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# Trends in Meeting Physical Activity Guidelines Among Urban and Rural Dwelling Adults — United States, 2008–2017

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Since the release of the 2008 Physical Activity Guidelines for Americans (https://health.gov/paguidelines/2008/pdf/paguide.pdf), the age-adjusted percentage of adults meeting the combined aerobic and muscle-strengthening guidelines increased from 18.2% to 24.3% in 2017 (*1*). Trends in urban and rural areas, across demographic subgroups, and among subgroups within urban and rural areas have not been reported. CDC analyzed 2008–2017 National Health Interview Survey (NHIS) data to examine trends in the age-standardized prevalence of meeting physical activity guidelines among adults aged ≥18 years living in urban and rural areas. Among urban and rural residents, prevalence increased from 19.4% to 25.3% and from 13.3% to 19.6%, respectively. Nationally, all demographic subgroups and regions experienced increases over this period; increases for several groups were not consistent year-to-year. Among urban residents, the prevalence was higher during 2016–2017 than during 2008–2009 for all demographic subgroups and regions. During the same period, prevalence was higher across all rural-dwelling subgroups except Hispanics, adults with a college education, and those living in the South U.S. Census region. Urban and rural communities can implement evidence-based approaches, including improved community design, improved access to indoor and outdoor recreation facilities, social support programs, and community-wide campaigns to make physical activity the safe and easy choice for persons of all ages and abilities (*2–4*). Incorporating culturally appropriate strategies into local programs might help address differences across subgroups.

Physical activity can lower a person's risk for several chronic diseases, including coronary heart disease, stroke, obesity, and type 2 diabetes (*3*). To attain substantial health benefits, federal physical activity guidelines recommend that adults perform at least 150–300 minutes of moderate-intensity, or 75–150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity aerobic physical activity (i.e., the aerobic guideline) (*3*). In addition, adults should do muscle-strengthening activities of at least moderate intensity that involve all major muscle groups on ≥2 days per week (i.e., the muscle-strengthening guideline) (*3*).

NHIS is an annual, multistage probability sample of U.S. households designed to be representative of the civilian, noninstitutionalized U.S. population.* Among sampled adults, sample sizes ranged from 21,781 (2008) to 36,697 (2014); response rates ranged from 53.0% (2017) to 66.3% (2011). Adults reported the frequency and duration of vigorous- and

* https://www.cdc.gov/nchs/nhis/index.htm.

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light- or moderate-intensity leisure-time physical activities.[†] The number of weekly minutes was calculated as the product of frequency (occurrences per week) and duration (minutes per occurrence). To match guidelines, the number of weekly minutes of vigorous-intensity physical activity was doubled and added to the number of weekly minutes of light- or moderate-intensity activity (*3*). Participants were classified as meeting the aerobic guideline if this total was at least 150 minutes per week. Adults also reported muscle-strengthening activities[§] and were classified as meeting the muscle-strengthening guideline if they reported such activity on ≥2 days per week. Participants were classified as meeting the combined aerobic and muscle-strengthening guidelines if they met both the aerobic and muscle-strengthening guidelines as defined.

[†] Leisure-time physical activity prompt: "The next questions are about physical activities (exercise, sports, physically active hobbies…) that you may do in your LEISURE time." Frequency of vigorous-intensity activity: "How often do you do vigorous leisure-time physical activities for at least 10 minutes that cause heavy sweating or large increases in breathing or heart rate?" Duration: "About how long do you do these vigorous leisure-time physical activities each time?" Frequency of light to moderate intensity activity: "How often do you do light or moderate leisure-time physical activities for at least 10 minutes that cause only light sweating or a slight to moderate increase in breathing or heart rate?" Duration: "About how long do you do these light or moderate leisure-time physical activities each time?"

[§] Frequency of muscle-strengthening activity: "How often do you do leisure-time physical activities specifically designed to strengthen your muscles such as lifting weights or doing calisthenics?"

The annual, age-standardized prevalence of meeting the combined guidelines was calculated for each year.[¶] Results were stratified by demographic characteristics (self-reported sex, age, race/ethnicity, and level of educational attainment), Census region of residence, and urban or rural residence (classified according to the U.S. Census Bureau definition) (*5*). Results for the racial/ethnic group "non-Hispanic other" are presented for reference purposes but were not interpreted because multiple races were combined and the sample sizes were small. Trends were assessed using age-adjusted logistic regression and orthogonal polynomial contrasts. When trends deviated from linearity, the best-fitting model was identified using sequential permutation tests in JoinPoint (version 4.7.0.0; National Cancer Institute)[**]; slopes from the selected model provided annual percentage point changes. To quantify doubly stratified changes over the period, the first 2 and last 2 years of data (i.e., 2008–2009 and 2016–2017) were combined, and prevalence of meeting the combined guidelines was estimated separately for urban and rural residents, stratified by demographic characteristics and region. Differences between periods were tested using adjusted Wald tests. Results with p-values <0.05 were considered statistically significant. Weighted analyses were

[¶] Estimates were age-adjusted using the 2000 U.S. population as the standard population and using five age groups: 18–24, 25–34, 35–44, 45–64, and ≥65 years.

[**] https://surveillance.cancer.gov/joinpoint/.

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performed in Stata (version 15; StataCorp) following NHIS analytic guidelines.

From 2008 to 2017, the age-standardized prevalence of meeting the combined physical activity guidelines increased 30.4% among urban residents (from 19.4% to 25.3%) and 47.4% among rural residents (from 13.3% to 19.6%) (Figure). The prevalence increased across all demographic subgroups, among residents of urban and rural areas, and in all Census regions (Table 1). The overall average annual percentage point change ranged from 0.3 (adults aged 45–64 years and those with some college education) to 0.7 (adults aged 25–34 years and those residing in the Northeast). Increases stalled in middle years overall and for several subgroups (women, adults aged 25–34 years, non-Hispanic whites, adults with at least some college education, urban residents, and adults in the Midwest and West). For example, among urban residents, the prevalence increased 1.1 percentage points per year from 2008 to 2010 (95% confidence interval [CI] = 0.3–2.0), followed by a non-significant 0.1 percentage point increase per year from 2010 to 2015 (95% CI = -0.2–0.4), then increased 1.6 percentage points per year from 2015 to 2017 (95% CI = 0.8–2.4).

Among residents of urban areas, the prevalence of meeting the combined physical activity guidelines was higher overall during 2016–2017 (24.4%) than during 2008–2009 (19.8%), as well as across all demographic subgroups and in all Census regions (Table 2). Among rural residents, the prevalence increased across all demographic and regional subgroups except Hispanics (2008–2009 prevalence = 11.0%; 2016–2017 prevalence = 12.4%), adults with a college education (25.5%; 28.0%), and adults residing in the South Census region (13.2%; 14.7%).

## Discussion

Since release of the 2008 Physical Activity Guidelines for Americans, the prevalence of meeting the combined aerobic and muscle-strengthening physical activity guidelines among adults has increased in both urban and rural areas. Despite the increases, additional progress is needed. In 2017, only one in four (25.3%) urban residents and one in five (19.6%) rural residents met the combined guidelines. To continue and perhaps accelerate progress, communities can implement evidence-based approaches that make physical activity the safe and easy choice, including improvements to community

**FIGURE. Age-standardized prevalence (with 95% confidence interval) of meeting the combined aerobic and muscle-strengthening physical activity guidelines among adults, by urban and rural residence — National Health Interview Survey, United States, 2008–2017**

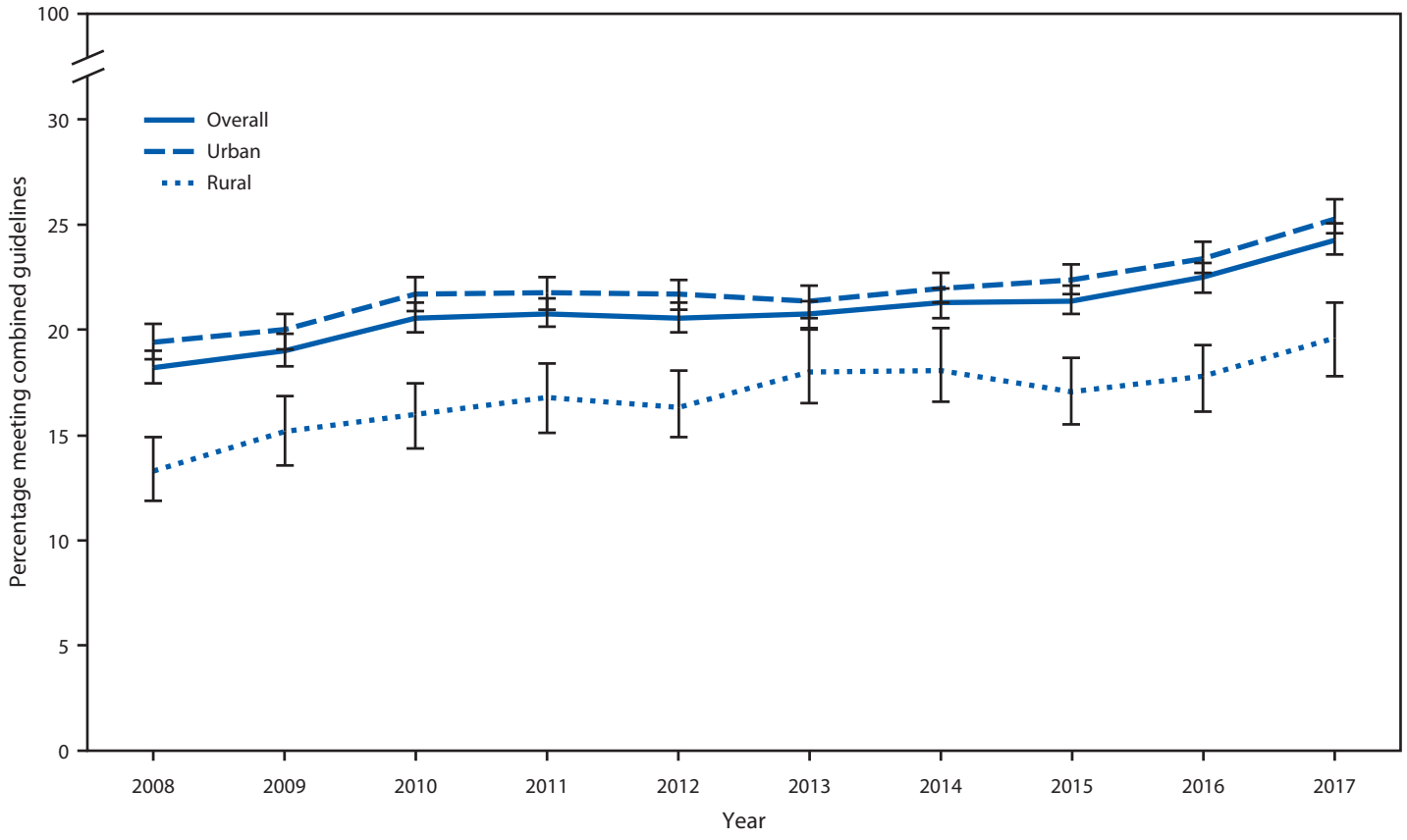

**TABLE 1. Prevalence* of meeting the combined aerobic and muscle-strengthening physical activity guidelines, and prevalence trends among adults — National Health Interview Survey, United States, 2008, 2012, and 2017**

| Characteristic | % (95% CI) 2008 | 2012 | 2017 | Average APC 2008–2017 (95% CI) | Segment 1 Years† | Segment 1 Segment average APC (95% CI) | Segment 2 Years† | Segment 2 Segment average APC (95% CI) | Segment 3 Years† | Segment 3 Segment average APC (95% CI) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | **18.2 (17.5 to 19)** | **20.6 (19.9 to 21.3)** | **24.3 (23.6 to 25.1)** | **0.5 (0.3 to 0.7)** | **2008–10** | **1.2 (0.4 to 2.0)** | **2010–15** | **0.2 (0.0 to 0.4)** | **2015–17** | **1.4 (0.6 to 2.2)** |
| **Sex** | | | | | | | | | | |
| Men | 21.7 (20.6 to 22.8) | 24.3 (23.3 to 25.3) | 28.8 (27.6 to 30.0) | 0.6 (0.4 to 0.8) | 2008–17 | 0.6 (0.4 to 0.8) | — | — | — | — |
| Women | 14.9 (14.1 to 15.8) | 17.1 (16.3 to 17.8) | 20.1 (19.2 to 21.0) | 0.4 (0.3 to 0.5) | 2008–10 | 0.8 (0.2 to 1.4) | 2010–15 | 0.2 (0.0 to 0.4) | 2015–17 | 1.1 (0.5 to 1.7) |
| **Age group (yrs)** | | | | | | | | | | |
| 18–24 | 26.1 (23.6 to 28.8) | 29.7 (27.5 to 31.9) | 33.8 (31.1 to 36.7) | 0.6 (0.4 to 1.0) | 2008–17 | 0.6 (0.4 to 1.0) | — | — | — | — |
| 25–34 | 22.6 (20.9 to 24.4) | 26.6 (25.1 to 28.1) | 30.6 (28.8 to 32.4) | 0.7 (0.5 to 0.9) | 2008–10 | 1.8 (0.3 to 3.3) | 2010–15 | 0.3 (−0.1 to 0.7) | 2015–17 | 1.7 (0.2 to 3.3) |
| 35–44 | 19.4 (17.8 to 21.1) | 21.7 (20.3 to 23.1) | 27.5 (25.8 to 29.3) | 0.5 (0.2 to 0.8) | 2008–17 | 0.5 (0.2 to 0.8) | — | — | — | — |
| 45–64 | 16.3 (15.2 to 17.4) | 17.2 (16.2 to 18.2) | 20.7 (19.6 to 21.8) | 0.3 (0.2 to 0.5) | 2008–15 | 0.2 (0.1 to 0.3) | 2015–17 | 1.2 (0.1 to 2.3) | — | — |
| ≥65 | 9.5 (8.3 to 10.8) | 11.9 (10.9 to 12.9) | 12.9 (11.9 to 13.9) | 0.4 (0.3 to 0.4) | 2008–17 | 0.4 (0.3 to 0.4) | — | — | — | — |
| **Race/Ethnicity** | | | | | | | | | | |
| White, non-Hispanic | 20.7 (19.7 to 21.7) | 22.8 (21.9 to 23.7) | 26.8 (25.9 to 27.8) | 0.5 (0.3 to 0.7) | 2008–10 | 1.0 (-0.1 to 2.2) | 2010–15 | 0.1 (−0.2 to 0.5) | 2015–17 | 1.7 (0.6 to 2.9) |
| Black, non-Hispanic | 14.8 (13.3 to 16.4) | 16.6 (15.2 to 18.0) | 20.8 (18.8 to 23.0) | 0.6 (0.4 to 0.8) | 2008–17 | 0.6 (0.4 to 0.8) | — | — | — | — |
| Hispanic | 11.3 (9.9 to 12.7) | 15.4 (14.3 to 16.7) | 18.7 (17.0 to 20.5) | 0.6 (0.4 to 0.8) | 2008–17 | 0.6 (0.4 to 0.8) | — | — | — | — |
| Other, non-Hispanic | 15.3 (13.3 to 17.6) | 19.0 (17.2 to 21) | 22.6 (20.5 to 24.9) | 0.6 (0.3 to 0.9) | 2008–17 | 0.6 (0.3 to 0.9) | — | — | — | — |
| **Education** | | | | | | | | | | |
| Less than high school | 7.3 (6.2 to 8.7) | 9.5 (8.3 to 10.8) | 11.3 (9.7 to 13.2) | 0.4 (0.3 to 0.5) | 2008–17 | 0.4 (0.3 to 0.5) | — | — | — | — |
| High school | 12.2 (11.1 to 13.4) | 13.3 (12.3 to 14.5) | 16.6 (15.3 to 18.0) | 0.4 (0.2 to 0.6) | 2008–17 | 0.4 (0.2 to 0.6) | — | — | — | — |
| Some college | 19.9 (18.7 to 21.1) | 21.7 (20.7 to 22.8) | 23.9 (22.7 to 25.2) | 0.3 (0.1 to 0.4) | 2008–11 | 0.6 (0.1 to 1.1) | 2011–15 | −0.1 (−0.6 to 0.4) | 2015–17 | 1.4 (0.3 to 2.4) |
| College graduate | 27.9 (26.2 to 29.7) | 31.2 (29.8 to 32.6) | 33.9 (32.5 to 35.3) | 0.4 (0.1 to 0.6) | 2008–10 | 2.2 (0.9 to 3.6) | 2010–13 | −0.6 (−1.6 to 0.5) | 2013–17 | 0.8 (0.5 to 1.1) |
| **Urban/Rural status** | | | | | | | | | | |
| Urban | 19.4 (18.6 to 20.3) | 21.7 (21.0 to 22.4) | 25.3 (24.5 to 26.2) | 0.5 (0.3 to 0.7) | 2008–10 | 1.1 (0.3 to 2.0) | 2010–15 | 0.1 (−0.2 to 0.4) | 2015–17 | 1.6 (0.8 to 2.4) |
| Rural | 13.3 (11.9 to 14.9) | 16.3 (14.6 to 18.1) | 19.6 (18.0 to 21.3) | 0.5 (0.3 to 0.7) | 2008–17 | 0.5 (0.3 to 0.7) | — | — | — | — |
| **Census region** | | | | | | | | | | |
| Northeast | 18.2 (16.3 to 20.2) | 20.3 (18.8 to 22.0) | 25.6 (23.7 to 27.7) | 0.7 (0.7 to 0.9) | 2008–17 | 0.7 (0.7 to 0.9) | — | — | — | — |
| Midwest | 19.9 (18.5 to 21.4) | 21.5 (20.2 to 23.0) | 25.9 (24.4 to 27.5) | 0.4 (0.1 to 0.7) | 2008–11 | 0.7 (0.3 to 1.1) | 2011–15 | −0.3 (−0.7 to 0.2) | 2015–17 | 2.6 (1.7 to 3.5) |
| South | 16.6 (15.3 to 17.9) | 18.5 (17.4 to 19.6) | 21.5 (20.3 to 22.8) | 0.4 (0.3 to 0.6) | 2008–17 | 0.4 (0.3 to 0.6) | — | — | — | — |
| West | 19.0 (17.5 to 20.7) | 23.2 (21.7 to 24.7) | 26.4 (24.8 to 28.0) | 0.5 (0.2 to 0.9) | 2008–11 | 2.0 (0.8 to 3.2) | 2011–15 | −0.4 (−1.4 to 0.6) | 2015–17 | 1.7 (−0.7 to 4.1) |

**Abbreviations:** APC = annual percentage point change; CI = confidence interval.
* Age-standardized to the 2000 U.S. adult population, except age-specific estimates.
† Segments were identified using JoinPoint software. Rows with only one segment indicate no statistically significant higher-order trends were present in JoinPoint (linear trend only). Subgroups with higher-order trends have information for either two or three segments, depending on which was the best fit in JoinPoint.

**TABLE 2. Prevalence* of meeting the combined aerobic and muscle-strengthening physical activity guidelines among urban and rural adult residents by selected demographic characteristics — National Health Interview Survey, United States, 2008–2009 and 2016–2017**

| | Urban | | | | Rural | | | |
|---|---|---|---|---|---|---|---|---|
| | 2008–2009 | 2016–2017 | Differences† | | 2008–2009 | 2016–2017 | Differences† | |
| Characteristic | % (95% CI) | % (95% CI) | Abs (95% CI) | Rel % (95% CI) | % (95% CI) | % (95% CI) | Abs (95% CI) | Rel % (95% CI) |
| **Total** | **19.8 (19.2–20.4)** | **24.4 (23.9–25.0)** | **4.7 (3.8–5.5)** | **23.6 (18.6–28.5)** | **14.3 (13.1–15.5)** | **18.7 (17.6–19.9)** | **4.4 (2.7–6.1)** | **31.0 (17.5–44.6)** |
| **Sex** | | | | | | | | |
| Men | 23.3 (22.5 to 24.2) | 29.0 (28.1 to 29.9) | 5.6 (4.4 to 6.9) | 24.1 (18.0 to 30.1) | 16.4 (14.9 to 18.1) | 21.1 (19.4 to 22.8) | 4.6 (2.3 to 7.0) | 28.1 (11.9 to 44.4) |
| Women | 16.4 (15.7 to 17.2) | 20.2 (19.5 to 20.9) | 3.7 (2.7 to 4.8) | 22.8 (15.9 to 29.7) | 12.1 (10.9 to 13.5) | 16.3 (15.0 to 17.8) | 4.2 (2.2 to 6.1) | 34.3 (15.5 to 53.2) |
| **Age group (yrs)** | | | | | | | | |
| 18–24 | 27.1 (25.2 to 29.0) | 33.4 (31.5 to 35.5) | 6.4 (3.6 to 9.1) | 23.5 (12.3 to 34.8) | 18.0 (14.5 to 22.2) | 25.3 (21.3 to 29.7) | 7.2 (1.5 to 13.0) | 40.2 (2.1 to 78.3) |
| 25–34 | 24.1 (22.8 to 25.4) | 31.3 (29.8 to 32.7) | 7.2 (5.2 to 9.1) | 29.8 (20.5 to 39.1) | 19.2 (16.3 to 22.5) | 23.6 (20.9 to 26.5) | 4.4 (0.2 to 8.6) | 22.8 (−1.7 to 47.4) |
| 35–44 | 21.6 (20.4 to 22.9) | 26.6 (25.3 to 27.9) | 5.0 (3.1 to 6.8) | 23.0 (13.5 to 32.5) | 15.8 (13.5 to 18.4) | 21.5 (18.9 to 24.4) | 5.7 (2.1 to 9.4) | 36.3 (8.9 to 63.8) |
| 45–64 | 17.8 (16.9 to 18.8) | 20.9 (20.0 to 21.8) | 3.1 (1.8 to 4.4) | 17.2 (9.2 to 25.1) | 12.8 (11.3 to 14.3) | 16.1 (14.8 to 17.6) | 3.4 (1.3 to 5.4) | 26.5 (8.0 to 44.9) |
| ≥65 | 10.7 (9.7 to 11.9) | 13.8 (13.0 to 14.7) | 3.1 (1.7 to 4.4) | 28.7 (13.8 to 43.5) | 7.0 (5.8 to 8.4) | 9.5 (8.4 to 10.7) | 2.6 (0.8 to 4.3) | 36.6 (6.2 to 67.1) |
| **Race/Ethnicity** | | | | | | | | |
| White, non-Hispanic | 23.1 (22.2 to 23.9) | 27.8 (27.1 to 28.6) | 4.8 (3.6 to 5.9) | 20.7 (15.1 to 26.2) | 14.7 (13.5 to 16.1) | 19.5 (18.2 to 20.8) | 4.7 (2.9 to 6.5) | 32.1 (17.8 to 46.4) |
| Black, non-Hispanic | 17.0 (15.8 to 18.3) | 21.1 (19.6 to 22.7) | 4.1 (2.1 to 6.1) | 24.0 (11.0 to 37.0) | 10.3 (7.7 to 13.6) | 17.9 (13.1 to 24.1) | 7.7 (1.5 to 13.9) | 74.8 (1.9 to 147.6) |
| Hispanic | 12.1 (11.1 to 13.1) | 18.1 (16.9 to 19.4) | 6.0 (4.4 to 7.6) | 49.8 (33.6 to 66.0) | 11.0 (7.7 to 15.6) | 12.4 (8.8 to 17.3) | 1.4 (−4.4 to 7.1) | 12.5 (−42.8 to 67.8) |
| Other, non-Hispanic | 15.0 (13.5 to 16.6) | 21.0 (19.5 to 22.7) | 6.0 (3.8–8.2) | 40.1 (22.3 to 57.9) | 13.3 (9.1 to 19.1) | 15.8 (12.4 to 20.0) | 2.5 (−3.8 to 8.7) | 18.4 (−33.9 to 70.7) |
| **Education** | | | | | | | | |
| Less than high school | 7.7 (6.8 to 8.7) | 11.4 (10.1 to 12.8) | 3.7 (2.1 to 5.3) | 47.7 (23.3 to 72.2) | 5.8 (4.1 to 8.2) | 10.6 (8.1 to 13.8) | 4.8 (1.3 to 8.2) | 82.0 (2.8 to 161.1) |
| High school | 12.5 (11.7 to 13.4) | 16.3 (15.2 to 17.4) | 3.8 (2.4 to 5.2) | 30.1 (17.4 to 42.8) | 9.9 (8.5 to 11.6) | 12.2 (10.7 to 13.9) | 2.3 (0.1 to 4.5) | 22.8 (−2.1 to 47.7) |
| Some college | 21.6 (20.6 to 22.6) | 24.1 (23.1 to 25.0) | 2.5 (1.1 to 3.9) | 11.7 (4.9 to 18.4) | 16.0 (14.2 to 18.0) | 20.4 (18.6 to 22.2) | 4.4 (1.7 to 7.0) | 27.2 (8.3 to 46.0) |
| College graduate | 29.6 (28.2 to 31.0) | 33.9 (32.8 to 35.0) | 4.3 (2.6 to 6.1) | 14.6 (8.1 to 21.1) | 25.5 (22.5 to 28.7) | 28.0 (25.4 to 30.8) | 2.5 (−1.6 to 6.6) | 9.9 (−7.2 to 27.0) |
| **Census region** | | | | | | | | |
| Northeast | 18.7 (17.2 to 20.4) | 24.9 (23.5 to 26.2) | 6.1 (4.0 to 8.2) | 32.7 (19.3 to 46.1) | 16.4 (13.3 to 20.1) | 24.2 (21.2 to 27.6) | 7.8 (3.1 to 12.4) | 47.4 (11.4 to 83.4) |
| Midwest | 21.8 (20.5 to 23.1) | 25.7 (24.4 to 27.1) | 3.9 (2.1 to 5.8) | 18.1 (8.9 to 27.3) | 14.1 (12.7 to 15.7) | 19.9 (18.0 to 22.1) | 5.8 (3.3 to 8.4) | 41.2 (20.3 to 62.1) |
| South | 18.9 (17.8 to 20.0) | 22.5 (21.5 to 23.5) | 3.6 (2.1 to 5.1) | 19.2 (10.6 to 27.8) | 13.2 (11.5 to 15.0) | 14.7 (13.2 to 16.3) | 1.5 (−0.9 to 3.9) | 11.3 (−7.8 to 30.5) |
| West | 19.9 (18.6 to 21.2) | 25.7 (24.7 to 26.9) | 5.9 (4.2 to 7.6) | 29.6 (19.7 to 39.6) | 15.9 (12.1 to 20.6) | 25.4 (21.2 to 30.2) | 9.6 (3.4 to 15.7) | 60.1 (9.0 to 111.3) |

**Abbreviations:** Abs = absolute difference; CI = confidence interval; Rel = relative difference.
* Age-standardized to the 2000 U.S. adult population, except for age-specific estimates.
† Absolute difference confidence intervals that exclude 0 indicate statistically significant differences.

design, improved access to indoor and outdoor recreation facilities, social support programs, and community-wide campaigns (*2*–*4*).

The prevalence of meeting the combined guidelines tended to be lower among rural residents than among urban residents, and remains below the national target established in Healthy People 2020 (20.1%). Environmental differences might contribute to this finding. For example, environmental supports and nearby destinations including sidewalks, public transit, and shops can encourage physical activity, but are less common in rural than in urban areas (*6*). To help rural communities address these challenges, the Federal Highway Administration published Small Town and Rural Multimodal Networks, a 2016 design guide with illustrated examples of activity-friendly infrastructure.†† Additionally, rural communities might have existing, underused supports for aerobic and muscle-strengthening activities, such as schoolyards, parks, or community centers. Improving access to and awareness of existing facilities through shared-use agreements, facility improvements, and outreach or community-wide campaigns could be effective strategies for rural communities (*3*,*4*).

The lack of improvement from 2008–2009 to 2016–2017 among rural Hispanics and adults living in the South is notable and concerning because of demonstrated burdens of obesity, diabetes, and related comorbidities in these groups (*7*). CDC's Racial and Ethnic Approaches to Community Health program helps communities implement culturally appropriate programs to address health issues among minority populations.§§ Under this program, the health authority in Cabarrus County, North Carolina initiated work with local organizations to improve community design and implement shared-use agreements with schools and churches in predominantly Hispanic and African-American areas. Similarly, CDC's High Obesity

†† https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/small_towns/.

§§ https://www.cdc.gov/nccdphp/dnpao/state-local-programs/reach/index.htm.

**Summary**

What is already known about this topic?

The prevalence of meeting the combined aerobic and muscle-strengthening physical activity guidelines among adults increased since 2008 but remained low (24.3%) in 2017.

What is added by this report?

Since 2008, the prevalence of meeting physical activity guidelines increased from 19.4% to 25.3% among urban residents and from 13.3% to 19.6% among rural residents. Among urban residents, all subgroups reported increases, whereas among rural residents, no increases were reported among Hispanics and adults living in the South.

What are the implications for public health practice?

Despite increases, physical activity prevalence remains low, especially for some rural subgroups with high incidences of chronic diseases. Incorporating culturally appropriate strategies into local, evidence-based programs might help communities build on recent progress.

Program works with state universities to improve physical activity in counties with high obesity prevalence, often in the rural South.¶¶ For example, Martin County, Kentucky recently increased opportunities for physical activity with a walking trail linking housing to nearby destinations in the small town of Warfield. These programs might serve as examples for other communities to follow.

The increases documented in this report are encouraging as they demonstrate that population-level change is possible, but additional progress is needed. To continue and perhaps accelerate progress, CDC launched Active People, Healthy Nation, which aims to improve the physical activity levels of 27 million Americans over 10 years (*8*). This multisector initiative presents five action steps, including 1) delivering programs that work, 2) mobilizing partners to ensure that physical activity initiatives are prioritized, coordinated, and updated using research and evaluation findings; 3) sharing messages that promote active lifestyles; 4) training leaders to take action and encourage both sector-specific and cross-sector training; and 5) developing technologies and tools to help address gaps in physical activity-related data. Active People, Healthy Nation provides a comprehensive path to improving physical activity levels in the United States and is poised to continue the momentum documented here.

The findings in this report are subject to at least three limitations. First, the physical activity assessment in NHIS is limited to leisure-time physical activity. Residents of rural areas might accrue more physical activity through occupational or domestic tasks than do residents of urban areas (*9*), although this might be somewhat offset by less transportation-related activity among rural residents (*10*). Second, NHIS asks about participation in light-intensity and moderate-intensity activity in a single question, which likely overestimates prevalence estimates of meeting the aerobic guideline, which focuses on activities of at least moderate intensity. Finally, all data are based on self-reports and might overestimate physical activity because of social desirability biases.

Despite recent increases in meeting physical activity guidelines, insufficient participation in physical activity remains a public health concern. By focusing on evidence-based approaches and the action steps of Active People, Healthy Nation, communities in both urban and rural areas can make physical activity the safe and easy choice for all U.S. residents.

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# Sepsis Attributed to Bacterial Contamination of Platelets Associated with a Potential Common Source — Multiple States, 2018

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During May–October 2018, four patients from three states experienced sepsis after transfusion of apheresis platelets contaminated with *Acinetobacter calcoaceticus-baumannii* complex (ACBC) and *Staphylococcus saprophyticus*; one patient died. ACBC isolates from patients' blood, transfused platelet residuals, and two environmental samples were closely related by whole genome sequencing. *S. saprophyticus* isolates from two patients' blood, three transfused platelet residuals, and one hospital environmental sample formed two whole genome sequencing clusters. This whole genome sequencing analysis indicated a potential common source of bacterial contamination; investigation into the contamination source continues. All platelet donations were collected using apheresis cell separator machines and collection sets from the same manufacturer; two of three collection sets were from the same lot. One implicated platelet unit had been treated with pathogen-inactivation technology, and two had tested negative with a rapid bacterial detection device after negative primary culture. Because platelets are usually stored at room temperature, bacteria in contaminated platelet units can proliferate to clinically relevant levels by the time of transfusion. Clinicians should monitor for sepsis after platelet transfusions even after implementation of bacterial contamination mitigation strategies. Recognizing adverse transfusion reactions and reporting to the platelet supplier and hemovigilance systems is crucial for public health practitioners to detect and prevent sepsis associated with contaminated platelets.

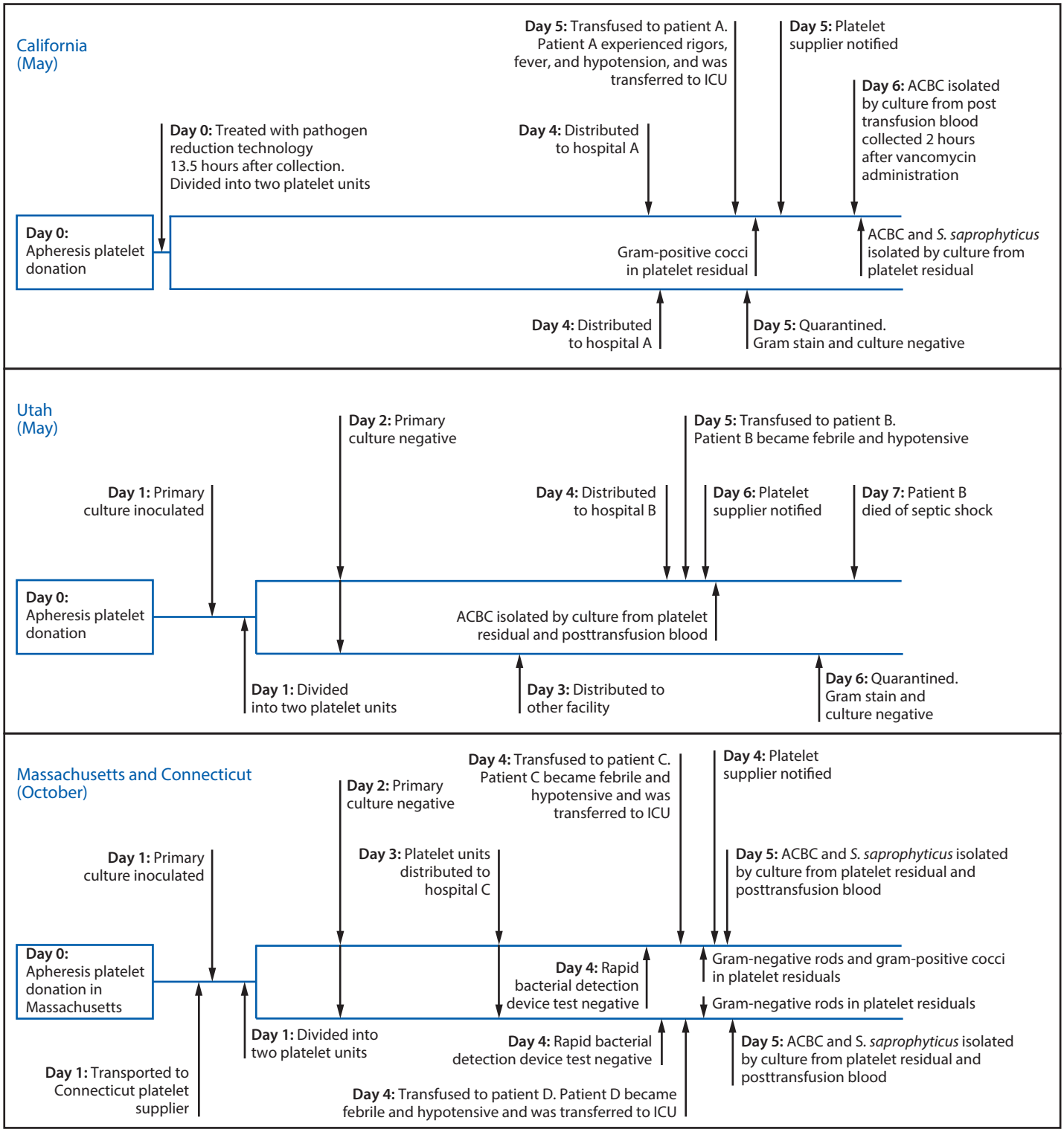
## Investigation and Results

**California.** On May 4, a male patient with acute lymphoblastic leukemia (patient A) received pathogen-reduced apheresis platelets at hospital A in California (Figure). Within minutes of completing the transfusion, he briefly experienced rigors, followed 2 hours later by fever and hypotension. He was transferred to the intensive care unit for management of septic shock and recovered fully. Posttransfusion patient blood cultures (obtained 2 hours after vancomycin administration) grew only ACBC. Gram stain of the implicated platelet bag residual revealed gram-positive cocci in pairs or chains; culture of the platelet bag residual grew ACBC and *S. saprophyticus*. The implicated platelet unit was one of two platelet units manufactured from a single apheresis donation collected 5 days earlier in California. Pathogen inactivation was performed 13.5 hours after collection. Hospital A located the second platelet unit (which had not been transfused), quarantined it, and notified the blood supplier. Gram stain and culture of this platelet unit were negative. Samples obtained from the donor's skin were culture-negative for ACBC and *S. saprophyticus*. Environmental samples obtained weeks later from the platelet collection facility and hospital A yielded no relevant organisms; however, sampled areas had been cleaned in the interim.

**Utah.** On May 10, a male patient with cirrhosis and thrombocytopenia (patient B) received a platelet transfusion at hospital B to prevent bleeding before a procedure (Figure). One hour after transfusion began, patient B complained of chills, and the transfusion was terminated. Two hours after transfusion, he became febrile, hypotensive, and tachypneic, and antibiotics were started; he died of septic shock 2 days later. ACBC was isolated by culture from platelet bag residuals and posttransfusion blood samples from the patient. The platelet supplier was notified, and a second platelet unit manufactured from the same apheresis donation, which had not been transfused, was recalled. The platelet supplier performed primary aerobic culture of the implicated donation for bacterial contamination 24 hours after collection in Utah; the primary culture remained negative after 5 days. The implicated platelet unit was transfused 5 days after collection. Samples obtained on May 24 from the donor's urine, perianal area, and multiple skin sites screened negative for ACBC colonization. Samples obtained from platelet agitators at the platelet manufacturing facility (May 23) and hospital B (June 7) yielded ACBC isolates.

**Connecticut and Massachusetts.** On October 4, at hospital C, two male patients with acute myeloid leukemia (patients C and D) each received a platelet unit manufactured from a common apheresis donation (Figure). Within two hours of transfusion, both patients became hypotensive and febrile. Both were transferred to the intensive care unit, and both recovered. ACBC and *S. saprophyticus* were isolated by culture from posttransfusion blood samples from both patients and from both platelet bag residuals. Hospital C notified the platelet supplier. The implicated apheresis platelet donation

**FIGURE. Timeline of four cases of sepsis attributed to bacterial contamination of platelets — California, Utah, Massachusetts, and Connecticut, 2018**




**Abbreviations:** ACBC = *Acinetobacter calcoaceticus-baumannii* complex; ICU = intensive care unit; *S. saprophyticus* = *Staphylococcus saprophyticus*.

had been collected in Massachusetts 4 days before transfusion and processed in Connecticut. Twenty-four hours after collection, the platelet supplier performed primary aerobic and anaerobic culture for bacterial contamination. Within 5 hours before transfusion, hospital C screened both platelet units with a rapid bacterial detection device; all tests were negative. No ACBC or *S. saprophyticus* isolates were identified among environmental swabs collected at platelet supplier facilities in Connecticut (November 15) and Massachusetts (November 16); *S. saprophyticus* was isolated from one platelet agitator at hospital C on November 13.

**Multistate investigation.** On July 17, notices were issued through CDC's Epi-X and the Infectious Diseases Society of America's Emerging Infections Network to identify additional cases of sepsis caused by *Acinetobacter* infections with onset of symptoms within 24 hours after platelet transfusion. Three cases were reported from two states (North Carolina [patients E and F] and Michigan [patient G]).

Traceback investigation revealed that the three platelet donations implicated in the California, Utah, and Connecticut septic transfusion reactions (i.e., sepsis attributed to transfusion) were from different donors. The donors in California, Utah, and Massachusetts had no known epidemiologic links to one another and no symptoms suggesting bacteremia or illness; all were indefinitely deferred. All three apheresis donations were collected in platelet additive solution using apheresis cell separator machines and collection sets from the same manufacturer; two of three collection sets were from a single lot.

CDC performed whole genome sequencing on collected ACBC and *S. saprophyticus* isolates (Table) using standard methods (*1*). ACBC organisms were isolated by culture from posttransfusion blood samples from patients A, B, C, and D; all four associated transfused platelet bag residuals; and environmental samples from hospital B and the platelet supplier in Utah. Fourteen ACBC isolates from these sources were highly related (differing by 0–32 single nucleotide polymorphisms [SNPs] across a 95.6% core genome) (Supplementary Figure 1, https://stacks.cdc.gov/view/cdc/78727) and appear to represent a novel ACBC taxon (only 90% match to *Acinetobacter seifertii* by average nucleotide identity). In contrast, ACBC isolates from cases in North Carolina and Michigan were not closely related to isolates from cases in California, Utah, and Connecticut by whole genome sequencing (differing by 13,398–14,289 SNPs across a 30.5% core genome).

*S. saprophyticus* was isolated by culture from posttransfusion blood samples from patients C and D; transfused platelet bag residuals from patients A, C, and D; and an environmental sample from hospital C (Table). Whole genome sequencing analysis revealed two clusters of *S. saprophyticus* isolates. One cluster consisted of *S. saprophyticus* isolates from patient C's blood, patient C's platelet bag residual, and an environmental swab from hospital C (differing by 0–37 SNPs across a 94.9% core genome) (Supplementary Figure 2, https://stacks.cdc.gov/view/cdc/78728); the second cluster consisted of isolates from patient D's blood and from patient D's and patient A's platelet bag residuals (difference of 1–27 SNPs across a 94.9% core genome).

## Discussion

Transfusion of platelets is more likely to result in sepsis than is transfusion of other blood products; data derived from primary cultures have indicated that approximately one in every 5,000 platelet collections is contaminated with bacteria (*2*). ACBC is not frequently reported as a contaminant of platelets (*3*). ACBC consists of gram-negative bacilli that commonly occur in wet environments and are opportunistic pathogens; ACBC organisms are resistant to desiccation, persist

**TABLE. Bacterial contamination mitigation strategies, posttransfusion culture results, and environmental sampling results associated with four septic transfusion reaction cases — California, Utah, and Connecticut, 2018**

| | State and patient | | | |
|---|---|---|---|---|
| | California | Utah | Connecticut | |
| Source | Patient A | Patient B | Patient C* | Patient D* |
| **Bacterial contamination mitigation strategy** | | | | |
| Pathogen-inactivation technology | Performed | Not done | Not done | Not done |
| Primary culture | Not done† | No growth | No growth | No growth |
| Rapid bacterial detection device | Not done | Not done | Negative | Negative |
| **Posttransfusion culture** | | | | |
| Patient posttransfusion blood | ACBC | ACBC | ACBC and *S. saprophyticus* | ACBC and *S. saprophyticus* |
| Transfused platelet unit residual | ACBC and *S. saprophyticus* | ACBC | ACBC and *S. saprophyticus* | ACBC and *S. saprophyticus* |
| Nontransfused platelet cocomponent | Negative | Negative | None | None |
| **Environmental sampling** | | | | |
| Hospital | Negative | ACBC | *S. saprophyticus* | *S. saprophyticus* |
| Platelet supplier facility | Negative | ACBC | Negative | Negative |

**Abbreviations:** ACBC = *Acinetobacter calcoaceticus-baumannii* complex; *S. saprophyticus* = *Staphylococcus saprophyticus*.
* Patients C and D each received one platelet unit manufactured from a common apheresis donation.
† The Food and Drug Administration does not require primary culture if the transfused platelet unit is treated with pathogen-inactivation technology.

**Summary**

What is already known about this topic?

Bacterial contamination of platelets is rare (approximately one in 5,000 platelet units) but poses serious risk to platelet transfusion recipients.

What is added by this report?

Sepsis resulting from bacterial contamination of platelets can occur even with implementation of bacterial mitigation strategies. Whole genome sequencing indicated a potential common source of bacterial contamination among four cases of septic transfusion reactions occurring in three states.

What are the implications for public health practice?

Clinicians need to monitor for sepsis after platelet transfusions even after implementation of bacterial mitigation strategies and immediately report adverse reactions to platelet suppliers and hemovigilance systems.

on environmental surfaces, and avidly adhere to plastics (*4*). Conversely, coagulase-negative *Staphylococcus* spp. are among the most common bacterial contaminants of platelets (*3*,*5*). However, *S. saprophyticus* might be less likely to contaminate platelets than other coagulase-negative *Staphylococcus* spp. because it typically resides in the gastrointestinal and urinary tracts rather than on the skin (*6*).

Whole genome sequencing analysis indicated an unidentified potential common source of bacterial contamination among the four cases of septic transfusion reactions reported here. Investigation into the contamination source continues. Although skin microflora and donor bacteremia are the most frequent sources of bacterial contamination (*7*), a cluster of septic transfusion reactions attributed to contamination of blood collection bags during manufacturing or packaging was reported in 1993 (*8*).

Food and Drug Administration regulations state that blood establishments and transfusion services must assure adequate control of the risk for bacterial contamination of platelets.* Most U.S. blood suppliers fulfill this requirement by performing a primary culture of platelet donations before transfusion (*2*). Because the risk for platelet transfusion–associated sepsis has persisted despite implementation of primary cultures, additional bacterial mitigation strategies have been implemented, including pathogen-inactivation technology, rapid bacterial detection devices, and alternative culture strategies (*2*). This report underscores the possibility that sepsis resulting from bacterial contamination of platelets can occur even with application of bacterial contamination mitigation strategies.

The consequences of septic transfusion reactions are often severe morbidity or mortality. In the cluster reported here, one of four patients died, and three recovered only after receiving intensive care. Even with implementation of bacterial contamination mitigation strategies, clinicians should continue to monitor recipients for sepsis after platelet transfusions and immediately report adverse reactions to the platelet supplier and hemovigilance systems.

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# *Vital Signs:* Trends in Human Rabies Deaths and Exposures — United States, 1938–2018

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## Abstract

**Introduction:** Each year, rabies causes approximately 59,000 deaths worldwide, including approximately two deaths in the United States. Before 1960, dogs were a common reservoir of rabies in the United States; however, increasingly, species of wildlife (e.g., bats, raccoons) are the main reservoirs. This report characterizes human rabies deaths, summarizes trends in rabies mortality, and highlights current rabies risks in the United States.

**Methods:** Rabies trends in the United States during 1938–2018 were analyzed using national rabies surveillance data. Data from the Healthcare Cost and Utilization Project for 2006–2014 were used to estimate the number of postexposure prophylaxis (PEP) visits per 100,000 persons during 2017–2018. The Centers for Medicare & Medicaid Services' average sales price data were used to estimate PEP costs.

**Results:** From 1960 to 2018, a total of 125 human rabies cases were reported in the United States; 36 (28%) were attributed to dog bites during international travel. Among the 89 infections acquired in the United States, 62 (70%) were attributed to bats. In 2018, approximately 55,000 persons sought PEP after contact with a potentially rabid animal.

**Conclusions and Comments:** In the United States, wildlife rabies, especially in bats, continues to pose a risk to humans. Travelers also might be exposed to canine rabies in countries where the disease is still present; increased awareness of rabies while traveling abroad is needed. Vaccinating pets, avoiding contact with wildlife, and seeking medical care if one is bitten or scratched by an animal are the most effective ways to prevent rabies. Understanding the need for timely administration of PEP to prevent death is critical.

## Introduction

Rabies virus, a *Lyssavirus* that infects mammals, is transmitted through saliva, most commonly from the bite or scratch of an infected animal. In the United States, several variants, or strains, of rabies virus circulate in animal reservoirs, including raccoons, skunks, foxes, and bats (*1*). Rabies virus infection, regardless of the variant or animal reservoir, is fatal in over 99% of cases, making it one of the world's most deadly diseases. There is no treatment once signs or symptoms of the disease begin, and the disease is fatal in humans and animals within 1–2 weeks of symptom onset. Prompt administration of postexposure prophylaxis (PEP), consisting of rabies vaccine and immune globulin, immediately after exposure effectively prevents disease (*1*,*2*).

The elimination of canine rabies virus variant (CRVV) from the United States is one of the most important public health successes of the 20th century. However, globally, approximately 59,000 persons still die from rabies every year; 98% of these cases are caused by CRVV (*3*). At the beginning of the 20th century, CRVV was enzootic in the United States, but beginning in 1947, animal vaccination and leash control laws led to improved rabies control nationwide. Canine rabies and associated human rabies cases fell sharply (*4*). By the late 1960s, fewer than 500 rabid dogs and three human rabies cases were reported annually (*5*).

In the United States, CRVV was eventually eliminated in 2004 (*6*) through use of parenteral and oral rabies vaccines. As the prevalence of CRVV declined, rabies viruses associated with wildlife reservoirs such as skunks, foxes, raccoons, and bats accounted for an increasing proportion of cases in animals and humans in the United States. Wildlife rabies is found in all states except Hawaii (*1*). Since the late 1970s, raccoon rabies has spread across the Eastern Seaboard from Alabama to Maine, causing the largest epizootic of animal rabies in U.S. history (*7*). Given the close proximity of raccoons to residents of suburban neighborhoods and trends toward urbanization, human exposures to rabies increased (*8*,*9*).

**Summary**

What is already known about this topic?

Each year, rabies causes approximately 59,000 deaths worldwide, including approximately two deaths in the United States. Rabies can be prevented with timely administration of postexposure prophylaxis (PEP).

What is added by this report?

During 1960–2018, among 89 U.S. acquired human rabies cases, 62 (70%) were attributed to bats. Dog bites acquired during international travel were the cause of 36 cases.

What are the implications for public health practice?

Awareness of the risk of rabies from wildlife, especially bats, and during international travel is needed. Understanding the need for timely administration of PEP to prevent death is critical.

The use of oral rabies vaccine, composed of vaccine wrapped in a flavored bait, has been successful in controlling westward spread of raccoon rabies.* However, outside oral rabies vaccination zones, raccoon rabies virus variant accounts for nearly 75% of the terrestrial animal rabies cases reported in the United States (*1*). In areas where both raccoon and bat rabies occur, human rabies exposures are 600% higher than in areas where only bat rabies occurs (*1*,*9*).

Although domestic animal exposures account for a large portion of human PEP usage, bat rabies virus variants are responsible for most human rabies deaths in the United States (*1*). This apparent paradox might be due to several factors, including lack of awareness of the risk of acquiring rabies from bats, or difficulty identifying bat bites and scratches (*10*). This analysis highlights current rabies risks in the United States, and assesses the cost and public health impact of rabies control efforts.

## Methods

U.S. National Rabies Surveillance data maintained by CDC's Poxvirus and Rabies Branch were analyzed to assess trends in human and animal rabies in the United States during the past 81 years (1938–2018) (*1*). Initial risk assessment and treatment for exposure to a rabid animal commonly occurs in the emergency department because of the need for wound treatment and rabies immune globulin, typically only available in emergency departments (*11*).

The Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project's (HCUP; https://www.hcup-us.ahrq.gov/) 2006–2014 data, which include longitudinal U.S. hospital care data, were used to estimate the rate of PEP visits (number per 100,000 persons) for 2017–2018 based on the U.S. population. HCUP patient data from emergency departments with an *International Classification of Diseases, Ninth Revision* diagnosis code of V04.5 (need for rabies prophylaxis) were evaluated (https://hcupnet.ahrq.gov). In addition, 2017 national sales data for rabies immune globulin were provided by an independent consultant (Marketing Research Bureau, Inc., unpublished data, 2019).

The 2019 Centers for Medicare & Medicaid Services average sales price data were analyzed to estimate the cost of PEP (*12*,*13*). The average sales price data lists rabies immune globulin at $312 per 150-IU dose (a 165-pound [75-kg] adult needs 10 doses and a 95-pound [45-kg] child needs 6 doses) and rabies vaccine at $290 per dose (4 total doses needed). The average PEP cost and range were determined using the 2019 average sales price data and previously published data from 2004, adjusted for inflation (*13*,*14*).

The cost and frequency of U.S. public health system rabies responses were derived from previously published literature and opinions of subject matter experts (*13*,*15*,*16*). An economic analysis conducted by CDC provided estimates of the number of imported dogs from countries at high risk for rabies and the public health cost associated with importation events (*15*).

## Results

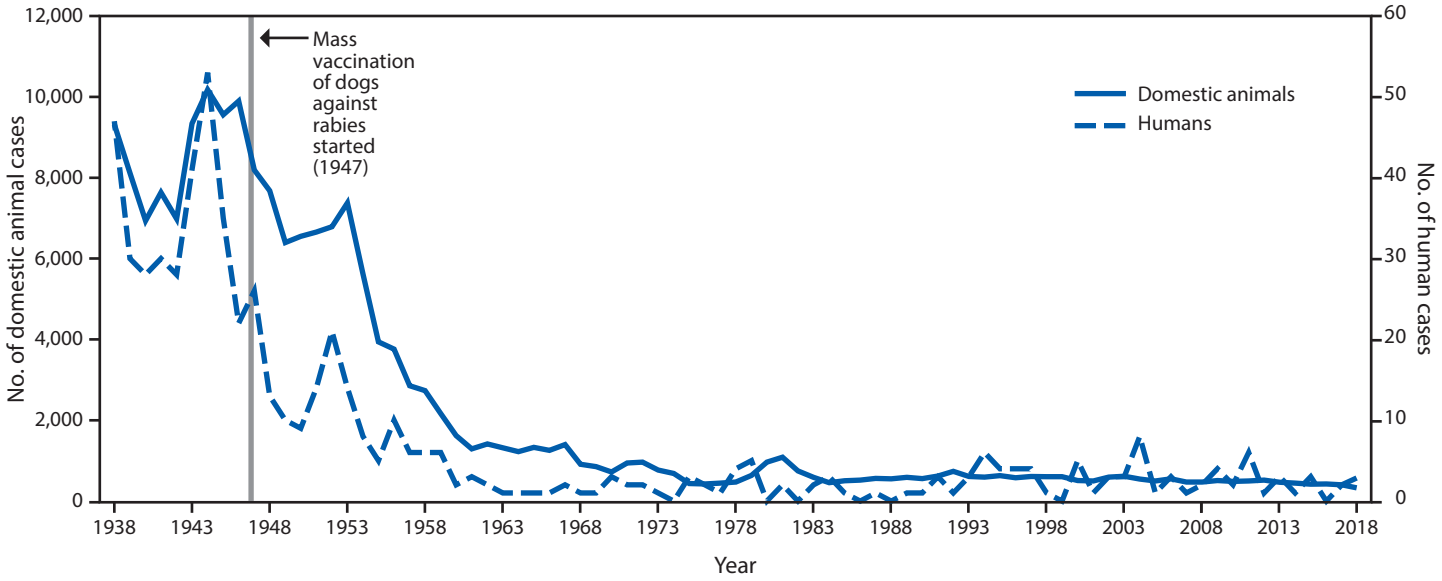
During 1938–2018, 588 cases of human rabies were reported in the United States. The elimination of CRVV in the United States through canine rabies vaccination has resulted in a tenfold decrease in human rabies cases reported from 1938 through 2018 (Figure 1). During 1960–2018, among 125 reported human rabies cases, 89 were U.S.-acquired, including six organ transplantation cases. Among all U.S.-acquired cases, 62 (70%) were caused by bat rabies virus variants (Figure 2). Since 1960, 36 (28%) U.S. residents have died of rabies acquired from dogs while traveling abroad.

During 2017–2018, an average of 55,000 (range = 45,453–66,000) persons were treated for potential rabies exposure each year. The cost for rabies PEP averages $3,800 (range = $1,200–$6,500), not including costs for hospital treatment or wound care. This results in annual estimated PEP costs of $209 million (range = $66 million–$358 million).

Since 2003, the U.S. public health system has responded to approximately two human rabies deaths, 175 mass bat exposure events (events where >10 persons are exposed to a potentially rabid bat), and one rabid dog importation every year (Table). CDC estimates that 1.06 million dogs enter the United States every year, including 107,000 (10%) that are imported from countries where CRVV is enzootic, thereby posing a potential risk for reintroduction of CRVV into the United States. Since 2015, three canine rabies cases have been imported in rescue dogs adopted from countries with a high risk for rabies. Canine rabies importation events are estimated to cost $213,833 (range = $171,066–$256,599) per event in public health response and health care costs to prevent the spread of the disease to humans and their pets.

* https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nrmp/ct_rabies.

**FIGURE 1. Rabies cases in humans and domestic animals — United States, 1938–2018**




Total estimated costs associated with rabies public health emergency response activities are $7.6 million per year (range = $2.6 million–$12.9 million) (Table).

## Discussion and Conclusions

Bats are currently the leading cause of human rabies deaths in the United States. Unlike rabies management programs targeting raccoon, fox, and coyote populations, bat vaccination is not yet logistically feasible, nor are any rabies vaccines currently approved for use in bats. Despite the rabies exposure risk, the vast majority of bats submitted for testing (94%) do not have rabies (*1*). Thus, widespread killing of bats is not recommended to prevent rabies. However, increased awareness of the risk for rabies from bats and knowledge of when to seek medical attention for PEP are needed. In addition to bat rabies cases, international travel-related rabies cases occur because of a lack of awareness about the ongoing global risk of rabies in dogs.

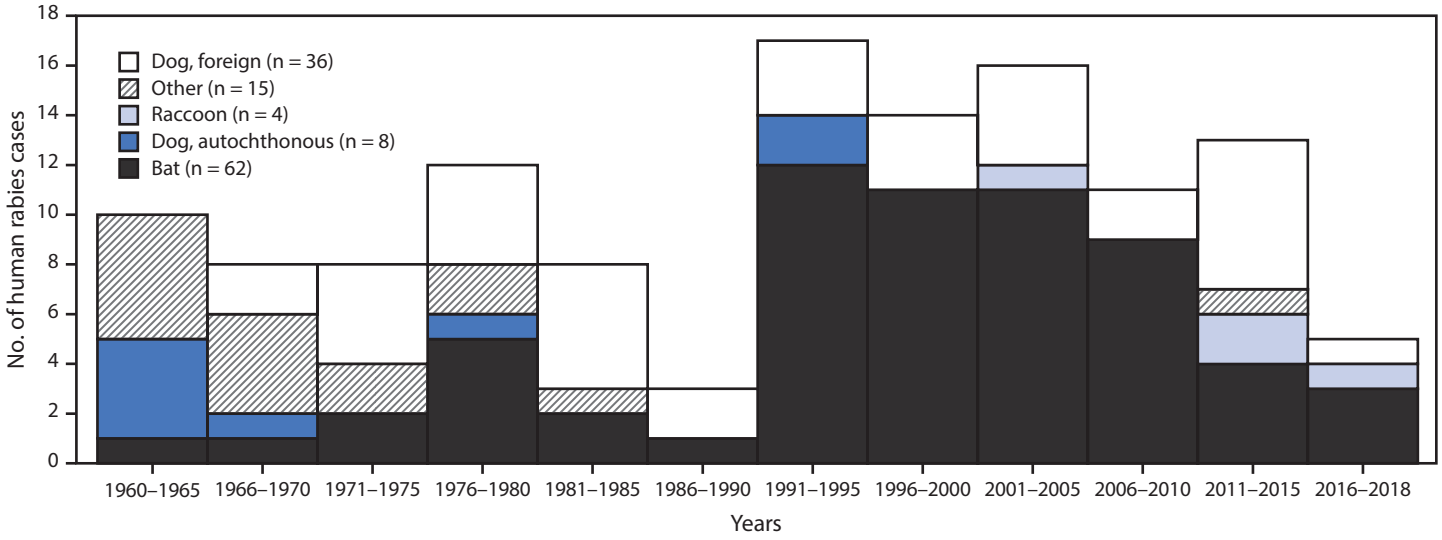
Efforts to control rabies in wildlife and maintain canine rabies elimination in the United States require ongoing, high-quality rabies surveillance and timely response capabilities. Rabies continues to be a priority zoonotic disease for One Health collaboration (*17*), requiring multi-agency cooperation to ensure continued success of the U.S. rabies control program. Currently, U.S. public health laboratories and United States Department of Agriculture Wildlife Services test approximately 100,000 animals per year, and approximately 5,000 are rabies-positive (*1*). Although CRVV has been eliminated from the United States, dogs might still acquire rabies from wildlife.

Whereas canine rabies vaccination is required throughout the United States, animal registration and rabies vaccination laws vary by county, making it difficult to estimate the current rabies vaccination coverage rates among dogs in the United States. In addition, recent antivaccination sentiments have been documented in owners reluctant to vaccinate their dogs against diseases (*18*). Failure to vaccinate dogs against rabies could constitute a considerable public health threat to both humans and animals. Thus, maintaining current rabies vaccination rates of at least 70% in dogs is critical not only to protect pets, but to protect pet owners as well (*19*).

The findings in this report are subject to three limitations. First, although rabies is a notifiable disease for both humans and animals, data on PEP use among persons seeking care for a potential exposure are limited and rely on emergency department data, some of which may be incomplete. Second, previously published data and current average sales price data from the Centers for Medicare & Medicaid were used to estimate costs for this analysis, but the actual amount hospitals bill for PEP varies considerably, making it difficult to assess the true cost of PEP (*10*). Finally, rabies prevention and control costs have a high degree of variability. For example, costs for public health emergency responses can vary considerably between states depending on the number and type of animals and humans involved.

As the human urban environment encroaches into wildlife settings, human rabies exposures continue to occur. However, the relatively few human rabies deaths that occur in the United States are a testament to the robust response capabilities of the nation's public health system, as well as the success of wildlife and pet vaccination programs and the availability of effective PEP. Although human rabies is now a rare disease in the United States, it remains one with extremely high consequences.

**FIGURE 2. Rabies virus variants* associated with human rabies cases (N = 125)† — United States, 1960–2018**




* Other rabies virus variants included skunk, fox, and unknown.
† Includes 120 persons who died and five survivors with suspected rabies infection in 1970, 1977, 2004, 2009, and 2011. Cases in survivors were never laboratory-confirmed; three cases are included in bat rabies virus variants because of epidemiologic links to bats and two are included in other (one unknown and one lab-acquired).

**TABLE. Estimated annual costs associated with emergency rabies responses — United States, 2017–2018**

| Type of rabies response/No. of exposures | Response item | Estimated costs |
|---|---|---|
| **Human cases** | | |
| 2 cases per year* | Investigation | $42,900 (1,300 hours† at $33 per hour§) |
| x 39 contacts per case¶ | PEP | + $148,200 (39 contacts x $3,800 per course**) |
| Total = 78 exposed contacts | Investigation and PEP | = $191,100 per case |
| Total cost for human cases | | **= $382,200 total cost per year (2 cases)** |
| **Mass bat exposures††** | | |
| 3.5 exposures per agency per year | Investigation | $2,871 (87 hours† at $33 per hour§) |
| x 50 state/territorial agencies§§ | PEP | + $38,000 (10 persons x $3,800 per course**) |
| Total = 175 exposures per year | Investigation and PEP | = $40,871 per exposure |
| Total cost for bat exposures | | **= $7,152,425 total cost per year (175 exposures)** |
| **Rabid dog importation events¶¶** | | |
| 1 event every 1–2 yrs | Investigation and PEP | $218,833 per 2 years |
| Total cost for importation events | | **= $109,416 total cost per year (1 event)** |
| **Total annual cost** | | **$7,644,041** |

**Abbreviation:** PEP = postexposure prophylaxis.
* Annual average of total number of cases reported during 1960–2018.
† Estimated average hours devoted to investigation estimated from information in a previously published report. https://onlinelibrary.wiley.com/doi/full/10.1111/zph.12105.
§ Cost per hour derived from 2019 epidemiologist salary listed by Bureau of Labor Statistics. https://www.bls.gov/ooh/life-physical-and-social-science/epidemiologists.htm.
¶ Estimated contacts per year were based on previously published data. https://www.intechopen.com/books/non-flavivirus-encephalitis/human-rabies-epidemiology-and-diagnosis.
** Average cost for PEP course determined using 2019 Centers for Medicare & Medicaid average sales price data (https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Part-B-Drugs/McrPartBDrugAvgSalesPrice/2019ASPFiles.html) and previously published 2004 data, adjusted for inflation (https://www.sciencedirect.com/science/article/pii/S0264410X08006373?via%3Dihub). Cost includes immunoglobulin and rabies vaccine; does not include costs for hospital treatment or wound care.
†† Mass exposures defined as >10 persons exposed to a potentially rabid bat. Estimated number of exposures per state/territorial agency per year based on previously published data. https://onlinelibrary.wiley.com/doi/full/10.1111/zph.12289.
§§ Includes agencies in 49 states and Puerto Rico; Hawaii not included because wildlife rabies is not found in the state.
¶¶ Number of importation events and related costs described in previously published report. https://www.federalregister.gov/d/2019-00506

## Recommendations

A critical component of rabies prevention in the United States is to avoid contact with wildlife, especially bats. Contact with a bat includes bites and scratches, which are often small and can be overlooked. Contact might also occur unknowingly if a bat is present in a room with a young child or mentally impaired person, including a child or person under the influence of medication, drugs, or alcohol or a person who is asleep. In those cases where unrecognized contact might have occurred, persons should assume they have a potential exposure to rabies if the bat is not available for testing and urgently seek care from their medical provider. If the bat can be safely collected and tested, this can inform the need for PEP.

CDC Travelers' Health provides vaccination recommendations for international travelers (https://www.cdc.gov/travel). Although the risk of travel-associated rabies infection is generally low, travelers should know the risk, avoid contact with animals, have a plan to get care if they are scratched or bitten, and have travel health insurance to pay for treatment should they need it. Travelers at higher risk (i.e., those who might be working with animals abroad or come into close contact with animals while traveling) should additionally consider preexposure prophylaxis vaccination and be aware that PEP is still recommended after a potential exposure, even among vaccinated persons (*2*).

Human rabies is 99% fatal. However, it is 100% preventable through vaccinating pets against rabies, avoiding contact with wildlife and unknown animals, and seeking medical care as soon as possible after being bitten or scratched by an animal.

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State and Local Health Departments; Animal Control Officers; the USDA Wildlife Services program; Kristina Angelo, Laurie Barker, Harrell Chesson, Joo Heesoo, Ronald Henry, Seonghye Jeon, Brian Maskery, Jennifer McQuiston, Martin Meltzer, Megan O'Sullivan, Agam Rao.

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# Notes from the Field

## Administration of Expired Injectable Influenza Vaccines Reported to the Vaccine Adverse Event Reporting System — United States, July 2018–March 2019

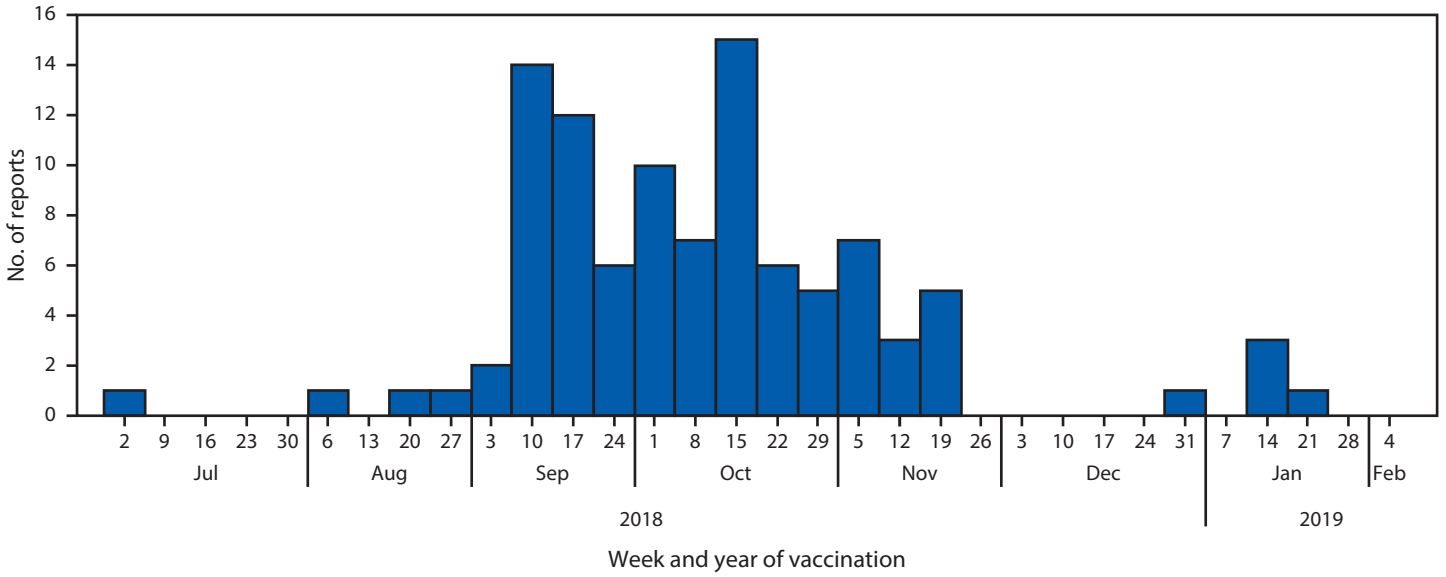
Elisabeth M. Hesse, MD[1,2]; Beth F. Hibbs, MPH[2]; Maria V. Cano, MD[2]

Influenza vaccination is recommended annually for persons aged ≥6 months for the prevention and control of influenza (*1*). Every year, injectable inactivated influenza vaccine (IIV) has a standard expiration date of June 30 for the upcoming influenza season (i.e., July 1–June 30 of the following year). Vaccination with an expired influenza vaccine might not protect against influenza infection because different influenza virus strains can be included in the vaccine each year; in addition, protection against viruses included in the vaccine could wane if vaccine potency decreases over time. During July 11, 2018–March 29, 2019 in the United States, the Vaccine Adverse Event Reporting System (VAERS) received 125 reports of 192 patients receiving expired IIV during the 2018–19 influenza season (*2*), during which time 169.1 million doses of seasonal influenza vaccine were distributed (*3*). Dates of vaccination were documented for 102 patients and ranged from July 2, 2018, to January 16, 2019. The number of expired vaccine doses administered increased in September and decreased after October, coinciding with dates when influenza vaccine is typically given (Figure). Ages were available for 103 vaccine recipients. Seventy-three recipients (70.1%) were identified as being in high-risk age groups for influenza; eight were aged <5 years, and 65 were aged >50 years (*1*). An additional six reports specified that the patient had been pregnant at time of vaccination; pregnancy outcomes were not reported. Adverse events after the administration of an expired IIV were rarely reported (four of 125 reports; 3.2%). None were serious, and adverse events were consistent with adverse events for seasonal IIV.

The VAERS adverse event findings suggest that expired IIV does not pose additional risks for adverse events beyond those of seasonal IIV. Vaccine failure was not assessed. In most reports, factors that contributed to administration of expired vaccine were not specified; however, one cluster of reports from a pharmacy stated that four persons received expired vaccine doses that had been mistakenly shipped from another pharmacy. Seven reports detailed that patients were offered revaccination with the current season's influenza vaccine; of these, three confirmed revaccination.

As a spontaneous reporting surveillance system, VAERS likely captures only a small fraction of expired IIV administered; therefore, this error might be more common than VAERS data indicate. CDC's Vaccine Storage and Handling Toolkit contains guidance pertaining to prevention of and mitigation of administration of expired vaccines and is available online (https://www.cdc.gov/vaccines/hcp/admin/storage/toolkit/index.html) (*4*). Vaccine stock should be rotated and examined for expired doses regularly. Any expired vaccines and

**FIGURE. Number of reports (n = 102) with documented dates of administration of expired injectable influenza vaccine — Vaccine Adverse Event Reporting System, United States, July 2018–January 2019**



diluents should be removed immediately to avoid inadvertent administration (*4*).

Vaccines should be inspected for expiration before they are administered or transported to other facilities. Facility vaccine coordinators need to be aware of the standard expiration date of June 30 for IIV and make plans for the safe disposal or return of any remaining doses of IIV after that date. Sometimes unused vaccine may be returned for credit, even if the doses must be discarded. State immunization programs or vaccine manufacturers should be contacted to determine whether such provisions apply. Any person who receives an expired influenza vaccine should be revaccinated with the current season's influenza vaccine.

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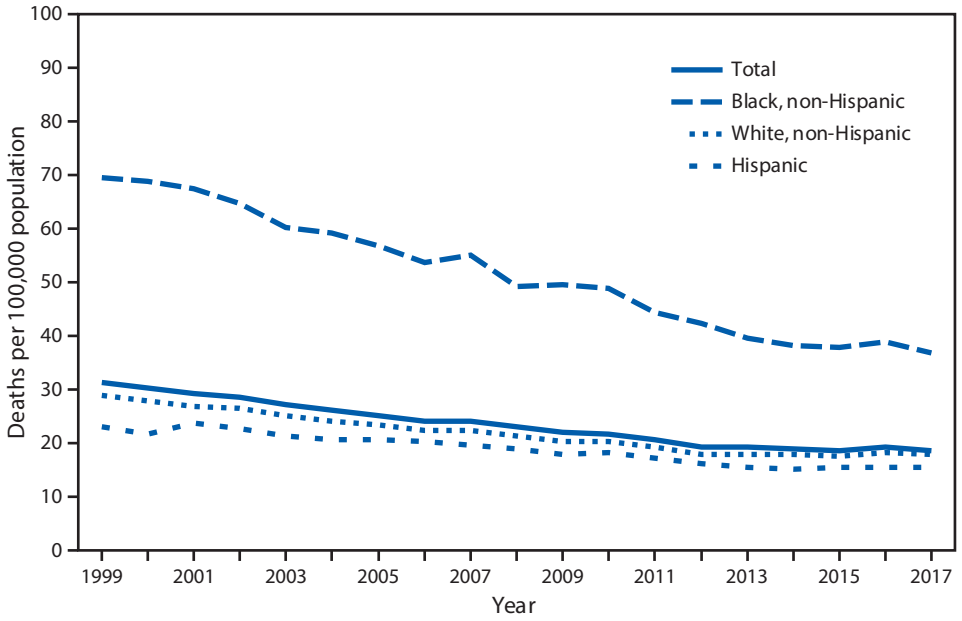
# QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

## Age-Adjusted Death Rates* from Prostate Cancer,† by Race/Ethnicity — National Vital Statistics System, United States, 1999–2017




* Deaths per 100,000 population, age-adjusted to the 2000 U.S. standard population.
† Prostate cancer deaths were those with the *International Classification of Diseases, Tenth Revision* (ICD-10) underlying cause of death code C61.

In 2017, the age-adjusted prostate cancer death rate among all males was 18.7 per 100,000, down from 31.3 in 1999. During 1999–2017, non-Hispanic black males had the highest prostate cancer death rate. In 2017, the rate for non-Hispanic black males was 36.8, compared with 17.8 for non-Hispanic white males and 15.4 for Hispanic males.

**Source:** National Vital Statistics System, Mortality, 1999–2017. https://wonder.cdc.gov/ucd-icd10.html.

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