023 | 194 | **597 (90)** | 515 | 86[†] |
| **Iowa** | | | | | | |
| No. deaths (rate) | **407 (12.8)** | 327 (20.7) | 80 (5.2) | **78 (2.5)** | 50 (3.2) | 28 (1.8) |
| Costs, million USD (per capita, USD*) | **520 (167)** | 437 | 81[†] | **114 (37)** | 87[†] | 32[§] |
| **Kansas** | | | | | | |
| No. deaths (rate) | **455 (15.7)** | 356 (25.0) | 99 (6.6) | **104 (3.6)** | 75 (5.2) | 29 (2.1) |
| Costs, million USD (per capita, USD*) | **624 (215)** | 511 | 111[†] | **168 (58)** | 132 | 34 |
| **Kentucky** | | | | | | |
| No. deaths (rate) | **727 (15.9)** | 582 (26.2) | 145 (6.2) | **203 (4.7)** | 153 (7.1) | 50 (2.3) |
| Costs, million USD (per capita, USD*) | **927 (210)** | 771 | 151 | **303 (69)** | 253 | 55[†] |
| **Louisiana** | | | | | | |
| No. deaths (rate) | **679 (14.3)** | 506 (22.2) | 173 (7.0) | **538 (11.6)** | 428 (18.6) | 110 (4.7) |
| Costs, million USD (per capita, USD*) | **888 (191)** | 692 | 176 | **941 (202)** | 796 | 135 |
| **Maine** | | | | | | |
| No. deaths (rate) | **220 (15.7)** | 174 (25.5) | 46 (6.7) | **23 (2.0)** | 15 (2.6) | —[††] |
| Costs, million USD (per capita, USD*) | **269[†] (202)** | 219[†] | 49[†] | **35[§] (26)** | —[**] | —[**] |
| **Maryland** | | | | | | |
| No. deaths (rate) | **606 (9.8)** | 470 (16.1) | 136 (4.2) | **387 (6.6)** | 312 (10.8) | 75 (2.4) |
| Costs, million USD (per capita, USD*) | **763 (128)** | 617 | 140[†] | **692 (116)** | 593 | 91[†] |
| **Massachusetts** | | | | | | |
| No. deaths (rate) | **596 (8.3)** | 472 (13.6) | 124 (3.4) | **110 (1.6)** | 91 (2.7) | 19 (0.5) |
| Costs, million USD (per capita, USD*) | **782 (116)** | 657 | 126 | **197 (29)** | 176 | 24[†] |
| **Michigan** | | | | | | |
| No. deaths (rate) | **1,354 (13.2)** | 1,062 (21.3) | 292 (5.6) | **589 (6.2)** | 465 (9.8) | 124 (2.6) |
| Costs, million USD (per capita, USD*) | **1,735 (175)** | 1,461 | 276 | **990 (100)** | 831 | 149 |
| **Minnesota** | | | | | | |
| No. deaths (rate) | **686 (12.2)** | 525 (18.8) | 161 (5.9) | **101 (1.9)** | 69 (2.6) | 32 (1.2) |
| Costs, million USD (per capita, USD*) | **914 (168)** | 741 | 172 | **170 (31)** | 125 | 40[†] |
| **Mississippi** | | | | | | |
| No. deaths (rate) | **380 (12.5)** | 299 (20.8) | 81 (5.3) | **332 (11.3)** | 277 (19.4) | 55 (3.5) |
| Costs, million USD (per capita, USD*) | **481 (161)** | 406 | 74[†] | **530 (177)** | 484 | 62[†] |
| **Missouri** | | | | | | |
| No. deaths (rate) | **1,017 (16.3)** | 817 (27.2) | 200 (6.3) | **441 (7.5)** | 357 (12.3) | 84 (2.8) |
| Costs, million USD (per capita, USD*) | **1,302 (215)** | 1,091 | 205 | **745 (123)** | 650 | 94 |
| **Montana** | | | | | | |
| No. deaths (rate) | **251 (23.8)** | 197 (36.8) | 54 (11.4) | **30 (2.9)** | 23 (4.4) | —[††] |
| Costs, million USD (per capita, USD*) | **302[†] (295)** | 250[†] | 52[†] | **40[†] (39)** | —[**] | —[**] |
| **Nebraska** | | | | | | |
| No. deaths (rate) | **251 (13.4)** | 202 (21.7) | 49 (5.4) | **63 (3.4)** | 47 (5.0) | 16 (1.7) |
| Costs, million USD (per capita, USD*) | **313 (166)** | 263 | 51[†] | **108 (58)** | 91[†] | —[**] |
| **Nevada** | | | | | | |
| No. deaths (rate) | **573 (19.5)** | 449 (31.2) | 124 (8.2) | **176 (6.3)** | 138 (9.8) | 38 (2.7) |
| Costs, million USD (per capita, USD*) | **669 (236)** | 547 | 124[†] | **266 (94)** | 235 | 41[§] |
| **New Hampshire** | | | | | | |
| No. deaths (rate) | **247 (17.6)** | 191 (27.5) | 56 (8.1) | **17 (1.3)[¶]** | —[††] | —[††] |
| Costs, million USD (per capita, USD*) | **302[†] (228)** | 251[†] | 49[†] | **—[**]** | —[**] | —[**] |

See table footnotes on page 11.

**TABLE 2. (*Continued*) Suicide and homicide deaths, rates per 100,000 population, lifetime medical and work-loss costs, and lifetime medical and work-loss costs per capita, by state — United States, 2014**

| State | Suicides | | | Homicides | | |
|---|---|---|---|---|---|---|
| | | Sex | | | Sex | |
| | Total | Male | Female | Total | Male | Female |
| **New Jersey** | | | | | | |
| No. deaths (rate) | **786 (8.3)** | 590 (12.9) | 196 (4.1) | **372 (4.4)** | 302 (7.2) | 70 (1.6) |
| Costs, million USD (per capita, USD*) | **958 (107)** | 748 | 203 | **654 (73)** | 568 | 80† |
| **New Mexico** | | | | | | |
| No. deaths (rate) | **449 (21.0)** | 350 (33.4) | 99 (9.2) | **135 (6.8)** | 106 (10.5) | 29 (2.9) |
| Costs, million USD (per capita, USD*) | **594 (285)** | 501 | 98 | **218 (105)** | 183 | 32§ |
| **New York** | | | | | | |
| No. deaths (rate) | **1,700 (8.1)** | 1,262 (12.5) | 438 (4.0) | **662 (3.3)** | 536 (5.5) | 126 (1.2) |
| Costs, million USD (per capita, USD*) | **2,139 (108)** | 1,674 | 435 | **1,157 (59)** | 1,010 | 147 |
| **North Carolina** | | | | | | |
| No. deaths (rate) | **1,351 (13.0)** | 984 (19.8) | 367 (6.9) | **551 (5.6)** | 435 (8.9) | 116 (2.3) |
| Costs, million USD (per capita, USD*) | **1,685 (169)** | 1,296 | 369 | **730 (73)** | 769 | 128 |
| **North Dakota** | | | | | | |
| No. deaths (rate) | **137 (17.5)** | 113 (27.8) | 24 (6.7) | **15 (2.0)¶** | 13 (3.0) | —†† |
| Costs, million USD (per capita, USD*) | **195† (264)** | 169† | —** | **—**** | —** | —** |
| **Ohio** | | | | | | |
| No. deaths (rate) | **1,491 (12.6)** | 1,163 (20.1) | 328 (5.7) | **578 (5.2)** | 472 (8.4) | 106 (1.9) |
| Costs, million USD (per capita, USD*) | **1,939 (167)** | 1,588 | 344 | **955 (82)** | 843 | 122 |
| **Oklahoma** | | | | | | |
| No. deaths (rate) | **736 (19.1)** | 561 (29.5) | 175 (9.2) | **250 (6.5)** | 183 (9.5) | 67 (3.5) |
| Costs, million USD (per capita, USD*) | **999 (258)** | 801 | 186 | **409 (105)** | 316 | 83† |
| **Oregon** | | | | | | |
| No. deaths (rate) | **782 (18.7)** | 614 (30.1) | 168 (7.9) | **99 (2.4)** | 65 (3.1) | 34 (1.7) |
| Costs, million USD (per capita, USD*) | **911 (229)** | 755 | 157† | **131 (33)** | 104† | 33† |
| **Pennsylvania** | | | | | | |
| No. deaths (rate) | **1,817 (13.3)** | 1,440 (21.6) | 377 (5.6) | **620 (5.1)** | 492 (8.1) | 128 (2.0) |
| Costs, million USD (per capita, USD*) | **2,307 (180)** | 1,928 | 378 | **1,059 (83)** | 901 | 149 |
| **Rhode Island** | | | | | | |
| No. deaths (rate) | **113 (10.0)** | 82 (14.9) | 31 (5.4) | **27 (2.5)** | 23 (4.2) | —†† |
| Costs, million USD (per capita, USD*) | **159† (151)** | 120† | —** | **45† (43)** | —** | —** |
| **South Carolina** | | | | | | |
| No. deaths (rate) | **753 (15.1)** | 579 (24.4) | 174 (6.8) | **363 (7.5)** | 286 (12.1) | 77 (3.1) |
| Costs, million USD (per capita, USD*) | **953 (197)** | 785 | 170 | **587 (121)** | 503 | 84† |
| **South Dakota** | | | | | | |
| No. deaths (rate) | **141 (17.0)** | 109 (25.9) | 32 (7.9) | **26 (3.2)** | 15 (3.6) | 11 (2.7) |
| Costs, million USD (per capita, USD*) | **197† (231)** | 162† | 37† | **—**** | —** | —** |
| **Tennessee** | | | | | | |
| No. deaths (rate) | **948 (14.1)** | 746 (23.3) | 202 (5.8) | **379 (5.9)** | 309 (9.6) | 70 (2.2) |
| Costs, million USD (per capita, USD*) | **1,241 (189)** | 1,032 | 214 | **595 (91)** | 523 | 82† |
| **Texas** | | | | | | |
| No. deaths (rate) | **3,254 (12.2)** | 2,528 (19.5) | 726 (5.4) | **1,389 (5.1)** | 1,059 (7.8) | 330 (2.5) |
| Costs, million USD (per capita, USD*) | **4,264 (158)** | 3,490 | 754 | **2,240 (83)** | 1,867 | 386 |
| **Utah** | | | | | | |
| No. deaths (rate) | **559 (20.6)** | 418 (31.0) | 141 (10.5) | **61 (2.1)** | 39 (2.7) | 22 (1.4) |
| Costs, million USD (per capita, USD*) | **802 (273)** | 634 | 158† | **89† (30)** | 67† | 25† |
| **Vermont** | | | | | | |
| No. deaths (rate) | **124 (18.6)** | 102 (30.7) | 22 (7.2) | **16 (2.9)¶** | 13 (4.8) | —†† |
| Costs, million USD (per capita, USD*) | **148† (237)** | 131† | —** | **—**** | —** | —** |
| **Virginia** | | | | | | |
| No. deaths (rate) | **1,122 (12.9)** | 870 (20.7) | 252 (5.7) | **339 (4.1)** | 249 (5.9) | 90 (2.2) |
| Costs, million USD (per capita, USD*) | **1,412 (170)** | 1,150 | 252 | **555 (67)** | 449 | 105† |
| **Washington** | | | | | | |
| No. deaths (rate) | **1,119 (15.2)** | 854 (23.5) | 265 (7.2) | **211 (3.0)** | 157 (4.4) | 54 (1.6) |
| Costs, million USD (per capita, USD*) | **1,404 (199)** | 1,147 | 253 | **333 (47)** | 272 | 63† |
| **West Virginia** | | | | | | |
| No. deaths (rate) | **359 (18.1)** | 280 (28.6) | 79 (8.1) | **103 (5.9)** | 70 (7.9) | 33 (3.9) |
| Costs, million USD (per capita, USD*) | **426 (230)** | 346 | 71† | **156 (85)** | 113† | 41† |

See table footnotes on page 11.

**TABLE 2. (*Continued*) Suicide and homicide deaths, rates per 100,000 population, lifetime medical and work-loss costs, and lifetime medical and work-loss costs per capita, by state — United States, 2014**

| State | Suicides | | | Homicides | | |
|---|---|---|---|---|---|---|
| | | Sex | | | Sex | |
| | Total | Male | Female | Total | Male | Female |
| **Wisconsin** | | | | | | |
| No. deaths (rate) | **769 (13.1)** | 598 (20.6) | 171 (5.9) | **166 (3.0)** | 126 (4.5) | 40 (1.4) |
| Costs, million USD (per capita, USD*) | **981 (170)** | 806 | 170 | **274 (48)** | 227 | 45† |
| **Wyoming** | | | | | | |
| No. deaths (rate) | **120 (20.7)** | 96 (32.3) | 24 (8.7) | **24 (4.4)** | 16 (5.8) | —†† |
| Costs, million USD (per capita, USD*) | **153† (262)** | 131† | 21† | **—**** | —** | —** |

* Costs per capita calculated only for totals.
† Average medical cost was statistically unstable; however, it accounted for less than 1% of combined average cost.
§ Average medical cost was statistically unstable; however, it accounted for less than 5% of combined average cost.
¶ Rates based on ≤20 deaths might be unstable.
** Both average medical cost and average work loss cost were statistically unstable.
†† State-level counts and rates based on <10 deaths have been suppressed.

# Prevalence of Perceived Food and Housing Security — 15 States, 2013

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Recent global (*1*) and national (*2*,*3*) health equity initiatives conclude that the elimination of health disparities requires improved understanding of social context (*4*,*5*) and ability to measure social determinants of health, including food and housing security (*3*). Food and housing security reflect the availability of and access to essential resources needed to lead a healthy life. The 2013 Behavioral Risk Factor Surveillance System (BRFSS) included two questions to assess perceived food and housing security in 15 states.* Among 95,665 respondents, the proportion who answered "never or rarely" to the question "how often in the past 12 months would you say you were worried or stressed about having enough money to buy nutritious meals?" ranged from 68.5% to 82.4% by state. Among 90,291 respondents living in housing they either owned or rented, the proportion who answered "never or rarely" to the question, "how often in the past 12 months would you say you were worried or stressed about having enough money to pay your rent/mortgage?" ranged from 59.9% to 72.8% by state. Food security was reported less often among non-Hispanic blacks (blacks) (68.5%) and Hispanics (64.6%) than non-Hispanic whites (whites) (81.8%). These racial/ethnic disparities were present across all levels of education; housing security followed a similar pattern. These results highlight racial/ethnic disparities in two important social determinants of health, food and housing security, as well as a substantial prevalence of worry or stress about food or housing among all subgroups in the United States. The concise nature of the BRFSS Social Context Module's single-question format for food and housing security makes it possible to incorporate these questions into large health surveys so that social determinants can be monitored at the state and national levels and populations at risk can be identified.

BRFSS is an ongoing surveillance system designed to measure behavioral risk factors for the noninstitutionalized adult population aged ≥18 years residing in the United States.† Two questions on perceived food and housing security were added to the BRFSS in 15 states in 2013. Respondents were asked how often they were worried or stressed in the last 12 months about having enough money to buy nutritious meals or pay rent or mortgage. Persons who responded "never or rarely" were considered secure; persons who responded "sometimes," "usually," or "always" were considered insecure. The food security question is a simplified version of the U.S. Department of Agriculture's (USDA's) Current Population Survey food security supplement (CPS-FSS) measure that has been used by USDA since 1995 to measure national estimates of food security (*6*). The BRFSS-based measure of food security was compared with the CPS-FSS measure by calculating the correlation between the estimated prevalence of food security in the 12 states that implemented the Social Context Module in 2009 with the average estimated prevalence of food security in those same states during 2008–2010. These two measures were highly correlated ($r = 0.71$; $p<0.01$; Mark Nord, USDA, personal communication, June 6, 2012). The 2009 state-specific BRFSS-measured estimates were lower on average by approximately 5 percentage points than the 2008–2010 CPS-FSS estimates for food security; the BRFSS estimates show slightly higher perceptions of stress from being food insecure. The 2009 BRFSS-based measure of housing security in the 12 states was compared with the U.S. Census Bureau's measure of housing affordability during 2007–2011 (i.e., the percentage of households with housing costs <30% of income). These two measures correlated highly ($r = 0.71$; $p<0.01$). Prevalence estimates were weighted to the age, sex, and racial/ethnic distribution of the 2013 intercensal estimates.

The 15 states included in this study represent approximately one third of the total U.S. population. Response rates for the 15 states ranged from 35.2% to 54.3% (median = 46.5%). BRFSS estimates of the prevalence of perceived food security varied by state, ranging from 68.5% (Arkansas) to 82.4% (Minnesota). Estimates of the prevalence of perceived housing security among respondents who owned or rented the housing in which they were living ranged from 59.9% (Arkansas) to 72.8% (Iowa) (Table 1); this variation persisted after controlling for age, education, and race and ethnicity. Disparities were also evident on the basis of age, sex, education level, and race and ethnicity. For example, the prevalence of food security was highest among whites (81.8%, CI = 81.2%–82.4%), lower among blacks (68.5%, CI = 66.3%–70.7%), and lowest among Hispanics (64.6%, CI = 62.5%–66.7%). The prevalence of food security was highest among persons with ≥4 years of college education (89.0%, CI = 88.3%–89.7%), lower among persons with a high school education and <4 years of college (75.7%, CI = 74.8%–76.6%), and lowest among persons with less than a high school education (59.9%, CI = 57.5%–62.1%). For each

* Arkansas, California, Connecticut, District of Columbia, Georgia, Iowa, Kansas, Louisiana, Maine, Minnesota, Nebraska, Nevada, New Jersey, New Mexico, Virginia.

† https://www.cdc.gov/brfss/.

**TABLE 1. Prevalence of perceived food security* and perceived housing security,† by state and selected characteristics — 15 states, Behavioral Risk Factor Surveillance Survey, 2013**

| Characteristic | Food secure† | | Housing secure† | |
|---|---|---|---|---|
| | No. | % (95% CI)§ | No. | % (95% CI)§ |
| **Overall** | 95,665 | 76.9 (76.3–77.6) | 90,291 | 65.6 (64.9–66.4) |
| **Age group (yrs)** | | | | |
| 18–24 | 4,606 | 73.7 (71.3–76.0) | 3,630 | 63.4 (60.4–66.3) |
| 25–34 | 9,068 | 70.0 (68.0–71.8) | 8,498 | 57.9 (55.8–60.0) |
| 35–44 | 11,918 | 72.8 (71.1–74.4) | 11,472 | 59.7 (57.8–61.6) |
| 45–54 | 16,767 | 75.0 (73.7–76.4) | 16,043 | 61.5 (59.9–63.2) |
| 55–64 | 22,273 | 78.9 (77.3–80.3) | 21,276 | 66.7 (65.0–68.4) |
| ≥65 | 31,033 | 88.9 (88.0–89.7) | 29,372 | 82.2 (80.8–83.5) |
| **Sex** | | | | |
| Male | 38,706 | 80.1 (79.1–81.0) | 36,548 | 68.8 (67.6–69.9) |
| Female | 56,959 | 73.9 (73.0–74.8) | 53,743 | 62.7 (61.7–63.7) |
| **Race/Ethnicity** | | | | |
| White, non-Hispanic | 72,935 | 81.8 (81.2–82.4) | 69,111 | 71.6 (70.9–72.3) |
| Black, non-Hispanic | 8,936 | 68.5 (66.3–70.7) | 8,312 | 56.3 (54.0–58.7) |
| Hispanic | 7,901 | 64.6 (62.5–66.7) | 7,449 | 52.7 (50.4–55.0) |
| Other | 4,656 | 80.7 (77.9–83.2) | 4,335 | 65.6 (61.8–69.2) |
| **Education** | | | | |
| <High school | 7,527 | 59.9 (57.5–62.1) | 6,911 | 48.2 (45.7–50.7) |
| High school to 3 yrs college | 52,078 | 75.7 (74.8–76.6) | 48,727 | 64.0 (62.9–65.0) |
| ≥4 yrs college | 35,861 | 89.0 (88.3–89.7) | 34,511 | 78.6 (77.5–79.6) |
| **State** | | | | |
| Arkansas | 4,638 | 68.5 (66.5–70.5) | 4,388 | 59.9 (57.8–62.0) |
| California | 5,935 | 77.3 (75.7–78.7) | 5,682 | 65.1 (63.3–66.8) |
| Connecticut | 6,784 | 77.2 (75.7–78.7) | 6,447 | 67.1 (65.3–68.8) |
| District of Columbia | 4,169 | 79.6 (77.4–81.7) | 3,995 | 71.6 (69.2–74.0) |
| Georgia | 6,864 | 73.8 (72.3–75.2) | 6,365 | 62.6 (61.0–64.3) |
| Iowa | 3,654 | 82.0 (80.1–83.7) | 3,497 | 72.8 (70.7–74.8) |
| Kansas | 9,942 | 80.3 (79.2–81.3) | 9,375 | 72.7 (71.5–73.9) |
| Louisiana | 4,845 | 74.3 (72.1–76.3) | 4,322 | 67.7 (65.3–70.1) |
| Maine | 4,636 | 76.3 (74.6–77.9) | 4,410 | 65.5 (63.7–67.3) |
| Minnesota | 12,646 | 82.4 (81.1–83.6) | 12,118 | 72.7 (71.1–74.1) |
| Nebraska | 7,828 | 81.0 (79.4–82.4) | 7,324 | 71.2 (69.5–72.9) |
| Nevada | 4,485 | 75.8 (73.2–78.3) | 4,280 | 62.2 (59.3–65.0) |
| New Jersey | 3,867 | 77.3 (75.2–79.4) | 3,635 | 62.0 (59.5–64.3) |
| New Mexico | 8,114 | 72.0 (70.5–73.5) | 7,664 | 62.2 (60.6–63.8) |
| Virginia | 7,258 | 76.8 (75.4–78.1) | 6,789 | 66.3 (64.7–67.8) |

**Abbreviation:** CI = confidence interval.
* Responded "never" or "rarely" to the question, "How often in the past 12 months would you say you were worried or stressed about having enough money to buy nutritious meals?"
† Responded "never" or "rarely" to the question, "How often in the past 12 months would you say you were worried or stressed about having enough money to pay your rent/mortgage?"
§ Prevalence (%) and 95% CI were calculated using sampling weights.

racial/ethnic group, the prevalence of food security was highest among persons with ≥4 years of college and lowest among persons with less than a high school education (Table 2). Patterns for housing security were similar.

## Discussion

This report provides population-based data, from single-question measures, that identify substantial state-to-state variation in the prevalence of reported food security and housing security in 15 states. Disparities by race, ethnicity, age, sex, and education were identified, and racial/ethnic disparities persisted across each level of education. These data on two important social determinants can help identify vulnerable populations, monitor change over time, and evaluate interventions intended to reduce health disparities in food and housing security.

Lack of food and housing security creates a social context that causes material hardship and psychosocial stress that can harm health (*7*). Differences in social context are related to increased risk for poor health outcomes, such as cardiovascular disease and some cancers as well as other health risk factors, including obesity, tobacco or alcohol use, and adverse childhood experiences (*5*,*8*). Food and housing security are examples of actionable social determinants. The Surgeon General's National Prevention Council Action Plan, for instance, emphasizes that increasing access to affordable healthy foods and safe, affordable housing are important strategies to support sustainable healthy

**TABLE 2. Prevalence of perceived food security* and housing security,† stratified by race/ethnicity and education — 15 states,§ Behavioral Risk Factor Surveillance Survey, 2013**

| | | Food secure | | Housing secure¶ | |
|---|---|---|---|---|---|
| **Race/Ethnicity** | **Education** | **No.** | **% (95% CI)** | **No.** | **% (95% CI)** |
| White, non-Hispanic | <High school | 3,640 | 65.2 (62.3–68.1) | 3,298 | 52.7 (49.4–55.9) |
| | High school to 3 yrs college | 39,615 | 79.2 (78.3–80.0) | 37,202 | 68.6 (67.5–69.6) |
| | ≥4 yrs college | 29,570 | 91.2 (90.5–91.7) | 28,528 | 81.7 (80.7–82.5) |
| Black, non-Hispanic | <High school | 1,182 | 58.3 (52.1–64.2) | 1,082 | 44.2 (37.7–50.8) |
| | High school to 3 yrs college | 5,245 | 67.3 (64.5–70.1) | 4,836 | 55.8 (52.8–58.8) |
| | ≥4 yrs college | 2,490 | 82.1 (79.2–84.6) | 2,379 | 68.7 (64.8–72.4) |
| Hispanic | <High school | 2,143 | 55.3 (51.5–59.0) | 2,016 | 45.3 (41.4–49.3) |
| | High school to 3 yrs college | 4,237 | 69.5 (66.8–72.1) | 3,975 | 55.9 (52.9–59.0) |
| | ≥4 yrs college | 1,502 | 79.8 (75.1–83.9) | 1,441 | 68.0 (63.0–72.6) |
| Other | <High school | 411 | 77.3 (67.7–84.6) | 380 | 61.8 (47.8–74.1) |
| | High school to 3 yrs college | 2,384 | 74.3 (69.3–78.8) | 2,180 | 57.1 (50.9–63.1) |
| | ≥4 yrs college | 1,848 | 87.8 (84.5–90.4) | 1,765 | 75.0 (70.3–79.1) |

**Abbreviation:** CI = confidence interval.
* Responded "never" or "rarely" to the question, "How often in the past 12 months would you say you were worried or stressed about having enough money to buy nutritious meals?"
† Responded "never" or "rarely" to the question, "How often in the past 12 months would you say you were worried or stressed about having enough money to pay your rent/mortgage?"
§ The 15 states include Arkansas, California, Connecticut, District of Columbia, Georgia, Iowa, Kansas, Louisiana, Maine, Minnesota, Nebraska, Nevada, New Jersey, New Mexico, and Virginia.
¶ Sample size is smaller than that for food security: some respondents were not asked the housing security question because they reported living in housing that did not require them to pay either rent or mortgage (e.g., living with family).

communities. Establishing farmers' markets, farm stands, and community gardens in disadvantaged neighborhoods can improve food security by increasing access to affordable healthy foods at lower cost or with alternative payment options (e.g., electronic benefits transfer discounts) and alleviating the costs associated with traveling to obtain these foods (*9*). These community-level interventions can be implemented in concert with policy-level improvements; for example, electronic benefits transfers can be used to provide beneficiaries of the Women, Infants and Children and Supplemental Nutrition Assistance programs with greater access and incentives to purchase healthy and nutritious foods (*3*,*9*). Coordination of investments, such as the Social Innovation Fund, AmeriCorps, and Partnership for Sustainable Communities, to provide vulnerable communities with access to affordable and safe housing is an example of a policy intervention to support housing security and prevent homelessness (*3*). The National Prevention Council Action Plan states that public health initiatives related to both food and housing security should be conducted in concert with other relevant lead agencies such as the USDA and the Department of Housing and Urban Development.

Achieving health equity by improving food and housing security is a major objective of CDC's Division of Community Health (DCH) programs, such as Partnerships to Improve Community Health and Racial and Ethnic Approaches to Community Health.§ With support from DCH, many communities are working to make healthy food choices easier for persons who live in food deserts (parts of a community offering little to no fresh fruit, vegetables, and other healthy whole foods), with emphasis on increased access to healthy, affordable foods and alternative payment options (*9*). These initiatives are examples of policy, systems, or environmental approaches that create opportunities for health and maximize the ability of all segments of the population to achieve optimal health. The overarching strategy is to change the community context to make the healthy choice the default choice (*8*).

Deciding where to target interventions and determining which interventions have the most impact on reducing health disparities will require an improved understanding of social determinants (*2*). The BRFSS food and housing security questions could play an important role in three ways: monitoring food and housing security over time, identifying vulnerable populations that are highest priority for intervention, and evaluating the effectiveness of these interventions. The concise nature of the Social Context Module's single-question format for food and housing security makes it possible to incorporate these questions into large health surveys to conduct nationwide monitoring of social determinants.

The findings in this report are subject to at least five limitations. First, data are self-reported, and therefore subject to recall and social desirability biases. Second, the single-item food security question does not account for the four conceptual domains measured in the USDA food security supplement survey (i.e., anxiety about food shortages, actual food shortages, concerns

§ https://www.cdc.gov/nccdphp/dch/programs/index.htm.

**What is already known about this topic?**

The elimination of health disparities among racial/ethnic groups will require improved ability to measure and address social determinants of health, including food and housing security, which are defined as lack of stress or worry about being able to afford nutritious food and adequate housing.

**What is added by this report?**

In 2013, the estimated prevalence of perceived food security ranged from 68.5% to 82.4% among adult respondents in 15 participating states, and the prevalence of housing security among adults who owned or rented ranged from 59.9% to 72.8%. Food security was reported less often by non-Hispanic blacks (68.5%) and Hispanics (64.6%) than by non-Hispanic whites (81.8%). Disparities on the basis of education were consistent across all racial/ethnic groups. Approximately one fifth of college graduates reported stress or worry about having enough money to pay their rent or mortgage.

**What are the implications for public health practice?**

Population-based food and housing security data can help identify populations that are at risk for health disparities. These data can be used by public health professionals, health care systems and decision makers to facilitate multisectorial collaboration to develop research, policies, and programs aimed at reducing these disparities.

about dietary quality, and differences between adult and child food quality and adequacy). Third, the study includes data from only 15 states, so the results are not necessarily nationally representative. Fourth, because response rates for all states were <60% there is possibility of nonresponse bias. Finally, no adjustment was made for income, although education and income are strongly correlated.

The critical role of social determinants of health, such as food and housing security, in the elimination of health disparities has been emphasized by the World Health Organization (*1*), CDC's National Expert Panel on Social Determinants of Health Equity (*2*), and the Surgeon General's National Prevention Council Action Plan (*3*), as well as *Healthy People 2020* (*10*). Progress toward achieving health equity can be facilitated by initiatives to reduce disparities within and between communities in social determinants of health such as food and housing security (*10*).

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# State Laws Requiring Hand Sanitation Stations at Animal Contact Exhibits — United States, March–April 2016

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In the United States, animal contact exhibits, such as petting zoos and agricultural fairs, have been sources of zoonotic infections, including infections with *Escherichia coli*, *Salmonella*, and *Cryptosporidium* (*1–4*). The National Association of State Public Health Veterinarians recommends handwashing after contact with animals as an effective prevention measure to disease transmission at these exhibits (*4*). This report provides a list of states that have used law, specifically statutes and regulations, as public health interventions to increase hand sanitation at animal contact exhibits. The report is based on an assessment conducted by CDC's Public Health Law Program, in collaboration with the Division of Foodborne, Waterborne, and Environmental Diseases in CDC's National Center for Emerging and Zoonotic Infectious Diseases. The assessment found that seven states have used statutes or regulations to require hand sanitation stations at these exhibits (*5*). Jurisdictions seeking to improve rates of hand sanitation at animal contact exhibits can use this report as a resource in developing their own legal interventions.

A list of statutes and regulations was compiled using WestlawNext, an online legal research database, from March 17 to April 1, 2016. Before searching the database, literature on animal contact exhibits was examined to identify potential search terms. Search strings were created to capture the various terms used by states to refer to animal contact exhibits in their law. Only animal contact exhibit laws that specifically referenced hand sanitation were included in the assessment. The search was conducted in all 50 states and the District of Columbia and documented in a detailed research procedure. Relevant laws were then analyzed and coded. On June 2016, the findings of the assessment were emailed to public health veterinarians in 50 states and the District of Columbia. They were asked to contact the research team if applicable laws were overlooked. None of the jurisdictions indicated that laws were overlooked in the assessment.

Seven states (New Jersey, New York, North Carolina, Pennsylvania, Utah, Washington, and Wisconsin) have laws requiring animal contact exhibits to provide hand sanitation stations (Table). However, state laws vary regarding the types of exhibits to which the requirements apply. For example, North Carolina's laws apply to all animal contact exhibits, including petting zoos, pony rides, and poultry handling exhibits. Wisconsin's law, however, applies only to petting zoos located at campgrounds.

Laws in four of the seven states (New York, North Carolina, Pennsylvania, and Wisconsin) specify where the handwashing stations must be located in relation to the exhibit. These provisions vary as to the specific location. For example, North Carolina requires that a handwashing station be located within 10 feet (3 meters) of the exit of the exhibit when feasible, whereas Pennsylvania requires that the station be conveniently located on the animal exhibition grounds.

All seven states require that animal contact exhibits have signs recommending hand sanitation, or indicating the health risk for contact with animals. Four states (New York, North Carolina, Pennsylvania, and Wisconsin) require that signs indicating the location of the hand sanitation stations be placed at the exhibit.

The statutory or regulatory code in all seven states authorizes penalties against operators of animal contact exhibits for noncompliance with hand sanitation station laws. For example, in Pennsylvania, noncompliance is subject to a civil penalty of $500. In Wisconsin, campground petting zoo operators who are in violation are subject to suspension or revocation of their permits.

## Discussion

Law has played a demonstrable role in the great public health achievements of the 20th century, such as improvements in motor-vehicle safety and immunization, meriting research into its potential use in other areas of public health, including animal contact exhibit outbreaks (*6,7*). The results of this assessment highlight the depth and breadth of state laws related to hand sanitation stations at animal contact exhibits, including the type of exhibits, locations of the stations, signage requirements, and penalties. Within the seven jurisdictions that have these laws, the types of facilities covered by the laws vary. Some jurisdictions' laws apply broadly to various facilities, whereas others apply only to a single facility type, such as petting zoos.

This study is subject to at least two limitations. First, although only seven states have established requirements for hand sanitation through statutes or regulations, states might be using other law or policy interventions not captured in this assessment to reduce the incidence of disease transmission at

**TABLE. Laws requiring hand sanitation stations at animal contact exhibits in seven states — United States, March–April 2016**

| State | Citation | Applicable facilities | Handwashing station required | Sign recommending sanitation or indicating risk required |
|---|---|---|---|---|
| New Jersey | N.J. Admin. Code Sect. 2:76-2A.13 | Farm-based recreational activities at commercial farms | Yes* | Yes† |
| New York | N.Y. McKinney's Public Health Law Sect.1311; N.Y. McKinney's Public Health Law Sect. 12 | Public establishments featuring animals | Yes | Yes |
| New York | N.Y. McKinney's General Business Law Sect. 399-ff | Petting zoos | Yes | Yes |
| New York | N.Y. Comp. Codes Rules and Regulations, Title 10, Sect. 7-5.1 - 5.15 | Petting zoos at agricultural fairgrounds | Yes | Yes§ |
| North Carolina | N.C. Gen. Stat. Ann. Sect. 106-520.1-72 N.C. Admin. Code 52K.0101-0702 | Animal exhibitions at agricultural fairs | Yes | Yes |
| Pennsylvania | 3 Pa. Code Sect. 2501-2504 | Animal exhibitions | Yes | Yes |
| Utah | Utah Admin. Code R58-6; R58-19-4 | Public exhibitions of poultry | Yes | Yes |
| Washington | Wash. Admin. Code Sect. 246-100-192; 246-100-070 | Animal venue operators | Yes | Yes |
| Wisconsin | Wis. Admin. Code DHS Sect. 178.03, 178.18, 178.08, 178.07; Wis. Stat. Ann. Sect. 254.47 | Petting zoos at campgrounds | Yes | Yes |

* New Jersey's law recommends and requires handwashing stations for commercial farms seeking to receive the protections of the New Jersey Right to Farm Act, NJSA 4:1C-1 et seq.
† New Jersey's law does not specifically mention signs but requires that visitors be advised to sanitize their hands, which is likely done via signage.
§ Per N.Y. McKinney's General Business Law § 399-ff, which applies to petting zoos in the state, New York's law requires recommending hand sanitation to patrons.


Summary

What is already known about this topic?

Disease transmission linked to petting zoos, agricultural fairs, and other animal contact exhibits continues to be associated with outbreaks in the United States and can be minimized by proper handwashing after contact with animals. Some states have used law as a public health intervention to reduce the incidence of disease outbreaks associated with animal contact exhibits.

What is added by this report?

Seven states require hand sanitation stations for certain animal contact exhibits through statute or regulation. These statutes and regulations also require signs indicating location of the hand sanitation stations, or recommending hand sanitation, or provide penalties for violation of applicable laws.

What are the implications for public health practice?

This report can be used as a tool for states in establishing hand sanitation laws for animal contact exhibits in their own jurisdictions, and as data for researchers in evaluating the effectiveness of these laws.


animal contact exhibits. For example, the assessment did not include a study of case law, administrative decisions, agency policies, or local laws. Second, this assessment did not study the implementation or enforcement of the statutory and regulatory requirements, which can influence the effectiveness of legal interventions. Despite these limitations, this assessment, a type of legal epidemiologic study, can increase the body of evidence-based research on the effectiveness of these legal interventions (*6*). Thus, the results of this assessment can be used by researchers in evaluating the public health impact of animal contact exhibit laws related to hand sanitation.

Proper handwashing is an effective way to prevent transmission of disease to persons at animal exhibits (*4*); however, outbreaks at animal contact exhibits continue to occur, in part because of a lack of handwashing stations. Statutory and regulatory interventions are tools that states use to address this preventable health risk. The results of this assessment of state laws related to hand sanitation at animal contact exhibits can be used as a tool for other jurisdictions interested in establishing similar laws.


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# Using National Inpatient Death Rates as a Benchmark to Identify Hospitals with Inaccurate Cause of Death Reporting — Missouri, 2009–2012

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Reporting causes of death accurately is essential to public health and hospital-based programs; however, some U.S. studies have identified substantial inaccuracies in cause of death reporting. Using CDC's national inpatient hospital death rates as a benchmark, the Missouri Department of Health and Senior Services (DHSS) analyzed inpatient death rates reported by hospitals with high inpatient death rates in St. Louis and Kansas City metro areas. Among the selected hospitals with high inpatient death rates, 45.8% of death certificates indicated an underlying cause of death that was inconsistent with CDC's Guidelines for Death Certificate completion. Selected hospitals with high inpatient death rates were more likely to overreport heart disease and renal disease, and underreport cancer as an underlying cause of death. Based on these findings, the Missouri DHSS initiated a new web-based training module for death certificate completion based on the CDC guidelines in an effort to improve accuracy in cause of death reporting.

Among all nonfederal, noninstitutional, short-stay hospitals or general hospitals in Missouri that each reported ≥20 deaths per year, 32 were purposively selected for the study. All selected hospitals were in the Kansas City metro area (15) or the St. Louis metro area (17). Combined, these hospitals reported half (50.7%) of all deaths in the state. Heart disease, cancer, and renal disease were selected from among the 10 top causes of death in the state, because death certificate–based reported deaths resulting from these conditions were substantially higher in Missouri than in the rest of the United States.

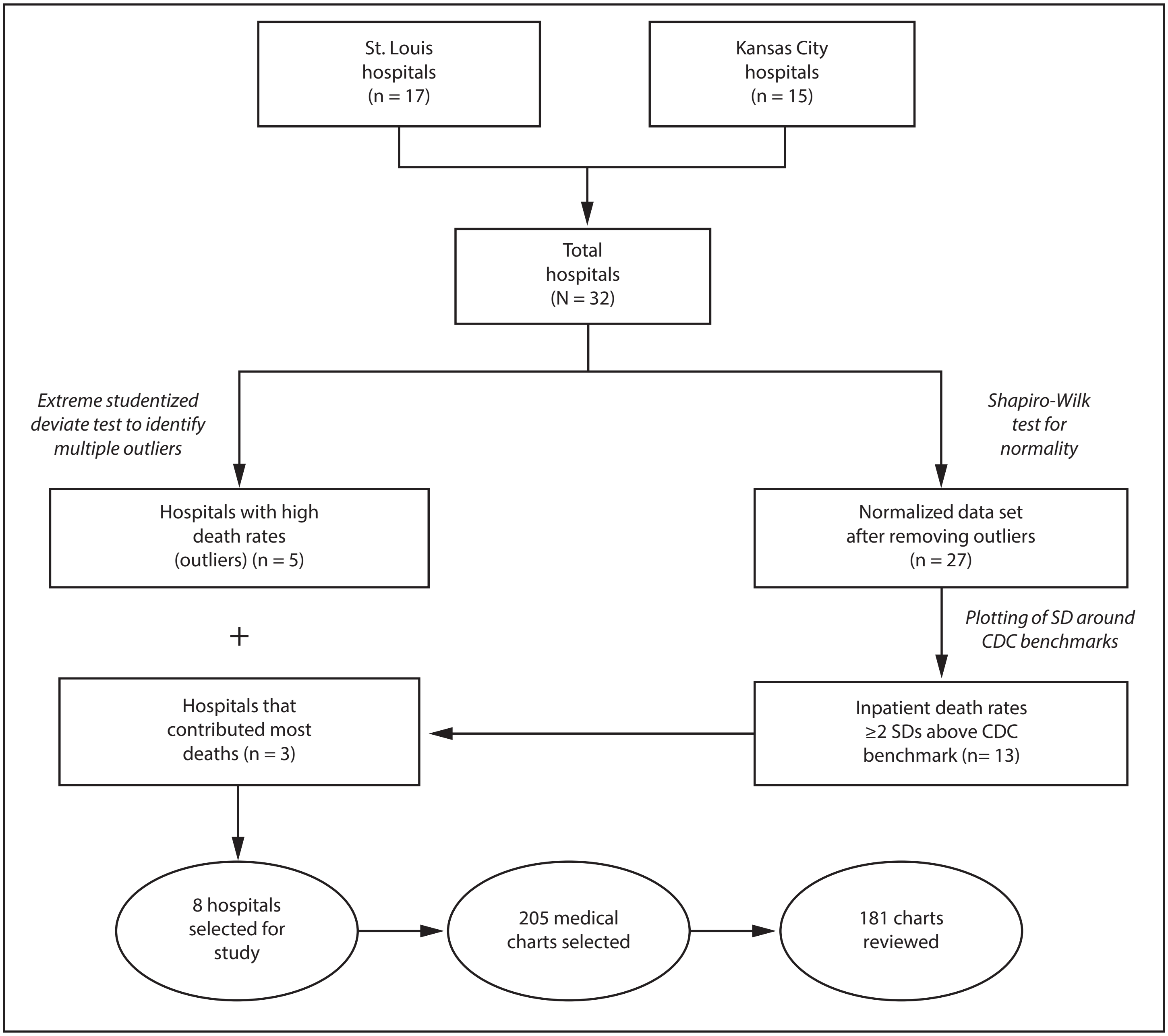
Death certificate data from 2009–2012 were obtained from the Missouri Department of Health and Senior Services (MDHSS) Vital Statistics Bureau. Heart disease deaths were defined as deaths assigned *International Classification of Diseases, 10th Revision* (ICD-10) codes I00–I09, I11, I13, or I20–I51; cancer deaths, as those with codes C00–C97; and renal disease deaths, as those with codes N00–N07, N17–N19, or N25–N27.

For each hospital, the average percentage of reported deaths from heart disease, cancer, and renal disease among persons hospitalized for each condition during the study period was calculated as the number of inpatients reported to have died from a particular cause divided by the total number of hospitalizations of persons with a diagnosis of that disease, multiplied by 100 (*1*). An extreme Studentized deviate test to detect multiple outliers in a univariate, approximately normally distributed data set (two-sided test, $\alpha = 0.1$) was applied to the calculated inpatient hospital death rates data set. Hospitals with high outlying death rates in any of the three disease categories were selected. The rest of the normalized data set was then tested for normality again with the Shapiro-Wilk test (Figure). After calculating the standard deviation (SD) of the normalized data set, the inpatient death data were plotted around the U.S. benchmark, and a tolerance zone (benchmark ±2 SD) was created. CDC's estimates of the U.S. 2010 inpatient hospital death rates for cancer, heart disease, and renal disease were used as benchmarks (*1*). Among hospitals with inpatient death rates ≥2 SD above the U.S. benchmark in any disease category, a sample of the hospitals that contributed the most deaths were selected. These hospitals, as well as the hospitals identified as outliers, were included in the analysis (Figure).

Medical charts for review were randomly selected from a data set that included all death certificates submitted by the hospital during 2009–2012 for the three disease categories. Sample sizes for the chart review were calculated to detect at least a 20% death certificate completion error rate, and ranged from 18 to 33 per hospital. Medical chart reviews were conducted by one physician and one epidemiologist who were trained in death certificate completion according to CDC guidelines (*2*). Death certificates were not available to the reviewers at the time of chart reviews. After a thorough review of medical charts with sufficient data available to determine cause of death, underlying cause of death was determined by consensus between the two reviewers. If the medical chart did not provide sufficient information to reject the cause of death recorded in the chart, the reviewers accepted the diagnosis recorded in the chart. The underlying cause of death determined based on the chart review was subsequently compared with the cause of death recorded on the death certificate. Proportions of deaths from heart disease, cancer, and renal disease as reported on all death certificates were compared with those ascertained through review of the medical chart. Differences were assessed using the McNemar test and a p-value <0.05 was considered statistically significant.

Among the 32 hospitals, five acute care small (<150 beds) hospitals (two in the St. Louis area and three in the Kansas City area) were determined to be outliers with high inpatient

**FIGURE. Selection of hospitals for assessment of accuracy of cause-of-death reporting — St. Louis and Kansas City metro areas, Missouri, 2009–2012**




**Abbreviation:** SD = standard deviation.

death rates (Figure). After setting aside those five hospitals, the resulting normalized data set comprised 27 hospitals: 12 in the Kansas City area and 15 in the St Louis area. Among these, 13 (48%) had inpatient death rates ≥2 SDs above the benchmark for at least one disease category (Table 1). Among these 13 hospitals, three that contributed the most deaths in this group (one in Kansas City and two in St. Louis) were selected by the researchers. These three hospital and the five outlier hospitals constituted the eight study hospitals. A total of 205 medical charts were selected for review at these eight hospitals. Among the 205 selected medical charts, 181 (88%) were reviewed; charts were unavailable or incomplete (e.g., missing notes, no discharge summary, no laboratory results, etc.) for 24 patients.

Overall, the cause of death reported on 24%–65% of death certificates submitted by the reviewed hospitals did not agree with the conclusions reached by the chart reviewers: among hospitals studied, heart disease was incorrectly identified as

**TABLE 1. No. of hospitals that exceeded CDC benchmarks +2 standard deviations* for deaths from heart disease, cancer, and renal disease and all-cause deaths — St. Louis and Kansas City, metro area hospitals, 2009–2012**

| | | St. Louis hospitals | | Kansas City hospitals | |
|---|---|---|---|---|---|
| Reported cause of death | CDC benchmark† (+2 SD) | No. within tolerance zone | No. outside tolerance zone (no. of outliers) | No. within tolerance zone | No. outside tolerance zone (no. of outliers) |
| Heart disease | 3.5 (5.9) | 13 | 4 (1) | 13 | 2 (2) |
| Cancer | 4.4 (13.7) | 11 | 6 (0) | 8 | 7 (3) |
| Renal disease | 3.1 (7.4) | 14 | 3 (1) | 10 | 5 (1) |
| All-cause death | 2.0 (3.3) | 17 | 0 (0) | 15 | 0 (0) |

**Abbreviation:** SD = standard deviation.
* SD is computed after removing outliers.
† Per 100 hospitalizations; benchmark denotes national in-patient death rate.

the cause of death on 54.5%–85% of death certificates, renal disease on 0%–44%, and cancer on 0%–9% (Table 2). Three hospitals with high heart disease death rates on the death certificates were more likely to overreport heart disease as an underlying cause of death (odds ratio [OR] = 4.5; 95% confidence interval [CI] = 4.1–90.2). The two hospitals with high renal disease death rates on the death certificates were more likely to overreport renal diseases as an underlying cause of death ($p = 0.041$). Six hospitals with high cancer death rates on the death certificates were more likely to underreport cancer on the death certificate (OR = 3.7, CI = 1.1–16.4) and overreport heart disease (OR = 9.0, CI = 13.8–25.6) and renal disease (OR = 1.8, CI = 0.6–5.9). As a group, all reviewed hospitals were more likely to overreport heart disease (OR = 6.6, CI = 3.3–14.9) and renal disease (OR = 2.8, CI = 1.04–8.7), but underreport cancer (OR = 4.0, CI = 1.2–17.7) as an underlying cause of death on the death certificate.

## Discussion

This study revealed substantial overreporting of heart disease and renal disease and underreporting of cancer as underlying causes of death by selected Kansas City and St. Louis area hospitals. Based on review of the medical record by trained reviewers, an average of 45.8% of reviewed death certificates were completed incorrectly. Accuracy of death certificates is of paramount importance, considering that such data are widely used to direct public health projects as well as to fund hospital-based programs and clinical research. However, several studies have demonstrated that death certificates are often completed incorrectly, leading to inaccurate mortality statistics being ascertained from death records (*3*–*6*).

This study was conducted to analyze whether inaccurate death reporting could explain consistently high inpatient death rates for selected conditions at some Missouri hospitals. Because population health risk factors are similar within the geographic region, investigators hypothesized that overreporting of some conditions could, in part, account for increased inpatient death rates associated with certain conditions, and developed an algorithm to identify hospitals with high death rates in both all-cause and selected disease categories. This approach seemed justified considering that all-cause death rates reported by every hospital in this study were comparable to the national rates. Even hospitals with high inpatient cancer death rates underreported cancer as an underlying cause of death at the same time that heart disease was overreported as an underlying cause of death. In those hospitals, the fraction of deaths caused by cancer was consistently and incorrectly identified as caused by heart disease on the death certificate, thereby increasing the heart disease death rate and lowering the cancer-associated death rate. These findings are consistent with previous studies demonstrating that death certificates are often filled out incorrectly (*7*–*10*).

The findings in this study are subject to at least three limitations. First, 12% of medical charts designated for review were unavailable or did not have sufficient information, which might have resulted in sampling bias. Second, the study was based on the assumption that the hospital medical charts provide more


Summary

What is already known about this topic?

Inaccurate completion of death certificates affects reliability of mortality statistics routinely used for policy, research, and public health practice.

What is added by this report?

Using CDC's national inpatient death rates data as a benchmark was helpful in identifying hospitals at the local level with high inpatient death rates. Selected hospitals with high inpatient death rates were more likely to overreport heart disease and renal disease, and underreport cancer as an underlying cause of death. A new web-based training module for death certificate completion was initiated in the state for all personnel involved in death records data entry.

What are the implications for public health practice?

Because cause of death data are widely used to direct local and national health policy, ongoing monitoring of accuracy of inpatient death reporting by public health agencies is needed to improve reporting.

**TABLE 2. Reported underlying cause of death on the death certificate and medical records and percentage of incorrect death certificates, by hospital and disease — St. Louis and Kansas City metro area hospitals, 2009–2012**

| Hospital | No. medical charts selected | Medical charts reviewed no. (%) | % Death certificates with inaccurate cause of death | % Death certificates that inaccurately identified these causes of death: Heart disease* | Cancer† | Renal disease§ |
|---|---|---|---|---|---|---|
| A | 18 | 18 (100) | 44.0 | 75.0 | 0.0 | 25.0 |
| B | 26 | 26 (100) | 50.0 | 85.0 | 0.0 | 15.0 |
| C | 25 | 25 (100) | 44.0 | 81.8 | 9.0 | 9.0 |
| D | 22 | 22 (100) | 41.0 | 56.0 | 0.0 | 44.0 |
| E | 20 | 20 (100) | 65.0 | 85.0 | 8.0 | 0.0 |
| F | 33 | 24 (73) | 45.8 | 54.5 | 9.0 | 27.0 |
| G | 31 | 21 (68) | 52.4 | 54.5 | 0.0 | 18.0 |
| H | 30 | 25 (83) | 24.0 | 83.0 | 0.0 | 0.0 |
| Mean | NA | NA | 45.8 | 71.9 | 3.3 | 17.3 |

**Abbreviation:** NA = not applicable.
* Defined as deaths assigned *International Classification of Diseases, 10th Revision* (ICD-10) codes I00–I09, I11, I13, or I20–I51.
† Defined as deaths assigned ICD-10 codes C00–C97.
§ Defined as deaths assigned ICD-10 codes N00–N07, N17–N19, or N25–N27.

accurate representation of the cause of death than the death certificates, although this might not be correct in all cases. Finally, although this study compared cause of death across broad disease categories, the determination of the underlying cause of death is not always straightforward and another reviewer might have reached a different conclusion.

The Missouri DHSS recently implemented a new web-based training module (http://health.mo.gov/training/moevr/certifier/index.html) instructing certifiers in death certificate completion and on-site training for all personnel involved in death records data entry. Monitoring of inpatient death reporting by public health agencies is ongoing to ensure consistent quality of death certificate data considering that these data are widely used to direct health policy locally and nationally.

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# Guidance for Assessment of Poliovirus Vaccination Status and Vaccination of Children Who Have Received Poliovirus Vaccine Outside the United States

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In 1988, the World Health Assembly resolved to eradicate poliomyelitis (polio). Since then, wild poliovirus (WPV) cases have declined by >99.9%, from an estimated 350,000 cases of polio each year to 74 cases in two countries in 2015 (*1*). This decrease was achieved primarily through the use of trivalent oral poliovirus vaccine (tOPV), which contains types 1, 2, and 3 live, attenuated polioviruses. Since 2000, the United States has exclusively used inactivated polio vaccine (IPV), which contains all three poliovirus types (*2,3*). In 2013, the World Health Organization (WHO) set a target of a polio-free world by 2018 (*4*). Of the three WPV types, type 2 was declared eradicated in September 2015. To remove the risk for infection with circulating type 2 vaccine-derived polioviruses (cVDPV), which can lead to paralysis similar to that caused by WPV, all OPV-using countries simultaneously switched in April 2016 from tOPV to bivalent OPV (bOPV), which contains only types 1 and 3 polioviruses (*5*). This report summarizes current Advisory Committee on Immunization Practices (ACIP) recommendations for poliovirus vaccination and provides CDC guidance, in the context of the switch from tOPV to bOPV, regarding assessment of vaccination status and vaccination of children who might have received poliovirus vaccine outside the United States, to ensure that children living in the United States (including immigrants and refugees) are protected against all three poliovirus types. This guidance is not new policy and does not change the recommendations of ACIP for poliovirus vaccination in the United States. Children living in the United States who might have received poliovirus vaccination outside the United States should meet ACIP recommendations for poliovirus vaccination, which require protection against all three poliovirus types by age-appropriate vaccination with IPV or tOPV. In the absence of vaccination records indicating receipt of these vaccines, only vaccination or revaccination in accordance with the age-appropriate U.S. IPV schedule is recommended. Serology to assess immunity for children with no or questionable documentation of poliovirus vaccination will no longer be an available option and therefore is no longer recommended, because of increasingly limited availability of antibody testing against type 2 poliovirus.

The widespread use of OPV, most commonly tOPV, has been critical for polio eradication efforts. However, OPV use, particularly in areas with low vaccination coverage, is associated with a low risk for reemergence of cVDPVs, which can lead to outbreaks of poliomyelitis similar to those caused by WPV (*6*). Type 2 cVDPVs in particular have accounted for >94% of all cVDPVs and have caused more than 650 polio cases since 2006, including several outbreaks in 2015 (*7*). Furthermore, type 2 cVPDVs have been detected in environmental (sewage) samples in recent years (in 2015 in Pakistan and in 2015 and 2016 in Nigeria) (*7,8*). To remove the risk for infection with type 2 cVDPVs, all OPV-using countries simultaneously switched from tOPV to bOPV in April 2016 (*5*). To further reduce the risk for reintroduction of type 2 polioviruses, laboratory containment activities limiting the handling of potentially infectious materials to certified poliovirus-essential facilities were initiated in 2015 (*9*). Although circulation of indigenous WPV in the United States ceased decades ago, the risk for importation of either WPV types 1 or 3 as well as cVDPVs remains (*10*). The following guidance is provided to highlight recent changes in global polio eradication program strategies and to ensure adequate vaccination according to ACIP recommendations of children who might have received poliovirus vaccination outside the United States.

## Current ACIP Recommendations for Routine Poliovirus Vaccination in the United States

In the United States, all infants and children should receive 4 doses of IPV at ages 2 months, 4 months, 6 through 18 months, and at 4 through 6 years (*2,3*). The final dose in the series should be administered on or after the fourth birthday, regardless of the number of previous doses, and should be given ≥6 months after the previous dose. A fourth dose in the routine IPV series is not necessary if the third dose was administered at age ≥4 years and ≥6 months after the previous dose.

Vaccines administered outside the United States generally can be accepted as valid doses if the schedule (i.e., minimum age for vaccination and intervals between doses) is similar to that recommended in the United States.* Vaccination against polio is also valid for children from countries that use an accelerated schedule, with the first dose given as early as 6 weeks and the second and third doses administered at least 4 weeks after the previous doses. The minimum interval between the third and fourth doses should be 6 months. Only written, dated

* https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6002a1.htm.

records are acceptable as evidence of previous vaccination. Documentation of vaccination with OPV outside the United States should specify vaccination against all three poliovirus types. If both tOPV and IPV were administered as part of a series, the total number of doses needed to complete the series is the same as that recommended for the U.S. IPV schedule. A minimum interval of 4 weeks should separate doses in the series, with the final dose administered on or after the fourth birthday and at least 6 months after the previous dose. If only tOPV was administered, and all doses were given before age 4 years, 1 dose of IPV should be given at age ≥4 years, at least 6 months after the last tOPV dose.

## Guidance for Assessment of Poliovirus Vaccination Status and for Vaccination of Children Who Might Have Been Vaccinated Outside the United States

**Children without adequate documentation of poliovirus vaccination.** Persons aged <18 years should be vaccinated or revaccinated in accordance with the age-appropriate U.S. IPV schedule.[†] Adverse events after administration of IPV are rare (*2*). The 2011 ACIP General Recommendations on Immunization included the option to perform serologic testing for neutralizing antibodies to poliovirus types 1, 2, and 3 to assess immunity in children without adequate documentation of vaccination against polio. Persons with protective titers against all three poliovirus types did not need to receive repeat doses, but were recommended to complete the schedule as age appropriate. In the United States, availability of serologic testing for neutralizing antibodies has been limited in certain commercial and state health department laboratories. Serologic testing for antibodies against poliovirus type 2, an assay that uses live virus, is becoming increasingly unavailable as U.S. laboratories conform to WHO's laboratory containment strategy to destroy type 2 poliovirus in their facilities; these activities were begun in late 2015. Demonstrating antibodies to poliovirus types 1 and 3 does not reliably indicate protection against poliovirus type 2, because countries might have used a combination of monovalent oral poliovirus vaccine (mOPV), bOPV, or tOPV for routine programs and immunization campaigns. In the absence of the availability of testing for antibodies to all 3 serotypes, serologic testing is no longer recommended to assess immunity.

**Children with documentation of poliovirus vaccination.** Previous poliovirus vaccination is valid if documentation indicates receipt of IPV or tOPV. Although tOPV was used for routine poliovirus vaccination in all OPV-using countries, mOPV or bOPV often were used in vaccination campaigns. Therefore, only documentation specifying receipt of tOPV constitutes proof of vaccination according to the U.S. polio vaccination recommendations. If such documentation cannot be validated, persons aged <18 years should be revaccinated with IPV according to the U.S. IPV schedule. Consistent with the polio eradication strategy, doses of OPV administered after April 2016 would either be bOPV (used in routine immunization and campaigns), or mOPV (used in a type-specific outbreak response).

ACIP and CDC provide public health recommendations based on the best available epidemiologic and scientific data. The global switch from tOPV to bOPV will markedly reduce the risk for type 2 cVDPV reemergence and possible importation into the United States. However, until this risk is estimated by WHO to approach zero, public health authorities in the United States should continue to follow ACIP recommendations regarding poliovirus vaccination to ensure that all children living in the United States are protected against all three poliovirus types (*2,3*).

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# Vital Signs: Decrease in Incidence of Diabetes-Related End-Stage Renal Disease among American Indians/Alaska Natives — United States, 1996–2013

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## Abstract

**Background:** American Indians and Alaska Natives (AI/AN) have the highest diabetes prevalence among any racial/ethnic group in the United States. Among AI/AN, diabetes accounts for 69% of new cases of end-stage renal disease (ESRD), defined as kidney failure treated with dialysis or transplantation. During 1982–1996, diabetes-related ESRD (ESRD-D) in AI/AN increased substantially and disproportionately compared with other racial/ethnic groups.

**Methods:** Data from the U.S. Renal Data System, the Indian Health Service (IHS), the National Health Interview Survey, and the U.S. Census were used to calculate ESRD-D incidence rates by race/ethnicity among U.S. adults aged ≥18 years during 1996–2013 and in the diabetic population during 2006–2013. Rates were age-adjusted based on the 2000 U.S. standard population. IHS clinical data from the Diabetes Cares and Outcomes Audit were analyzed for diabetes management measures in AI/AN.

**Results:** Among AI/AN adults, age-adjusted ESRD-D rates per 100,000 population decreased 54%, from 57.3 in 1996 to 26.5 in 2013. Although rates for adults in other racial/ethnic groups also decreased during this period, AI/AN had the steepest decline. Among AI/AN with diabetes, ESRD-D incidence decreased during 2006–2013 and, by 2013, was the same as that for whites. Measures related to the assessment and treatment of ESRD-D risk factors also showed more improvement during this period in AI/AN than in the general population.

**Conclusion and implications for public health practice:** Despite well-documented health and socioeconomic disparities among AI/AN, ESRD-D incidence rates among this population have decreased substantially since 1996. This decline followed implementation by the IHS of public health and population management approaches to diabetes accompanied by improvements in clinical care beginning in the mid-1980s. These approaches might be a useful model for diabetes management in other health care systems, especially those serving populations at high risk.

## Introduction

In the United States, diabetes is the leading cause of end-stage renal disease (ESRD), which is kidney failure treated with dialysis or transplantation (*1*). The prevalence of diabetes among American Indians/Alaska Natives (AI/AN) in the United States in 2012 (15.9%) was higher than that among non-Hispanic blacks (blacks) (13.2%), Hispanics (12.8%) or non-Hispanic whites (whites) (7.6%) during 2010–2012 (*2*). Diabetes accounts for 44% of new cases of ESRD (diabetes-associated ESRD [ESRD-D]) in the overall U.S. population and for 69% among AI/AN (*1*). Prevention or delay of ESRD-D involves control of blood pressure and blood glucose, early identification and monitoring of kidney disease, and use of angiotensin converting enzyme (ACE) inhibitors and angiotensin II receptor blockers (ARB) in patients with albuminuria (*3*,*4*). This report presents trends in ESRD-D incidence for AI/AN compared with other racial/ethnic groups, and discusses the probable factors that influenced the improvements observed in this population during 1996–2013.

## Methods

Medicare covers ESRD treatment for beneficiaries regardless of age and pays most of the cost of ESRD treatment in the United States (*1*). The U.S. Renal Data System (USRDS) is a surveillance system for ESRD based on clinical and claims data reports to the Centers for Medicare & Medicaid Services (CMS). Funded by the National Institute of Diabetes and Digestive and Kidney Diseases of the National Institutes of Health, the USRDS collects, analyzes, and distributes demographic and clinical data on patients being treated for ESRD, including the primary diagnosis or cause of kidney failure. Because most ESRD patients become eligible for Medicare coverage after 90 days of ESRD treatment, only data on patients who have been treated for at least 90 days are included in the data set (*1*).

For each year studied, USRDS data were used to determine the number of adults aged ≥18 years in the United States who began treatment (dialysis or kidney transplantation) for ESRD-D. Data were analyzed for AI/AN, white, black, and Asian racial groups, which include persons of Hispanic and non-Hispanic origin. Data for persons of Hispanic origin were analyzed separately.

ESRD-D incidence was calculated using the number of newly treated ESRD-D cases and two population estimates for each racial and ethnic group: 1) total population from the U.S. Census during 1996–2013, and 2) population with diagnosed diabetes during 2006–2013.

The number of AI/AN with diagnosed diabetes was calculated using age- and sex-specific prevalence estimates from the Indian Health Service (IHS) National Data Warehouse during 2006–2013 and multiplying them by annual bridged single race population estimates for AI/AN from the U.S. Census; 2006 was the first year for which consistent prevalence data are available. The IHS National Data Warehouse includes patient registration and encounter data from IHS facilities, tribally operated health programs, and urban Indian (I/T/U) health systems.* These facilities serve approximately 2.2 million AI/AN persons who belong to 567 federally recognized tribes in 36 states.† Diabetes cases were identified using diagnosis codes 250.0–250.93 from the *International Classification of Diseases, Ninth revision, Clinical Modification*. Patients were considered to have diagnosed diabetes if they had at least two health care visits with a diabetes diagnosis code reported during the fiscal year (*5*). For the other racial and ethnic groups, estimates of the adult population with diagnosed diabetes (self-reported) were derived from the National Health Interview Survey.§

ESRD-D incidence rates were age-adjusted based on the 2000 U.S. standard population, and joinpoint regression was used to analyze trends (*6*,*7*). Each trend segment is described by an annual percentage change (APC) with a 95% confidence interval (CI), and the trend for the entire study period is described by the average annual percentage change (AAPC). The rate of change for linear trends was tested to determine whether it was significantly different from zero. Results were considered significant if the p value was <0.05.

Measures of care for AI/AN with diabetes were obtained from the IHS Diabetes Care and Outcomes Audit (Audit), including prescription of ACE inhibitors and ARBs; blood pressure; hemoglobin A1C to assess glucose control; and urine albumin-to-creatinine ratio testing for identifying and monitoring diabetic kidney disease. The Audit is an annual process for assessing diabetes care and health outcomes for AI/AN with diagnosed diabetes who receive care at I/T/U facilities, tracking performance on several dozen diabetes care measures and prevalence of several diabetes complications, including kidney disease.¶

## Results

Among AI/AN adults, age-adjusted ESRD-D incidence per 100,000 population increased, but not significantly, from 57.3 in 1996 to 63.5 in 1999 and then declined to 26.5 in 2013, a decrease of 54% (AAPC = −4.4% per year [95% CI = −5.7% to −3.0%], p<0.001) throughout the study period (Figure 1) (Table 1). Among other racial/ethnic groups, age-adjusted ESRD-D incidence among adults declined beginning in 1998 for Asians, 2001 for blacks, 2006 for whites, and 2000 for Hispanics.

Among AI/AN adults with diabetes, ESRD-D incidence declined during 2009–2013 (APC = −7.0% per year [−10.8% to −3.0%], p = 0.01) and, by 2013, was similar to that of whites with diabetes (152.7 versus 159.0 per 100,000 diabetic population, p = 0.84) (Figure 2) (Table 1). Among other racial/ethnic groups with diabetes, ESRD-D incidence declined in blacks and in whites during 2006–2013, and showed no consistent trend among Asians. Among Hispanics, ESRD-D incidence declined during 2006–2008, and then leveled off.

Data from the Audit show that prescription of ACE inhibitors and ARBs for AI/AN patients with diabetes increased substantially, from 42% in 1997 to 74% in 2002, and then remained steady, ranging from 68% to 73% each year through 2015 (Figure 3). Among AI/AN patients with diabetes and hypertension or chronic kidney disease (CKD), prescription of ACE inhibitors and ARBs was >77% for each year studied. Furthermore in 2014, among AI/AN with diabetes, 76% were prescribed ACE inhibitors or ARBs, compared with 56% of adults with diabetes in the general U.S. population during 2009–2014, assessed using National Health and Nutrition Examination Survey data (*8*).** Average blood pressure levels in AI/AN with diabetes have been well controlled since 1997, the first year such data were available. In 2015, average blood

* https://www.ihs.gov/NDW.

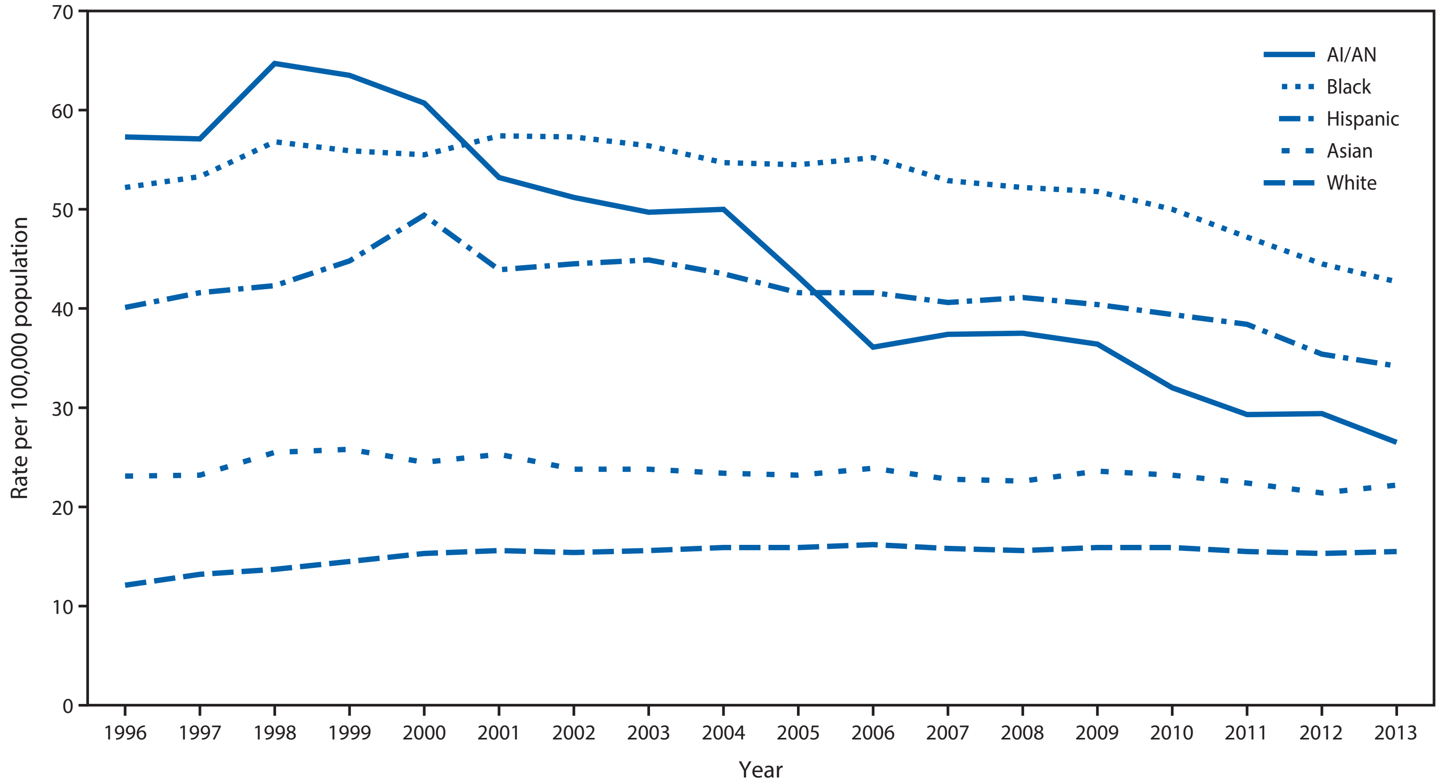
† IHS. The 2016 Indian Health Service and Tribal Health Care Facilities' Needs Assessment Report to Congress. https://www.ihs.gov/newsroom/includes/themes/newihstheme/display_objects/documents/RepCong_2016/IHSRTC_on_FacilitiesNeedsAssessmentReport.pdf.

§ CDC. U.S. Diabetes Surveillance System. http://www.cdc.gov/diabetes/data.

¶ https://www.ihs.gov/diabetes/audit/.

** American Community Survey 1-Year Estimates, 2015. United States Census Bureau. https://www.census.gov/programs-surveys/acs/.

**FIGURE 1. Incidence* of diabetes-related end-stage renal disease among adults aged ≥18 years, by race and ethnicity — United States, 1996–2013**



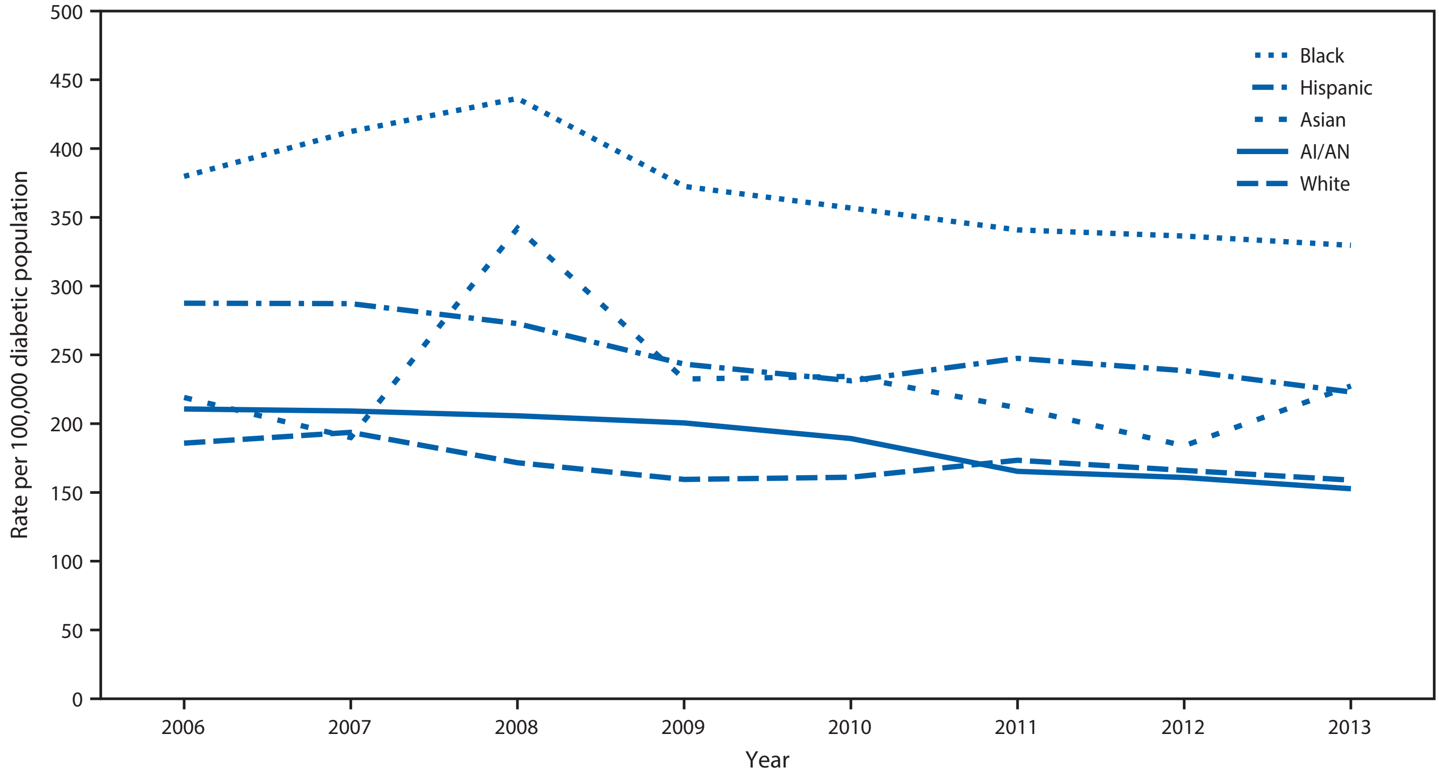

**Source:** Data from the U.S. Renal Data System and the U.S. Census.
**Abbreviation:** AI/AN=American Indians and Alaska Natives.
* Rate per 100,000 population and age-adjusted based on the 2000 U.S. standard population. Racial groups include persons of Hispanic and non-Hispanic origin; Hispanics may be of any race.

**TABLE 1. Age-adjusted incidence rates* and trend analysis of diabetes-related end-stage renal disease among adults aged ≥18 years in the general population (1996–2013) and in the diabetic population (2006–2013), by race and ethnicity† — United States**

| | Rate | | | Overall trend | | Trend segment 1§ | | | Trend segment 2/3§ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| General population | 1996 | 2013 | % change | AAPC (95% CI) | p value | Period | APC (95% CI) | p value | Period | APC (95% CI) | p value |
| AI/AN | 57.3 | 26.5 | −54 | −4.4 (−5.7 to −3.0) | <0.001 | 1996–1999 | 3.3 (−4.7 to 12.0) | 0.40 | 1999–2013 | −6.0 (−6.7 to −5.2) | <0.001 |
| Asians | 23.1 | 22.2 | −4 | −0.2 (−1.0 to 0.6) | 0.62 | 1996–1998 | 5.4 (−2.2 to 13.6) | 0.15 | 1998–2013 | −0.9 (−1.2 to −0.6) | <0.001 |
| Blacks | 52.2 | 42.7 | −18 | −1.3 (−1.8. to −0.7) | <0.001 | 1996–2001 | 1.7 (0.5 to 2.9) | 0.01 | 2001–2009 | −1.3 (−2.0 to −0.6) | 0.002 |
| | | | | | | | | | 2009–2013 | −4.8 (−6.4 to −3.2) | <0.001 |
| Whites | 12.1 | 15.5 | +28 | 1.4 (0.9 to 1.8) | <0.001 | 1996–2000 | 5.8 (4.5 to 7.1) | <0.001 | 2000–2006 | 0.7 (−0.1 to 1.6) | 0.09 |
| | | | | | | | | | 2006–2013 | −0.6 (−1.1 to −0.1) | 0.03 |
| Hispanics | 40.1 | 34.2 | −15 | −0.6 (−1.3 to 0.1) | 0.08 | 1996–2000 | 4.4 (1.6 to 7.3) | 0.005 | 2000–2013 | −2.1 (−2.5 to −1.6) | <0.001 |
| | **Rate** | | | **Overall trend** | | **Trend segment 1§** | | | **Trend segment 2/3§** | | |
| **Diabetic population** | **2006** | **2013** | **% change** | **AAPC (95% CI)** | **p value** | **Period** | **APC (95% CI)** | **p value** | **Period** | **APC (95% CI)** | **p value** |
| AI/AN | 210.7 | 152.7 | −28 | −4.9 (−7.0 to −2.7) | <0.001 | 2006–2009 | −2.0 (−8.2 to 4.7) | 0.41 | 2009–2013 | −7.0 (−10.8 to −3.0) | 0.01 |
| Asians | 219.0 | 227.4 | +4 | −0.8 (−5.9 to 4.6) | 0.72 | 2006–2013 | −0.8¶ (−5.9 to 4.6) | 0.72 | — | — | — |
| Blacks | 379.8 | 329.6 | −13 | −2.8 (−4.7 to −1.0) | 0.01 | 2006–2013 | −2.8¶ (−4.7 to −1.0) | 0.01 | — | — | — |
| Whites | 185.8 | 159.0 | −14 | −2.0 (−3.9 to −0.0) | 0.05 | 2006–2013 | −2.0¶ (−3.9 to −0.0) | 0.05 | — | — | — |
| Hispanics | 287.6 | 223.0 | −22 | −0.1 (−0.1 to −0.1) | <0.001 | 2006–2008 | −0.3 (−0.5 to −0.1) | 0.01 | 2008–2013 | −0.0 (−0.0 to 0.0) | 0.79 |

**Abbreviations:** AAPC = average annual percentage change; AI/AN = American Indians and Alaska Natives; APC = annual percentage change; CI = confidence interval.
* Per 100,000 population or per 100,000 diabetic population and age-adjusted based on the 2000 U.S. standard population.
† Racial groups include persons of Hispanic and non-Hispanic origin; Hispanics may be of any race.
§ Trend segment identified by joinpoint regression.
¶ APC = AAPC (i.e., trend had 0 joinpoints).

**FIGURE 2. Incidence* of diabetes-related end-stage renal disease among adults aged ≥18 years with diabetes, by race and ethnicity — United States, 2006–2013**




**Sources:** U.S. Renal Data System, U.S. Diabetes Surveillance System, and data from the Indian Health Service applied to the U.S. Census population.
**Abbreviation:** AI/AN=American Indians and Alaska Natives.
* Rate per 100,000 diabetic population and age-adjusted based on the 2000 U.S. standard population. Racial groups include persons of Hispanic and non-Hispanic origin; Hispanics may be of any race.

pressure among >101,000 AI/AN in the Audit with diabetes and hypertension was 133/76 mmHg, below the target of <140/90.[††] Average hemoglobin A1C levels in AI/AN with diabetes decreased 10% from 1996 to 2014, from 9.0% to 8.1% (*9*). Finally, urine albumin-to-creatinine ratio testing was performed in 50% of AI/AN aged ≥65 years with diabetes in 2013, increasing to 62% by 2016. In the general Medicare diabetes population aged ≥65 years, the rate of urine albumin testing was 40% in 2013 (*1*).

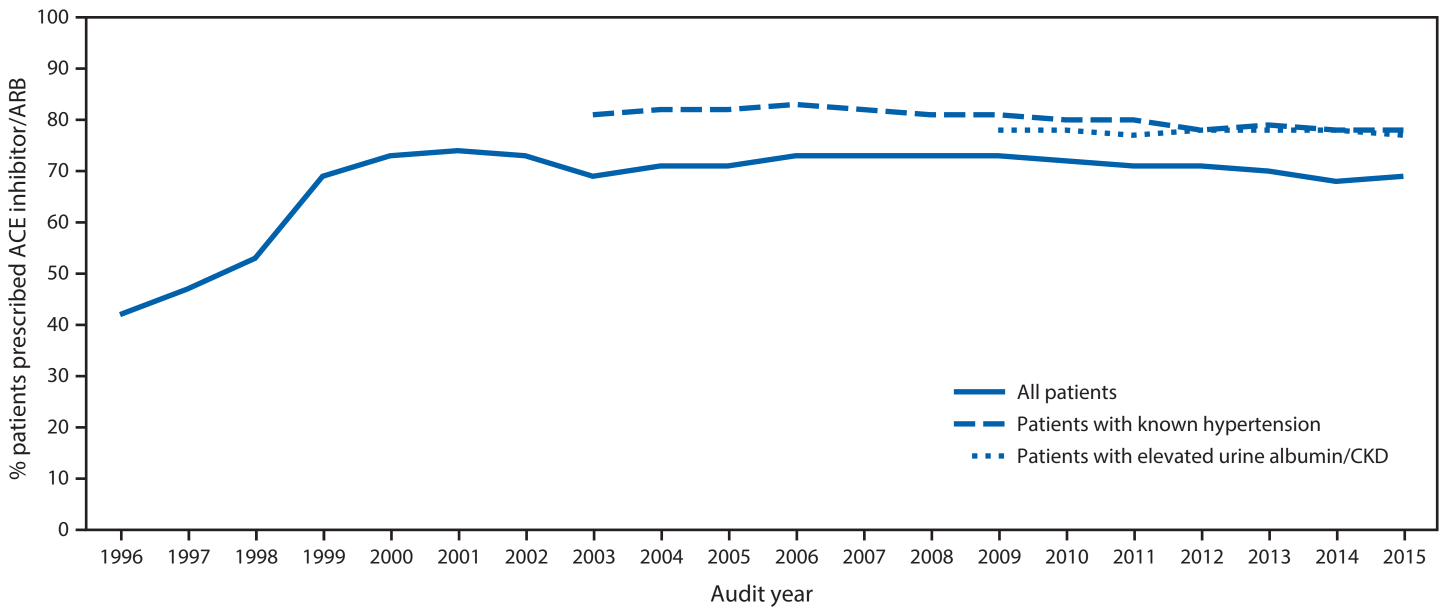
## Conclusions and Comment

Among AI/AN adults, age-adjusted ESRD-D incidence decreased 54% during 1996–2013; by 2013, among adults with diabetes, the ESRD-D rate was the same in AI/AN as in whites. This decline is especially remarkable given the well-documented health and socioeconomic disparities in the AI/AN population, including poverty, limited health care resources, and disproportionate burden of many health problems (*10*). The findings in this report are consistent with other studies among AI/AN nationwide and among Pima Indians in the Southwest, which concluded that improvements in blood pressure, blood glucose, and the use of ACE inhibitors and ARBs played a significant role in the decline of ESRD-D in these populations (*11*,*12*).

The decrease of ESRD-D in AI/AN with diabetes was likely the result of improvements in both process and outcome measures presented in this report. Prescription of ACE inhibitors and ARBs in AI/AN with diabetes increased 76% from 1997 to 2002. In 2014, prescription of these medications among AI/AN with diabetes was 36% higher than for the overall U.S. population with diabetes (*8*). Similarly, among persons with diabetes aged ≥65 years, the rate of urine albumin-to-creatinine ratio testing is 55% higher in AI/AN compared with Medicare beneficiaries (*1*). Outcome measures are also positive, including blood pressure control in AI/AN with diabetes and hypertension and improved glycemic control overall. Establishing and sustaining these favorable trends in diabetes management and prevention of ESRD-D are related to population and team-based approaches to diabetes management undertaken by the IHS.

[††] American Diabetes Association. Standards of Medical Care in Diabetes—2017. Diabetes Care 2017 Jan; 40 (Supplement 1): S1–S135.

**FIGURE 3. ACE inhibitor/ARB prescription in AI/AN patients with diabetes, 1996–2015**




**Source:** Indian Health Service Diabetes Care and Outcomes Audit.
**Abbreviations:** ACE = angiotensin converting enzyme; AI/AN = American Indians and Alaska Natives; ARB = angiotensin receptor blocker; CKD = chronic kidney disease.

Starting in the mid-1980s, IHS implemented systematic approaches to diabetes care that have contributed to the outcomes presented here (*13,14*). These approaches were informed by public health and population management principles, which focus not just on short-term outcomes for individual patients who seek care, but also long-term outcomes, costs, disparities, and wellness of the entire community (*15*). These approaches include multidisciplinary team-based, coordinated clinical care and education, community outreach, and tracking of clinical process and outcomes data at the local, regional, and national levels (*9*).

This IHS system of diabetes care enabled I/T/U sites to successfully and consistently deliver evidence-based interventions that reduce ESRD-D risk factors. In 1986, IHS developed its first Diabetes Standards of Care to disseminate evidence-based recommendations aimed at improving diabetes care for AI/AN (*13*). These standards were revised in the early 1990s to include assessment and treatment of CKD (*16*). IHS was one of the first systems to establish routine reporting of the estimated glomerular filtration rate, yearly monitoring of urine albumin excretion, and prescription of ACE inhibitors and ARBs (*14*). Both of these classes of therapeutic agents have been shown to prevent or delay the development of ESRD-D in patients with albuminuria, independent of their effects in reducing blood pressure (*4,17*).

As data collection and analysis are fundamental components of an effective diabetes care system, IHS first implemented the Diabetes Care and Outcomes Audit in 1986 at several sites, and in 1997, developed a centralized, national database (*18*). Successful implementation of evidence-based clinical interventions as documented by the Audit might explain in part the decline in ESRD-D incidence in AI/AN adults with diabetes. IHS has made other improvements in diabetes care by developing clinical education programs and tools; culturally relevant patient education materials; and population-based management tools in the IHS electronic health record (*9,14,19*). I/T/U case managers help coordinate in-house care as well as referrals for specialty services, to facilitate greater care continuity than in more fragmented systems.[§§] I/T/U facilities also support diabetes care and education by using public health nurses and community health workers to provide outreach and education to the community.[¶¶,***]

In 1997, Congress established the Special Diabetes Program for Indians (SDPI) (*9*). The SDPI provides much-needed funding to 301 I/T/U sites to implement interventions which reduce risk factors for diabetes and its complications, including ESRD-D (Table 2) (*9*).[†††] In addition, SDPI funds have been

§§ IHS: Special Diabetes Program for Indians—2011 report to Congress, 2011. https://www.ihs.gov/newsroom/includes/themes/newihstheme/display_objects/documents/RepCong_2012/2011RTC_Layout_10102012_508c.pdf.
¶¶ IHS. Public Health Nursing. http://www.ihs.gov/dper/index.cfm/planning/rrm/public-health-nursing.
*** IHS. Community Health Representatives. https://www.ihs.gov/chr.
††† IHS Division of Diabetes Treatment and Prevention. Special Diabetes Program for Indians FY 2016 Community-Directed Grant Programs 2016. https://www.ihs.gov/sdpi/includes/themes/newihstheme/display_objects/documents/factsheets/SDPI_FY2016_CD_GrantPrograms.pdf.

### Key Points

- In the United States, American Indians/Alaska Natives (AI/AN) are more likely to have diagnosed diabetes than any other racial or ethnic group. In response to the epidemic of diabetes in AI/AN, the Indian Health Service (IHS) developed a comprehensive diabetes program, which includes clinical care improvements as well as public health and population management approaches.
- End-stage renal disease (ESRD) is a costly complication of diabetes. Incidence of ESRD related to diabetes (ESRD-D) among AI/AN decreased 54% during 1996–2013. By 2013, in adults with diabetes, ESRD-D incidence was the same in AI/AN as in whites.
- Since diabetes and its complications are public health problems, the response of IHS, a direct care agency organized around a public health model, might be useful to other health care systems.
- Additional information is available at https://www.cdc.gov/vitalsigns.

used by IHS to improve its national program for disseminating evidence-based interventions and providing training, tools for data collection and analysis, and support to diabetes programs in AI/AN communities across the country. Because of SDPI, the partnership of IHS and I/T/U programs is stronger, and together they provide a comprehensive public health–oriented national program that has demonstrated success in addressing the diabetes epidemic and reducing complications such as ESRD-D (*9*).

The findings in this report are subject to at least five limitations. First, the data are for persons receiving ESRD treatment as reported to CMS and do not include patients who refused treatment, those who died before receiving treatment, or those whose treatment was not reported to CMS. Second, primary diagnosis was obtained from the CMS Medical Evidence Report and was based on a physician's assessment of the patient, which could be influenced by the physician's awareness of diabetes prevalence among AI/AN. Third, differential classification of AI/AN race in the USRDS, U.S. Census, and IHS data systems could result in over- or underestimation of the actual incidence of ESRD-D in this population. Fourth, IHS data on diabetes prevalence might not be representative of the total AI/AN population and might result in over- or underestimation of the number of AI/AN with diabetes in the United States and, therefore, the incidence of ESRD-D. Although these biases might have affected incidence estimates, trends in incidence would not be affected if the biases

**TABLE 2. Percentage of Special Diabetes Program for Indians programs reporting diabetes services — United States**

| Intervention | 1997 % | 2013 % |
|---|---|---|
| Diabetes clinical teams | 30 | 96 |
| Diabetes patient registries | 34 | 98 |
| Nutrition services for adults | 39 | 93 |
| Access to registered dietitians | 37 | 79 |
| Access to physical activity specialists | 8 | 74 |
| Access to culturally tailored diabetes education materials | 36 | 97 |

**Source:** Special Diabetes Program for Indians — 2014 report to Congress. Rockville, Maryland: Indian Health Service; 2014. https://www.ihs.gov/newsroom/includes/themes/newihstheme/display_objects/documents/RepCong_2016/SDPI_2014_Report_to_Congress.pdf.

remained consistent over time. Finally, the data on diabetes measures reflect care provided to AI/AN who access the I/T/U system and cannot be generalized to AI/AN who do not.

ESRD-D is a disabling and costly condition associated with high mortality.[§§§] The Medicare expenditure per person per year for hemodialysis patients was $84,550 in 2013, and the per person per year cost for ESRD-D was $82,141 (*1*). In 2013, total Medicare spending for ESRD-D was $14 billion, about half (45%) of the $31 billion Medicare spending for ESRD overall (*1*). A decrease in ESRD-D incidence in the general U.S. population comparable to that experienced in the AI/AN population could result in fewer cases of newly treated ESRD-D and contribute to leveling or lowering of total Medicare expenditures for ESRD. Integrating public health, clinical, and community-based approaches to deliver evidence-based interventions aimed at reducing ESRD-D risk factors can sustain and improve trends in ESRD-D incidence.

§§§ Morbidity and Mortality in Patients with Chronic Kidney Disease. USRDS Coordinating Center. https://www.usrds.org/2015/view/v1_03.aspx?zoom_highlight=mortality.

[1]Division of Diabetes Treatment and Prevention, Indian Health Service, Rockville, Maryland; [2]Division of Diabetes Translation, CDC; [3]National Institute of Diabetes Digestive and Kidney Diseases, National Institutes of Health, Bethesda, Maryland; [4]National Center for Chronic Disease Prevention and Health Promotion, CDC; [5]Office for State, Tribal, Local & Territorial Support, CDC.

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# Notes from the Field

## Pan-Resistant New Delhi Metallo-Beta-Lactamase-Producing *Klebsiella pneumoniae* — Washoe County, Nevada, 2016

Lei Chen, PhD[1]; Randall Todd, DrPH[1]; Julia Kiehlbauch, PhD[2,3]; Maroya Walters, PhD[4]; Alexander Kallen, MD[4]

On August 25, 2016, the Washoe County Health District in Reno, Nevada, was notified of a patient at an acute care hospital with carbapenem-resistant Enterobacteriaceae (CRE) that was resistant to all available antimicrobial drugs. The specific CRE, *Klebsiella pneumoniae*, was isolated from a wound specimen collected on August 19, 2016. After CRE was identified, the patient was placed in a single room under contact precautions. The patient had a history of recent hospitalization outside the United States. Therefore, based on CDC guidance (*1*), the isolate was sent to CDC for testing to determine the mechanism of antimicrobial resistance, which confirmed the presence of New Delhi metallo-beta-lactamase (NDM).

The patient was a female Washoe County resident in her 70s who arrived in the United States in early August 2016 after an extended visit to India. She was admitted to the acute care hospital on August 18 with a primary diagnosis of systemic inflammatory response syndrome, likely resulting from an infected right hip seroma. The patient developed septic shock and died in early September. During the 2 years preceding this U.S. hospitalization, the patient had multiple hospitalizations in India related to a right femur fracture and subsequent osteomyelitis of the right femur and hip; the most recent hospitalization in India had been in June 2016.

Antimicrobial susceptibility testing in the United States indicated that the isolate was resistant to 26 antibiotics, including all aminoglycosides and polymyxins tested, and intermediately resistant to tigecycline (a tetracycline derivative developed in response to emerging antibiotic resistance). Because of a high minimum inhibitory concentration (MIC) to colistin, the isolate was tested at CDC for the *mcr-1* gene, which confers plasma-mediated resistance to colistin; the results were negative. The isolate had a relatively low fosfomycin MIC of 16 $\mu$g/mL by ETEST.* However, fosfomycin is approved in the United States only as an oral treatment of uncomplicated cystitis; an intravenous formulation is available in other countries.

A point prevalence survey, using rectal swab specimens and conducted among patients currently admitted to the same unit as the patient, did not identify additional CRE. Active surveillance for multidrug-resistant bacilli including CRE has been conducted in Washoe County since 2010 and is ongoing; no additional NDM CRE have been identified.

This report highlights three important issues in the control of CRE. First, although CRE are commonly sent to CDC as part of surveillance programs or for reference testing, isolates that are resistant to all antimicrobials are very uncommon. Among >250 CRE isolate reports collected as part of the Emerging Infections Program, approximately 80% remained susceptible to at least one aminoglycoside and nearly 90% were susceptible to tigecycline (*2*). Second, to slow the spread of bacteria with resistance mechanisms of greatest concern (e.g., gene encoding NDM or *mcr-1*) or with pan-resistance to all drug classes, CDC recommends that when these bacteria are identified, facilities ensure that appropriate infection control contact precautions are instituted to prevent transmission and that health care contacts are evaluated for evidence of transmission (*3*). Third, the patient in this report had inpatient health care exposure in India before receiving care in the United States. Health care facilities should obtain a history of health care exposures outside their region upon admission and consider screening for CRE when patients report recent exposure outside the United States or in regions of the United States known to have a higher incidence of CRE (*1*).

* http://www.biomerieux-diagnostics.com/etest.

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# Notes from the Field

## Occupational Lead Exposures at a Shipyard — Douglas County, Wisconsin, 2016

Debora Weiss, DVM[1,2]; Stephanie J. Yendell, DVM[3]; Luke A. Baertlein, MPH[3]; Krista Y. Christensen, PhD[2,4]; Carrie D. Tomasallo, PhD[2]; Paul D. Creswell, PhD[2,4]; Jenny L. Camponeschi, MS [2]; Jon G. Meiman, MD[2]; Henry A. Anderson, MD[4]

On March 28, 2016, the Minnesota Poison Control System was consulted by an emergency department provider regarding clinical management of a shipyard worker with a blood lead level (BLL) >60 $\mu$g/dL; the National Institute for Occupational Safety and Health defines elevated BLLs as ≥5 $\mu$g/dL (*1*). The Minnesota Poison Control System notified the Minnesota Department of Health (MDH). Concurrently, the Wisconsin Department of Health Services (WDHS) received laboratory reports concerning two workers from the same shipyard with BLLs >40 $\mu$g/dL. These three workers had been retrofitting the engine room of a 690-foot vessel since January 4, 2016.

Work was suspended during March 29–April 4 in the vessel's engine room, the presumptive primary source of lead exposure. On March 29, the shipyard partnered with a local occupational health clinic to provide testing for workers. Employees and their household members were also tested by general practitioners and local laboratories. The shipyard hired sanitation crews for lead clean-up and abatement and provided personal protective equipment for its employees. On April 1, WDHS and MDH issued advisories to alert regional health care organizations, local public health agencies, and tribal health departments to the situation and launched a joint investigation on April 4. Subsequently, WDHS activated its Incident Command System and worked with MDH to compile a list of potentially exposed workers. By August 31, a total of 357 workers who might have been employed at the shipyard during December 2015–March 2016 had been identified.

During April–July 2016, WDHS and MDH attempted telephone interviews with workers. The goal of the interviews was to gather information regarding employment history, work tasks, personal exposure prevention, symptoms commonly associated with lead exposures, and take-home contamination prevention and household composition and to convey health messages.

As of August 31, a total of 233 (65.3%) of 357 workers received at least one BLL test and 185 (51.8%) completed interviews. Among 233 tested workers (median = 16.0 $\mu$g/dL; interquartile range = 4.4–30.6 $\mu$g/dL), 171 (73.4%) had BLLs ≥5 $\mu$g/ dL, 151 (64.8%) had BLLs ≥10 $\mu$g/dL, 33 (14.2%) had BLLs≥40 $\mu$g/dL, and two (0.9%) had BLLs ≥60 $\mu$g/dL. Among 341 household members identified through worker interviews, 46 (13.5%) received a BLL test; none had an elevated BLL. Not all exposed workers and household members were tested for lead, and not every BLL test result might have been reported to WDHS or MDH.

At this time, WDHS and MDH have concluded their joint investigation of the shipyard. The Occupational Safety and Health Administration enforcement investigation began on February 10, 2016 because of lead exposure hazards and revealed that shipyard workers were exposed to lead at ≥20 times the reduced permissible exposure limit of 40 $\mu$g/m$^3$ (*2*,*3*).

This investigation highlights timely laboratory-based BLL reporting and efficient interstate collaboration. Moreover, it emphasizes the importance of implementing proper engineering controls and periodic BLL monitoring of employees exposed to lead (*4*) and providing correct personal protective equipment for workers in the shipbuilding industry (*3*).

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## Erratum

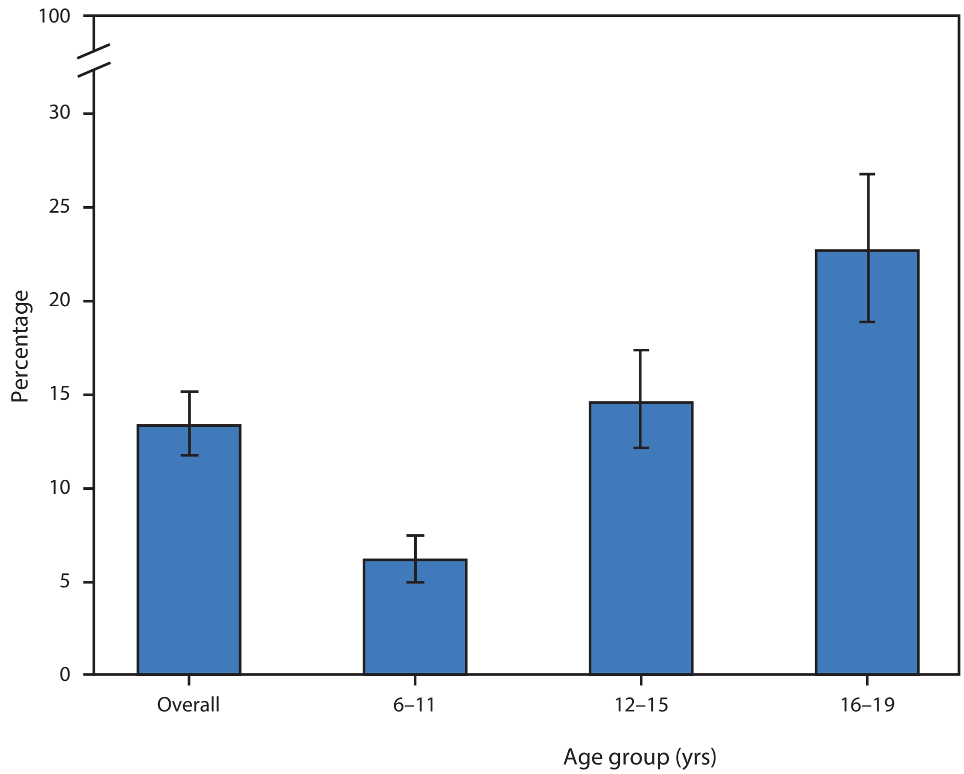
### Vol. 65, Nos. 50 & 51

In the report "Increases in Drug and Opioid-Involved Overdose Deaths — United States, 2010–2015" in both "TABLE 1. Number and age-adjusted rate of drug overdose deaths* involving natural and semisynthetic opioids† and methadone,§,¶ by sex, age group, race/ethnicity,** U.S. Census region, and selected states†† — United States, 2014 and 2015," and in "TABLE 2. Number and age-adjusted rate of drug overdose deaths* involving synthetic opioids other than methadone† and heroin,§,¶ by sex, age group, race/ethnicity,** U.S. Census region, and selected states†† — United States, 2014 and 2015," the seventh footnote (§§) should have read as follows: "Statistically significant at p<0.05 level. **Nonoverlapping confidence intervals based on the gamma method** were used if the number of deaths was <100 in 2014 or 2015, and z-tests were used if the number of deaths was ≥100 in both 2014 and 2015."

# *QuickStats*

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

## Prevalence* of Untreated Dental Caries† in Permanent Teeth Among Children and Adolescents Aged 6–19 Years, by Age Group — National Health and Nutrition Examination Survey, United States, 2011–2014




* With 95% confidence intervals indicated with error bars.
† Untreated dental caries (i.e., dental cavities) are defined as tooth decay that has not received appropriate treatment. Data were collected by dentists in the mobile examination center as part of the oral health component of the National Health and Nutrition Examination Survey.

During 2011–2014, 13.3% of children and adolescents aged 6–19 years had untreated dental caries in their permanent teeth. The percentage of children and adolescents with untreated dental caries increased with age: 6.1% among those aged 6–11 years, 14.5% among those aged 12–15 years, and 22.6% among those aged 16–19 years.

**Source:** National Health and Nutrition Examination Survey data. Hyattsville, MD: US Department of Health and Human Services, CDC, National Center for Health Statistics; 2011–2014. https://www.cdc.gov/nchs/nhanes.htm.

**Reported by:** Eleanor Fleming, PhD, DDS; efleming@cdc.gov; 301-458-4062; Joseph Afful, MS; Steven M. Frenk, PhD.

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