Please note: This report has been corrected. An erratum has been published.

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# Interim Estimates of 2019–20 Seasonal Influenza Vaccine Effectiveness — United States, February 2020

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During the 2019–20 influenza season, influenza-like illness (ILI)* activity first exceeded the national baseline during the week ending November 9, 2019, signaling the earliest start to the influenza season since the 2009 influenza A(H1N1) pandemic. Activity remains elevated as of mid-February 2020. In the United States, annual vaccination against seasonal influenza is recommended for all persons aged ≥6 months (*1*). During each influenza season, CDC estimates seasonal influenza vaccine effectiveness in preventing laboratory-confirmed influenza associated with medically attended acute respiratory illness (ARI). This interim report used data from 4,112 children and adults enrolled in the U.S. Influenza Vaccine Effectiveness Network (U.S. Flu VE Network) during October 23, 2019–January 25, 2020. Overall, vaccine effectiveness (VE) against any influenza virus associated with medically attended ARI was 45% (95% confidence interval [CI] = 36%–53%). VE was estimated to be 50% (95% CI = 39%–59%) against influenza B/Victoria viruses and 37% (95% CI = 19%–52%) against influenza A(H1N1)pdm09, indicating that vaccine has significantly reduced medical visits associated with influenza so far this season. Notably, vaccination provided substantial protection (VE = 55%; 95% CI = 42%–65%) among children and adolescents aged 6 months–17 years. Interim VE estimates are consistent with those from previous seasons, ranging from 40%–60% when influenza vaccines were antigenically matched to circulating viruses. CDC recommends that health care providers continue to administer influenza vaccine to persons aged ≥6 months because influenza activity is ongoing, and the vaccine can still prevent illness, hospitalization, and death associated with currently circulating influenza viruses as well as other influenza viruses that might circulate later in the season.

Methods used by the U.S. Flu VE Network have been published previously (*2*). At five study sites (Michigan, Pennsylvania, Texas, Washington, and Wisconsin), patients aged ≥6 months seeking outpatient medical care for an ARI with cough within 7 days of illness onset were enrolled once local influenza circulation was identified.† Enrollment eligibility criteria included 1) age ≥6 months on September 1, 2019

* Fever (temperature ≥100°F [37.8°C]) and a cough or a sore throat without a known cause other than influenza (https://www.cdc.gov/flu/weekly/overview.htm).

† Study enrollment began at each site after local surveillance identified increasing weekly influenza activity or one or more laboratory-confirmed cases of influenza per week for 2 consecutive weeks. The U.S. Flu VE Network sites and the dates enrollment began are as follows: University of Michigan School of Public Health (partnered with the University of Michigan Health System, Ann Arbor, Michigan, and the Henry Ford Health System, Detroit, Michigan) (November 20, 2019); University of Pittsburgh Schools of the Health Sciences (partnered with the University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania) (November 25, 2019); Kaiser Permanente Washington, Seattle, Washington (November 25, 2019); Marshfield Clinic Research Institute, Marshfield, Wisconsin (December 30, 2019); and Baylor Scott and White Health, Texas A&M University College of Medicine, Temple, Texas (October 23, 2019).

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(i.e., vaccine-eligible); 2) ARI with cough, with onset ≤7 days earlier; and 3) no treatment with influenza antiviral medication (e.g., oseltamivir or baloxavir) during this illness. Consenting participants or their proxies were interviewed to collect demographic data, information on general and current health status and symptoms, and 2019–20 influenza vaccination status. Nasal and oropharyngeal swabs (nasal swabs alone for children aged <2 years) were collected to obtain respiratory specimens; swabs were placed in a single cryovial with viral transport medium and tested at U.S. Flu VE Network laboratories using CDC's real-time reverse transcription–polymerase chain reaction (RT-PCR) protocol for detection and identification of influenza viruses.[§] For interim estimates, participants (including children aged <9 years, who require 2 vaccine doses during their first vaccination season) were considered to be vaccinated if they received ≥1 dose of any seasonal influenza vaccine ≥14 days before illness onset, according to medical records, registries, or patient report. VE against all influenza virus types combined and against viruses by type/subtype was estimated as 100% x (1 – odds ratio).[¶] Estimates were adjusted for study site, age group, sex, race/ethnicity, self-rated health status, days from illness onset to enrollment, and month of illness using logistic regression. VE estimates by age group and influenza subtype are presented for strata with sufficient numbers of influenza cases to achieve adequate statistical power to detect a significant VE based on a priori sample size calculations.[**]

Among 4,112 ARI patients enrolled during October 23, 2019–January 25, 2020, a total of 1,060 (26%) tested positive for influenza virus infection by real-time RT-PCR, including 691 (17%) for influenza B viruses and 374 (9%) for influenza A viruses (Table 1); five patients tested positive for both influenza A and B viruses. Of 673 influenza B viruses with lineage information available, 670 (>99%) belonged to the B/Victoria lineage, and three (<1%) belonged to the B/Yamagata lineage. Among 335 subtyped influenza A viruses, 326 (97%) were A(H1N1)pdm09 viruses, and only 11 (3%) were A(H3N2) viruses. The proportion of patients with influenza differed among study sites, age groups, racial/ethnic groups, self-rated health status, and days from illness onset to enrollment. The percentage of ARI patients who were vaccinated ranged from

§ https://www.cdc.gov/flu/professionals/diagnosis/molecular-assays.htm.

¶ 100% x (1 – odds ratio [ratio of odds of being vaccinated among outpatients with CDC's real-time RT-PCR influenza-positive test results to the odds of being vaccinated among outpatients with influenza-negative test results]).

** Sample sizes to achieve an adequate number of influenza cases to estimate a significant VE with 95% confidence intervals that do not include zero were estimated by virus subtype and the following age groups: 6 months–17 years, 18–49 years, 50–64 years, and ≥65 years. Sample size calculations were based on a type I error probability of 5% and a type II error probability of 20% (power 80%) to detect 40% VE against any influenza, 50% VE against influenza A(H1N1) or influenza B, and 30% VE against influenza A(H3N2). Assumptions about vaccination coverage varied by age group as follows: 50% for children and adolescents aged 6 months–17 years, 45% for adults aged 18–49 years, 60% for adults aged 50–64 years, and 80% for adults aged ≥65 years. These VE and coverage assumptions were made on the basis of pooled estimates from the 2012–13 through 2018–19 influenza seasons in the U.S. Flu VE Network. Age strata with insufficient influenza cases were aggregated to provide VE estimates for larger strata when possible.

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**TABLE 1. Influenza real-time reverse transcription–polymerase chain reaction test results and seasonal vaccination status among patients with medically attended acute respiratory illness (N = 4,112), by selected characteristics — U.S. Influenza Vaccine Effectiveness Network, October 23, 2019—January 25, 2020**

| Characteristic | Test result status: Influenza-positive no. (%) | Test result status: Influenza-negative no. (%) | P-value* | Total no. of patients | Vaccinated no. (%)† | P-value* |
|---|---|---|---|---|---|---|
| **Overall** | **1,060 (26)** | **3,052 (74)** | **N/A** | **4,112** | **2,072 (50)** | **N/A** |
| **Study site** | | | | | | |
| Michigan | 94 (25) | 280 (75) | 0.001 | 374 | 226 (60) | <0.001 |
| Pennsylvania | 222 (32) | 466 (68) | | 688 | 346 (50) | |
| Texas | 303 (25) | 916 (75) | | 1,219 | 469 (38) | |
| Washington | 236 (23) | 787 (77) | | 1,023 | 620 (61) | |
| Wisconsin | 205 (25) | 603 (75) | | 808 | 411 (51) | |
| **Sex** | | | | | | |
| Male | 448 (27) | 1,198 (73) | 0.08 | 1,646 | 789 (48) | 0.01 |
| Female | 612 (25) | 1,854 (75) | | 2,466 | 1,283 (52) | |
| **Age group** | | | | | | |
| 6 mos–8 yrs | 263 (29) | 652 (71) | <0.001 | 915 | 470 (51) | <0.001 |
| 9–17 yrs | 199 (41) | 282 (59) | | 481 | 164 (34) | |
| 18–49 yrs | 413 (28) | 1,084 (72) | | 1,497 | 595 (40) | |
| 50–64 yrs | 113 (18) | 532 (82) | | 645 | 372 (58) | |
| ≥65 yrs | 72 (13) | 502 (87) | | 574 | 471 (82) | |
| **Race/Ethnicity§** | | | | | | |
| White | 691 (24) | 2,169 (76) | 0.002 | 2,860 | 1,522 (53) | <0.001 |
| Black | 120 (32) | 260 (68) | | 380 | 134 (35) | |
| Other race | 111 (28) | 291 (72) | | 402 | 227 (56) | |
| Hispanic | 137 (30) | 325 (70) | | 462 | 186 (40) | |
| **Self-rated health status¶** | | | | | | |
| Fair or poor | 55 (18) | 248 (82) | <0.001 | 303 | 182 (60) | <0.001 |
| Good | 231 (21) | 866 (79) | | 1,097 | 576 (53) | |
| Very good | 393 (26) | 1,141 (74) | | 1,534 | 761 (50) | |
| Excellent | 380 (32) | 794 (68) | | 1,174 | 549 (47) | |
| **Illness onset to enrollment (days)** | | | | | | |
| <3 | 492 (35) | 900 (65) | <0.001 | 1,392 | 653 (47) | <0.001 |
| 3–4 | 390 (26) | 1,099 (74) | | 1,489 | 713 (48) | |
| 5–7 | 178 (14) | 1,053 (86) | | 1,231 | 706 (57) | |
| **Influenza test result** | | | | | | |
| **Negative** | **N/A** | **3,052 (74)** | N/A | **3,052** | **1,682 (55)** | N/A |
| **Influenza B positive**** | **691 (17)** | **N/A** | | **691** | **232 (34)** | |
| B/Yamagata | 3 (<1) | N/A | | 3 | 3 (100) | |
| B/Victoria | 670 (93) | N/A | | 670 | 221 (33) | |
| B lineage undetermined | 18 (7) | N/A | | 18 | 8 (44) | |
| **Influenza A positive**** | **374 (9)** | **N/A** | | **374** | **161 (43)** | |
| A (H1N1)pdm09 | 326 (63) | N/A | | 326 | 138 (42) | |
| A (H3N2) | 11 (3) | N/A | | 11 | 7 (64) | |
| A subtype undetermined | 39 (34) | N/A | | 39 | 16 (41) | |

**Abbreviation:** N/A = not applicable.

* The chi-squared statistic was used to assess differences between the numbers of persons with influenza-negative and influenza-positive test results, in the distribution of enrolled patient and illness characteristics, and in differences between groups in the percentage vaccinated.

† Defined as having received ≥1 dose of influenza vaccine ≥14 days before illness onset. A total of 104 participants who received the vaccine ≤13 days before illness onset were excluded from the study sample.

§ Patients were categorized into one of four mutually exclusive racial/ethnic populations: white, black, other race, and Hispanic. Persons identifying as Hispanic might have been of any race. Persons identifying as white, black, or other race were non-Hispanic. Race/ethnicity was missing for eight patients.

¶ General self-rated health status was missing for four patients.

** Five patients had coinfection with influenza A and influenza B, making the sum 1,065, or five more than the total number of influenza-positive patients. Two patients had coinfection with influenza A(H1N1)pdm09 and A(H3N2).

38% to 61% among study sites and differed by study site, sex, age group, race/ethnicity, self-rated health status, and days from illness onset to enrollment.

Among influenza-positive participants, 37% had received the 2019–20 seasonal influenza vaccine, compared with 55% of influenza-negative participants (Table 2). Overall, the adjusted VE was 45% against influenza A and B virus types combined, 50% against influenza B/Victoria, and 37% against A(H1N1)pdm09. VE was higher among children and adolescents aged 6 months–17 years and lower among adults aged 18–49 years,

**TABLE 2. Number and percentage of outpatients with acute respiratory illness and cough (N = 4,112) receiving 2019–20 seasonal influenza vaccine, by influenza real-time reverse transcription–polymerase chain reaction (RT-PCR) test result status, age group, and vaccine effectiveness* against all influenza A and B, B/Victoria and A(H1N1)pdm09 — U.S. Influenza Vaccine Effectiveness Network, October 23, 2019–January 25, 2020**

| | Influenza-positive | | Influenza-negative | | Vaccine effectiveness | |
|---|---|---|---|---|---|---|
| Influenza type/Age group | Total | Vaccinated no. (%) | Total | Vaccinated no. (%) | Unadjusted % (95% CI) | Adjusted† % (95% CI) |
| **Influenza A and B** | | | | | | |
| **Overall** | **1,060** | **390 (37)** | **3,052** | **1,682 (55)** | **53 (45 to 59)** | **45 (36 to 53)** |
| **Age group** | | | | | | |
| 6 mos–17 yrs | **462** | 142 (31) | **934** | 492 (53) | 60 (50 to 69) | 55 (42 to 65) |
| 18–49 yrs | **413** | 143 (35) | **1,084** | 452 (42) | 26 (6 to 42) | 25 (3 to 41) |
| ≥50 yrs | **185** | 105 (57) | **1,034** | 738 (71) | 47 (27 to 62) | 43 (19 to 60) |
| **Influenza B/Victoria** | | | | | | |
| **Overall** | **634** | **211 (33)** | **2,968** | **1,641 (55)** | **60 (52 to 66)** | **50 (39 to 59)** |
| **Age group** | | | | | | |
| 6 mos–17 yrs | **353** | 104 (29) | **934** | 492 (53) | 62 (51 to 71) | 56 (42 to 67) |
| ≥18 yrs | **317** | 117 (37) | **2,118** | 1,190 (56) | 54 (42 to 64) | 32 (11 to 48) |
| **Influenza A(H1N1)pdm09** | | | | | | |
| **Overall** | **326** | **138 (42)** | **3,052** | **1,682 (55)** | **40 (25 to 53)** | **37 (19 to 52)** |
| **Age group** | | | | | | |
| 6 mos–17 yrs | **98** | 35 (36) | **934** | 492 (53) | 50 (23 to 68) | 51 (22 to 69) |
| 18–49 yrs | **125** | 48 (38) | **1,084** | 452 (42) | 13 (-27 to 40) | 5 (–45 to 37) |
| ≥50 yrs | **103** | 55 (53) | **1,034** | 738 (71) | 54 (31 to 69) | 50 (20 to 68) |

* Vaccine effectiveness was estimated as 100% x (1 – odds ratio [ratio of odds of being vaccinated among outpatients with CDC's real-time RT-PCR influenza-positive test results to the odds of being vaccinated among outpatients with influenza-negative test results]); odds ratios were estimated using logistic regression.

† Adjusted for study site, age group, sex, race/ethnicity, self-rated general health, number of days from illness onset to enrollment, and month of illness using logistic regression.

especially against A(H1N1)pdm09 (VE = 5%; 95% CI = – 45% to 37%).

As of January 25, 2020, CDC had genetically characterized 177 influenza B/Victoria viruses from U.S. Flu VE Network participants; 172 (97%) belonged to genetic subclade V1A.3, a different subclade from the V1A.1 subclade that includes the 2019–20 B/Victoria vaccine reference strain (B/Colorado/06/2017), and five (3%) belonged to V1A.1. All of the 32 genetically characterized A(H1N1)pdm09 viruses were from genetic group 6B.1A, which includes the 2019–20 A(H1N1)pdm09 vaccine reference strain (A/Brisbane/02/2018).

## Discussion

The 2019–20 influenza season began early with predominant influenza B/Victoria virus circulation, followed by increasing A(H1N1)pdm09 virus activity, with ongoing detection of both viruses (*3*). Through the week ending February 8, 2020, influenza activity remained elevated in most parts of the country (https://www.cdc.gov/flu/weekly). Markers of severe illness, including laboratory-confirmed influenza-associated hospitalization rates among children and adolescents aged <18 years and young adults aged 18–49 years, are higher than at this time in recent seasons, including the 2017–18 season. To date for this season, 92 influenza-associated deaths have been reported in children and adolescents aged <18 years; other than the 2009 pandemic, this is the largest number reported for this time of the season since reporting began for the 2004–05 influenza season (https://www.cdc.gov/flu/weekly). These interim VE estimates indicating a 45% reduction in influenza illness associated with a medical visit so far this season are particularly important in the context of the substantial prevalence of influenza in the United States: during the previous decade, influenza caused an estimated 4.3–21 million doctor visits, 140,000–810,000 hospitalizations, and 12,000–61,000 deaths each year.[††]

Among U.S. Flu VE Network participants, influenza virus infections accounted for approximately 25% of medically attended visits for ARI, demonstrating the considerable contribution of influenza virus infections to medically attended outpatient visits for ILI this season. Both influenza A and B viruses can cause severe illness, including hospitalizations and deaths. Some studies have suggested that influenza B virus infections might also result in more severe illness among children (*4*,*5*). Interim VE estimates indicate that the 2019–20 influenza vaccine protects against the predominant B/Victoria viruses from subclade V1A.3 and are consistent with VE estimates against influenza B/Victoria

[††] https://www.cdc.gov/flu/about/burden/index.html.

(range = 49%–56%) during seasons when the B/Victoria component of the vaccine was well matched to circulating viruses.§§

Influenza A(H1N1)pdm09 circulation increased in late December 2019; as of January 31, 2020, all A(H1N1)pdm09 viruses antigenically characterized at CDC were similar to the cell-propagated vaccine reference virus for the A(H1N1)pdm09 component of the 2019–20 Northern Hemisphere vaccine. Interim VE estimates against influenza A(H1N1)pdm09 viruses among children and older adults are consistent with average VE for influenza A(H1N1)pdm09 viruses reported previously (*6*). Among adults aged 18–49 years, the interim VE estimate against influenza A(H1N1)pdm09 was low and not statistically significant. Additional enrollment during the season while A(H1N1)pdm09 viruses circulate will determine whether VE against A(H1N1)pdm09 in this age group is lower than during previous seasons and will help evaluate potential contributing factors to lower than expected effectiveness.

During the five previous influenza seasons, the number of weeks that ILI activity was above baseline ranged from 11 to 20 weeks, with an average of 18 weeks (*7*). At 21 weeks, the 2018–19 influenza season was prolonged, demonstrating that influenza activity can continue beyond the winter months. CDC continues to recommend influenza vaccination while influenza viruses are circulating. Vaccination can protect against infection with influenza viruses that are currently circulating and those that might circulate later in the season. During the 2018–19 influenza season, in which influenza A(H3N2) and A(H1N1)pdm09 viruses cocirculated, interim VE was estimated to be 29% against illnesses associated with any influenza virus (*8*) and vaccination was estimated to prevent 4.4 million illnesses, 2.3 million medical visits, 58,000 hospitalizations, and 3,500 deaths (*9*).

Current influenza vaccines are providing substantial public health benefits; however, more effective influenza vaccines are needed. Therefore, many U.S. government agencies (including CDC, the National Institutes of Health, the Food and Drug Administration, and the Biomedical Advanced Research and Development Authority) are collaborating to improve influenza vaccines in support of the executive order issued by the White House on September 19, 2019.¶¶

Influenza antiviral medications remain an important adjunct to influenza vaccination. CDC recommends antiviral treatment for any patient with suspected or confirmed influenza who is hospitalized, has severe or progressive illness, or is at high risk for complications from influenza, including children aged <2 years and adults aged ≥65 years, regardless of vaccination status or results of point-of-care influenza diagnostic testing.*** Antiviral treatment can also be considered for any previously healthy symptomatic outpatient not at high risk for complications, with confirmed or suspected influenza, if treatment can be started within 48 hours of illness onset.

The findings in this report are subject to at least four limitations. First, sample sizes were insufficient to estimate overall VE against illnesses associated with A(H3N2) virus infections. End-of-season VE estimates could change as additional patient data become available or if a change in circulating viruses occurs later in the season. Second, vaccination status included self-report at four of five sites, which might result in misclassification of vaccination status for some patients. Third, an observational study design has more potential for confounding and bias than do randomized clinical trials. However, the test-negative design is widely used in VE studies and has been extensively validated, including against findings from randomized trials (*10*). Finally, the VE estimates in this report are limited to the prevention of outpatient medical visits rather than more severe illness outcomes, such as hospitalization or death; data from studies measuring VE against more severe outcomes this season will be available at a later date.

Annual influenza vaccination is the best strategy for preventing seasonal influenza and influenza-associated complications. This season, influenza B and A(H1N1)pdm09 viruses have cocirculated, and influenza activity remains elevated in most parts of the country. Interim VE estimates indicate that the current season's influenza vaccine reduces the risk of medical visits associated with influenza, including visits associated with circulating influenza B viruses. Persons aged ≥6 months who have not yet received influenza vaccine during the current season should get vaccinated to protect against influenza.

§§ https://www.cdc.gov/flu/vaccines-work/past-seasons-estimates.html.

¶¶ https://www.whitehouse.gov/briefings-statements/statement-press-secretary-executive-order-modernizing-influenza-vaccines-u-s-promote-national-security-public-health.

*** https://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm.


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**Summary**

What is already known about this topic?

Annual vaccination against seasonal influenza is recommended for all U.S. persons aged ≥6 months. Effectiveness of seasonal influenza vaccine varies by season.

What is added by this report?

According to data from the U.S. Influenza Vaccine Effectiveness Network on 4,112 children and adults with acute respiratory illness during October 23, 2019–January 25, 2020, the overall estimated effectiveness of seasonal influenza vaccine for preventing medically attended, laboratory-confirmed influenza virus infection was 45%.

What are the implications for public health practice?

Vaccination remains the best way to protect against influenza and its potentially serious complications. CDC continues to recommend influenza vaccination while influenza viruses are circulating in the community.

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# Characteristics and Health Status of Informal Unpaid Caregivers — 44 States, District of Columbia, and Puerto Rico, 2015–2017

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In 2015, an estimated 17.7 million U.S. persons were informal caregivers who provided substantial services through in-home, unpaid assistance to their family members and friends (*1*). Caregiving can have many benefits, such as enhancing the bond between caregiver and recipient, but it can also place an emotional and physical strain on caregivers, leading to higher rates of depression, lower quality of life, and poorer overall health (*2*). As the U.S. population continues to age (*3*), the need for informal caregivers will likely increase. However, little nationally representative information on prevalence of caregivers is available. This study examined demographic characteristics and health status of informal caregivers from 44 states,* the District of Columbia (DC), and Puerto Rico, based on data from the Behavioral Risk Factor Surveillance System (BRFSS) collected during 2015–2017. Overall, approximately one in five adults reported that they had provided care to a family member or friend in the preceding 30 days. Fifty-eight percent of caregivers were women, and a majority were non-Hispanic white, with at least some college education, and married or living with a partner. Across all states, 19.2% of caregivers reported being in fair or poor health, although significant state-to-state variation occurred. Caregivers provide important support to family members, friends, and the health care system and might compromise their own health to provide this support (*1*,*2*). Better understanding of caregivers and the challenges they face could inform implementation of improvements in support systems that could enhance not only the health of the caregiver, but that of the care recipient as well. For example, additional data regarding demographics at the state level might aid in more effective planning and support of caregivers with evidence-based programs and assistance (https://www.cdc.gov/aging/publications/features/caring-for-yourself.html).

BRFSS is a random-digit–dialed landline and cellular telephone survey of noninstitutionalized, civilian U.S. adults aged ≥18 years conducted by all 50 states, DC, and three U.S. territories (*4*). Data collected during each calendar month yields a representative sample for the year. Across all states and territories, the weighted median response rate was 45.9% in 2017,† 47.0% in 2016,§ and 47.2% in 2015.¶

Over a 3-year period (2015–2017), 44 states, DC, and Puerto Rico administered a nine-question module in BRFSS about caregiving to all adult respondents aged ≥18 years. In states where the caregiving module questions were asked in more than 1 year, only the most recent year was included in the analytic data set. The module begins with a screening question: “During the past 30 days, did you provide regular care or assistance to a friend or family member who has a health problem or disability?” Respondents who answered affirmatively were classified as caregivers, and seven additional questions were asked about the main illness or condition of the care recipient, the duration and intensity of caregiving, the level of care needed, unmet needs of the caregiver, and the relationship of the caregiver to the recipient. The remaining question asked noncaregivers (those who responded “No” to the caregiving screening question) to forecast whether they anticipated becoming a caregiver in the next 2 years (Yes/No). As part of the core BRFSS, participants were asked “Would you say your health is excellent, very good, good, fair, or poor?” Information on demographic characteristics reported for caregivers included sex, race/ethnicity (non-Hispanic white [white], non-Hispanic black [black], Hispanic, and other), age (≤44 years, 45–64 years, and ≥65 years), education (high school or less versus some college or more), employment status (employed full time, part time, or self-employed versus all others), and marital status (married or living with a partner versus all others). In addition, the age-adjusted percentage** of caregivers who reported fair or poor health are presented by state. All analyses were carried out using Complex Samples procedure within SPSS Statistics software (version 24; IBM) to account for the weighted data set and complex sampling design.

During 2015–2017, a total of 441,456 U.S. noninstitutionalized adults aged ≥18 years participated in the BRFSS in the 44 states, DC, and Puerto Rico, where the optional caregiving module was administered, yielding 252,602 completed interviews. Overall, 20.7% of respondents were classified

* Alabama, Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, and Wyoming.

† https://www.cdc.gov/brfss/annual_data/2017/pdf/2017-response-rates-table-508.pdf.

§ https://www.cdc.gov/brfss/annual_data/2016/pdf/2016_ResponseRates_Table.pdf.

¶ https://www.cdc.gov/brfss/annual_data/2015/2015_ResponseRates.html.

** Age-adjusted to the 2000 U.S. Census.

as caregivers (95% confidence interval (CI) = 20.2–21.1) (Figure 1). Among those who were not currently caregivers, 16.7% (95% CI = 16.2–17.1) reported that they expected to become caregivers within the next 2 years. The percentage of caregivers across states varied, from 13.7% in Puerto Rico (95% CI = 12.5–15.0) to 28.2% in Tennessee (95% CI = 26.5–30.0). The four states with the highest prevalences of unpaid caregivers (Alabama, Arkansas, Louisiana, and Tennessee) were southern states with >25% of adults identifying as caregivers. Women accounted for 58.1% (56.9–59.3) of unpaid caregivers in all participating states, ranging from 53.0% in Alaska (95% CI = 45.8–60.0) to 62.6% in Maryland (95% CI = 56.9–67.9) (Table). The racial/ethnic characteristics of unpaid caregivers largely mirrored the racial demographics of the states. For example, the majority of caregivers in all jurisdictions except California, DC, Hawaii, New Mexico, and Puerto Rico were white, whereas in Louisiana, Maryland, and Mississippi, blacks represented ≥30% of caregivers and in DC, 57.2% of caregivers. The highest prevalences of Hispanic caregivers were in California, New Mexico, and Puerto Rico, and the highest percentages of caregivers of other races/ethnicities were in Hawaii. Overall, 44.8% of unpaid caregivers were aged <45 years, 34.4% were aged 45–64 years, and 20.7% were aged ≥65 years. However, age distribution also varied by state. In Utah and DC, 55.9% and 54.0% of caregivers, respectively, were aged <45 years, whereas persons aged ≥65 years accounted for 25.4% of caregivers in Florida and 25.1% in Oregon, the two states with the largest percentages of caregivers in this age group.

Across the jurisdictions, 61.0% of unpaid caregivers reported having at least some college education; Colorado had the highest proportion of caregivers with at least a college education (71.5%), and Arkansas had the highest proportion of caregivers with a high school diploma or less (53.0%). Overall, 56.8% of unpaid caregivers were employed, ranging from 37.8% in Puerto Rico to 66.1% in both DC and South Dakota. An average of 57.6% of caregivers were married or living with a partner, ranging from 67.2% in Idaho to 33.1% in DC.

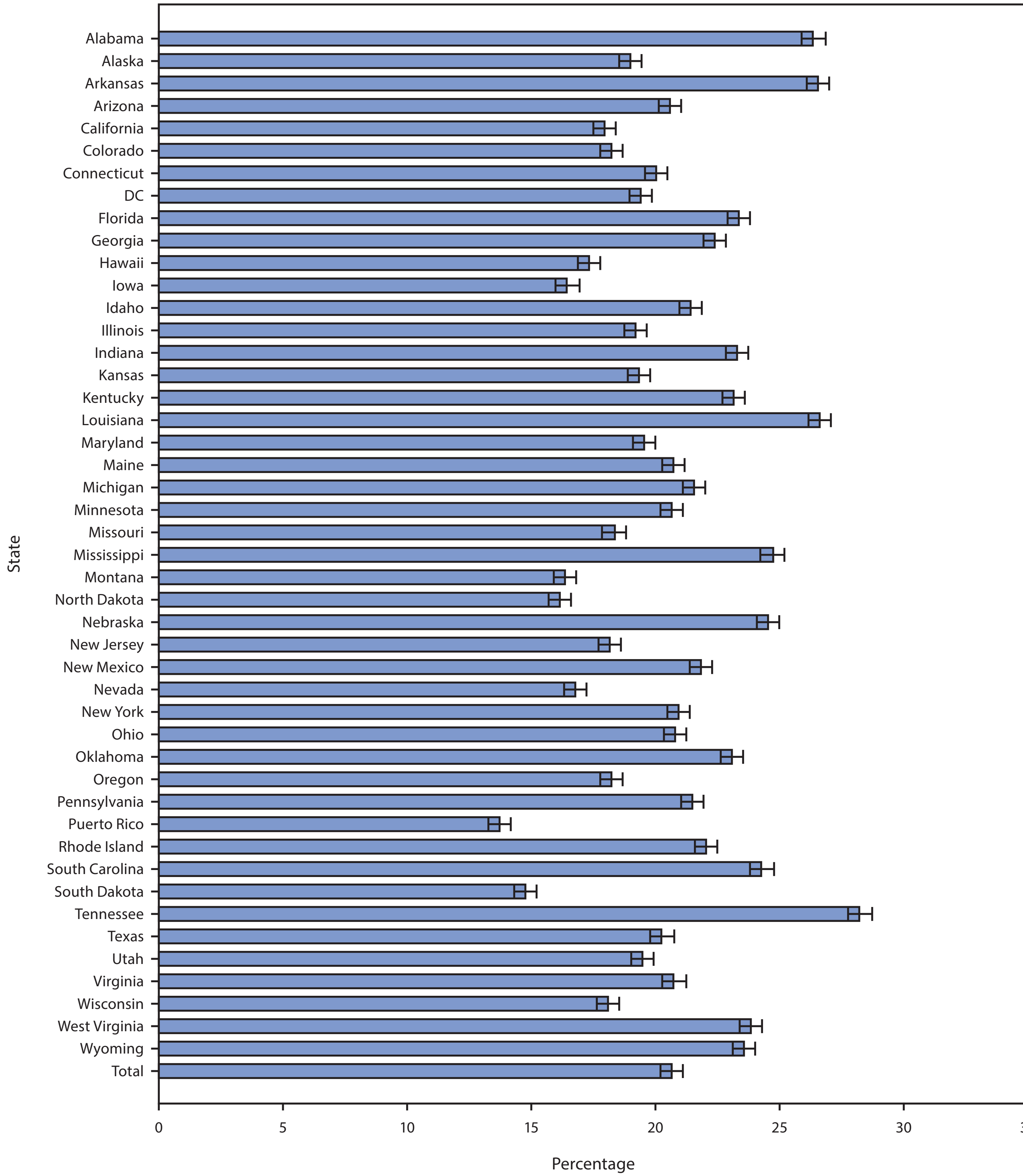
After age adjustment, 19.2% of caregivers (95% CI = 18.3–20.1) reported being in fair or poor health, although significant state-level variation occurred (Figure 2). Estimates ranged from 11.7% in Minnesota (95% CI = 10.3–13.3) to 34.4% in Puerto Rico (95% CI = 30.4–38.7). In 19 states (Alabama, Alaska, Arizona, Georgia, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Nevada, New Mexico, Ohio, Oklahoma, Oregon, Rhode Island, Tennessee, Texas, West Virginia, and Wyoming) age-adjusted rates of fair or poor caregiver health were ≥20%.

## Discussion

In 44 states, DC, and Puerto Rico, approximately one in five adults reported that they had provided care for a relative or friend in the last month during 2015–2017, suggesting that informal, unpaid caregiving is a widely occurring part of family life in the United States, and that these caregivers play an important role as an adjunct to the formal health care system. In this study, much of the responsibility of caregiving was borne by younger adults (aged <45 years). For younger persons, caregiving might adversely affect their ability to work or negatively affect their income by limiting their work hours or their ability to take on additional job responsibilities (*5*). Among older persons, the physical demands of caregiving might make continued caregiving unsustainable. This study found that the age-adjusted percentage of current caregivers who reported that their health was fair or poor was nearly 20%, with estimates ranging as high as one third in Arkansas and Puerto Rico and >20% in many other states.

As the U.S. population continues to age, the need for informal caregivers is likely to increase. Persons born during 1946–1964 (often referred to as "baby boomers"), who account for a substantial portion of the population, are reaching or are older than age 65 years; in addition, older adults are living longer, with persons aged ≥85 years the most rapidly growing age group (*3*). These circumstances were reflected in the response to the caregiving forecasting question, which found that one in six adults who were not currently engaged in caregiving expected to become caregivers in the next 2 years. Despite the forecasted increase in need for caregivers, population dynamics might result in fewer available caregivers per person for several reasons. First, the number of adult children available per person in need of care is decreasing because of smaller family size (*1*). Second, more adult women, to whom caregiving responsibilities have historically fallen, are currently in the workforce, and therefore might have less ability to become full-time family caregivers. Finally, more families are dispersed geographically, limiting the availability of nearby caregivers (*6*). As these demographic changes are occurring, there is increasing desire among persons born during 1946–1964 to stay in their homes rather than move to senior-oriented housing (*6*); family caregivers likely will be needed to support this option. Recent findings on Alzheimer's disease have indicated that Alzheimer's decedents are now more likely to die at home than in institutional settings than they were 15 years ago (*7*); relying on informal caregivers might potentially lower costs to the U.S. health care system (*8*). Given that in many states ≥20% of caregivers describe their current health status as fair or poor, the potential for losing

**FIGURE 1. Percentage of respondents self-reporting as informal, unpaid caregivers, by state — Behavioral Risk Factor Surveillance System, United States, 2015–2017***




**Abbreviation:** DC = District of Columbia.
* With 95% confidence intervals presented as error bars.

**TABLE. Demographic characteristics of informal, unpaid caregivers, by state — Behavioral Risk Factor Surveillance System, United States, 2015–2017**

| | % (95% CI) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sex | Race/Ethnicity* | | | | Age group (yrs) | | | Education level | | Employment status | Marital status |
| State | Women | White | Black | Hispanic | Other | <45 | 45–64 | ≥65 | High school or less | Some college or more | Full/Part- time employment | Married/Living with partner |
| Alabama | 57.5 (54.2–60.7) | 70.8 (67.8–73.6) | 25.6 (22.9–28.6) | 1.5 (0.8–2.6) | 2.1 (1.4–3.1) | 43.8 (42.1–45.5) | 35.1 (33.6–36.6) | 21.2 (20.1–22.2) | 46.5 (43.3–49.8) | 53.5 (50.2–56.7) | 50.2 (48.7–51.7) | 53.9 (50.6–57.1) |
| Alaska | 53.0 (45.8–60.0) | 64.8 (56.9–71.9) | 8.6 (4.1–17.2) | 4.4 (2.1–9.1) | 22.2 (16.5–29.3) | 49.1 (46.0–52.2) | 34.8 (32.1–37.6) | 16.1 (14.5–17.8) | 40.9 (33.9–48.3) | 59.1 (51.7–66.1) | 64.3 (61.5–67.1) | 63.4 (56.3–70.0) |
| Arizona | 60.1 (54.8–65.1) | 67.7 (62.0–72.8) | 4.5 (2.2–9.1) | 21.6 (17.1–26.9) | 6.2 (4.3–8.8) | 46.2 (43.6–48.8) | 31.8 (29.7–34.0) | 22.0 (20.6–23.4) | 34.9 (29.6–40.5) | 65.1 (59.5–70.4) | 52.4 (49.9–54.8) | 54.4 (48.9–59.7) |
| Arkansas | 60.2 (54.9–65.2) | 76.4 (71.1–81.0) | 13.8 (10.4–18.0) | 6.1 (3.4–10.6) | 3.7 (2.2–6.2) | 43.7 (41.0–46.4) | 33.9 (31.7–36.2) | 22.4 (20.9–23.9) | 53.0 (47.9–58.1) | 47.0 (41.9–52.1) | 50.9 (48.5–53.3) | 59.9 (54.6–65.0) |
| California | 56.1 (49.0–63.0) | 48.2 (41.1–55.3) | 7.0 (4.0–12.0) | 35.5 (28.8–42.9) | 9.3 (6.3–13.5) | 47.4 (44.6–50.2) | 34.1 (31.5–36.8) | 18.5 (16.8–20.4) | 30.5 (24.8–36.9) | 69.5 (63.1–75.2) | 57.5 (55.0–60.1) | 52.1 (45.0–59.0) |
| Colorado | 57.9 (53.2–62.4) | 71.0 (66.1–75.4) | 3.4 (1.9–6.0) | 17.0 (13.5–21.2) | 8.6 (5.8–12.6) | 48.5 (46.5–50.5) | 33.2 (31.2–35.0) | 18.4 (17.3–19.5) | 28.5 (24.5–33.0) | 71.5 (67.0–75.5) | 63.3 (61.5–65.1) | 61.4 (56.5–66.0) |
| Connecticut | 56.2 (51.6–60.8) | 70.8 (66.2–75.0) | 9.4 (6.7–13.1) | 14.1 (10.8–18.2) | 5.6 (3.9–8.1) | 41.9 (39.7–34.9) | 36.8 (34.9–38.6) | 21.4 (20.2–22.6) | 32.6 (28.2–37.3) | 67.4 (62.7–71.8) | 59.3 (57.4–61.3) | 59.1 (54.5–63.7) |
| Florida | 58.0 (52.9–62.8) | 59.7 (54.6–64.6) | 15.6 (12.0–20.1) | 18.7 (15.0–23.2) | 5.9 (4.0–8.6) | 41.1 (38.8–43.5) | 33.5 (33.5–31.5) | 25.4 (23.9–26.9) | 41.1 (36.1–46.3) | 58.9 (53.7–63.9) | 51.8 (49.7–53.9) | 55.7 (50.7–60.6) |
| Georgia | 58.2 (53.9–62.4) | 59.6 (55.3–63.8) | 28.8 (25.1–32.9) | 4.8 (3.1–7.4) | 6.8 (4.4–10.3) | 43.5 (41.5–45.6) | 36.4 (34.5–38.5) | 20.1 (18.9–21.3) | 43.0 (38.7–47.3) | 57.0 (52.7–61.3) | 55.2 (53.4–56.9) | 56.3 (51.9–60.5) |
| Hawaii | 57.1 (53.2–61.0) | 21.5 (18.5–24.9) | 1.8 (0.6–5.4) | 12.4 (9.9–15.5) | 64.3 (60.3–68.1) | 43.1 (41.5–44.8) | 32.4 (31.0–33.9) | 24.4 (23.2–25.8) | 34.7 (30.9–38.8) | 65.3 (61.2–69.1) | 62.9 (61.4–64.4) | 58.3 (54.3–62.1) |
| Idaho | 55.6 (51.3–59.8) | 83.6 (79.4–87.0) | 0.4 (0.1–2.8) | 10.1 (7.2–14.0) | 5.9 (4.2–8.3) | 46.0 (43.9–48.0) | 33.1 (31.3–34.9) | 21.0 (19.7–22.3) | 39.1 (35.0–43.3) | 60.9 (56.7–65.0) | 58.5 (56.6–60.3) | 67.2 (63.0–71.1) |
| Illinois | 57.5 (53.1–61.8) | 71.3 (67.0–75.2) | 14.6 (11.5–18.2) | 9.7 (7.2–13.0) | 4.5 (2.9–6.7) | 44.6 (42.7–46.6) | 35.6 (33.9–37.3) | 19.8 (18.7–20.9) | 34.8 (30.8–39.2) | 65.2 (60.8–69.2) | 58.1 (56.4–59.8) | 59.8 (55.5–64.0) |
| Indiana | 60.3 (56.1–64.3) | 85.9 (82.4–88.8) | 6.9 (4.8–9.7) | 4.0 (2.5–6.4) | 3.3 (2.2–5.0) | 43.4 (41.4–45.5) | 35.9 (34.1–37.7) | 20.7 (19.5–21.9) | 47.5 (43.2–51.8) | 52.5 (48.2–56.8) | 56.2 (54.3–58.0) | 62.5 (58.0–66.7) |
| Iowa | 57.3 (52.9–61.7) | 90.9 (87.3–93.5) | 3.0 (1.8–5.0) | 2.5 (1.1–5.5) | 3.6 (2.1–6.2) | 43.0 (41.2–44.8) | 34.9 (33.5–36.5) | 22.1 (21.0–23.3) | 39.2 (34.9–43.7) | 60.8 (56.3–65.1) | 61.0 (59.4–62.6) | 63.9 (59.2–68.3) |
| Kansas | 59.7 (56.8–62.5) | 80.8 (77.9–83.4) | 5.0 (3.9–6.4) | 8.6 (6.5–11.3) | 5.6 (4.4–7.2) | 45.5 (44.3–46.8) | 33.0 (31.9–34.2) | 21.4 (20.6–22.3) | 34.2 (31.4–37.1) | 65.8 (62.9–68.6) | 62.4 (61.3–63.5) | 66.6 (63.8–69.2) |
| Kentucky | 56.7 (52.7–60.6) | 87.2 (83.7–90.0) | 7.7 (5.5–10.5) | 1.8 (0.9–3.6) | 3.4 (1.9–5.9) | 43.8 (41.9–45.7) | 35.8 (34.1–37.5) | 20.4 (19.2–21.6) | 49.0 (45.1–52.9) | 51.0 (47.1–54.9) | 51.6 (49.9–53.3) | 59.3 (55.3–63.2) |
| Louisiana | 56.1 (51.9–60.1) | 62.5 (58.3–66.4) | 30.0 (26.3–34.1) | 3.3 (2.0–5.4) | 4.2 (2.9–6.0) | 45.5 (43.5–47.6) | 34.6 (32.8–36.5) | 19.8 (18.6–21.1) | 49.5 (45.4–53.5) | 50.5 (46.5–54.6) | 55.1 (53.2–56.9) | 51.9 (47.9–56.0) |
| Maine | 56.1 (52.1–60.1) | 94.4 (91.7–96.2) | 1.0 (0.3–3.4) | 1.7 (0.8–3.8) | 2.8 (1.8–4.6) | 38.0 (36.0–40.0) | 38.1 (36.3–22.7) | 23.9 (22.7–5.3) | 42.9 (38.9–47.0) | 57.1 (53.0–61.1) | 57.4 (55.6–59.2) | 64.4 (60.4–68.3) |
| Maryland | 62.6 (56.9–67.9) | 58.8 (52.7–64.6) | 30.5 (25.2–36.3) | 3.7 (2.1–6.3) | 7.0 (3.6–13.1) | 43.7 (41.0–46.5) | 35.3 (33.1–37.6) | 21.0 (19.4–22.5) | 33.5 (27.8–39.6) | 66.5 (60.4–72.2) | 61.8 (59.4–64.1) | 58.7 (52.6–64.4) |
| Michigan | 54.4 (49.6–59.2) | 73.0 (68.2–77.3) | 17.1 (13.4–21.7) | 2.9 (1.5–5.4) | 7.0 (4.9–10.0) | 42.3 (40.1–44.5) | 35.5 (33.5–37.6) | 22.2 (20.8–23.7) | 41.0 (36.3–45.9) | 59.0 (54.1–63.7) | 53.5 (51.4–55.6) | 57.4 (52.5–62.1) |
| Minnesota | 61.0 (59.0–63.1) | 86.7 (84.9–88.3) | 5.5 (4.4–6.9) | 2.3 (1.8–3.0) | 5.5 (4.5–6.7) | 44.2 (43.3–45.2) | 35.2 (34.3–36.1) | 20.6 (20.0–21.2) | 29.8 (27.8–31.9) | 70.2 (68.1–72.2) | 64.2 (63.4–65.1) | 65.2 (63.1–67.3) |
| Mississippi | 55.6 (51.3–59.8) | 58.7 (54.4–62.8) | 38.8 (34.8–43.0) | 1.8 (0.7–4.3) | 0.7 (0.3–1.6) | 45.9 (43.9–47.9) | 34.0 (32.3–35.8) | 20.1 (19.0–21.2) | 43.9 (39.8–48.2) | 56.1 (51.8–60.2) | 49.4 (47.5–51.2) | 54.0 (49.8–58.1) |
| Missouri | 57.7 (53.2–62.0) | 83.3 (79.8–86.3) | 9.8 (7.5–12.7) | 3.4 (2.0–5.8) | 3.6 (2.5–5.0) | 41.8 (39.8–43.8) | 35.2 (33.4–36.9) | 23.1 (21.8–24.3) | 45.0 (40.5–49.6) | 55.0 (50.4–59.5) | 58.4 (56.7–60.1) | 59.6 (55.0–64.1) |
| Montana | 58.2 (53.5–62.8) | 84.0 (80.1–87.2) | 0.0 (0.0) | 3.9 (2.3–6.6) | 12.1 (9.3–15.5) | 41.5 39.6–43.5) | 34.6 (32.9–36.3) | 23.9 (22.6–25.2) | 37.6 (33.0–42.3) | 62.4 (57.7–67.0) | 58.8 (57.0–60.5) | 62.5 (57.7–67.0) |
| Nebraska | 58.4 (54.8–62.0) | 85.4 (81.8–88.3) | 5.6 (3.7–8.5) | 4.6 (3.1–6.6) | 4.5 (2.8–7.0) | 46.2 (44.4–47.9) | 33.4 (31.9–35.0) | 20.4 (19.4–21.5) | 37.1 (33.6–40.7) | 62.9 (59.3–66.4) | 64.7 (63.1–66.2) | 61.3 (57.7–64.9) |
| Nevada | 54.7 (49.2–60.1) | 57.5 (51.8–63.0) | 13.9 (10.1–18.9) | 13.3 (10.2–17.2) | 15.3 (10.8–21.3) | 46.2 (43.9–48.5) | 33.5 (31.4–35.7) | 20.3 (18.8–21.9) | 38.0 (32.7–43.7) | 62.0 (56.3–67.3) | 57.7 (55.6–59.8) | 50.5 (45.2–55.8) |
| New Jersey | 58.8 (53.9–63.6) | 69.7 (65.2–73.9) | 12.1 (9.3–15.6) | 10.0 (7.3–13.5) | 8.2 (5.9–11.4) | 43.1 (40.7–45.5) | 35.8 (33.7–38.0) | 21.0 (19.7–22.6) | 36.9 (32.3–41.8) | 63.1 (58.2–67.7) | 57.7 (55.5–59.8) | 61.0 (56.4–65.5) |
| New Mexico | 58.5 (54.4–62.5) | 42.2 (38.3–46.1) | 2.0 (1.1–3.5) | 44.8 (40.7–49.0) | 11.1 (8.9–13.7) | 43.9 (42.0–45.9) | 33.2 (31.5–34.9) | 22.9 (21.6–24.2) | 36.5 (32.5–40.7) | 63.5 (59.3–67.5) | 51.2 (49.4–52.9) | 58.5 (54.3–62.5) |
| New York | 60.2 (56.2–64.1) | 64.5 (60.6–68.1) | 15.3 (12.5–18.7) | 12.8 (10.5–15.6) | 7.4 (5.4–10.1) | 44.4 (42.5–46.3) | 34.8 (33.1–36.6) | 20.7 (19.5–22.0) | 33.6 (29.7–37.8) | 66.4 (62.2–70.3) | 56.4 (54.6–58.1) | 57.2 (53.1–61.2) |
| North Dakota | 59.7 (55.3–63.9) | 85.0 (80.8–88.3) | 2.4 (0.9–5.8) | 1.6 (0.9–3.1) | 11.0 (8.3–14.6) | 47.8 (46.1–49.6) | 31.8 (30.4–33.3) | 20.3 (19.3–21.4) | 36.4 (32.1–40.9) | 63.6 (59.1–67.9) | 64.8 (63.2–66.4) | 63.3 (58.7–67.7) |
| Ohio | 60.6 (56.8–64.3) | 80.5 (76.8–83.7) | 11.8 (9.2–15.0) | 2.8 (1.6–4.9) | 4.9 (3.3–7.2) | 43.8 (42.0–45.5) | 34.9 (33.4–36.4) | 21.3 (20.3–22.4) | 43.3 (39.5–47.0) | 56.7 (53.0–60.5) | 58.0 (56.4–59.6) | 52.8 (49.1–56.5) |
| Oklahoma | 60.5 (55.5–65.2) | 72.7 (67.9–77.1) | 5.3 (3.5–8.0) | 4.3 (2.7–6.9) | 17.6 (13.9–22.1) | 46.2 (43.7–48.7) | 32.5 (30.4–34.7) | 21.3 (19.9–22.8) | 42.9 (38.0–48.0) | 57.1 (52.0–62.0) | 54.8 (52.5–57.1) | 59.5 (54.5–64.4) |

See table footnotes on next page.

**TABLE. (*Continued*) Demographic characteristics of informal, unpaid caregivers, by state — Behavioral Risk Factor Surveillance System, United States, 2015–2017**

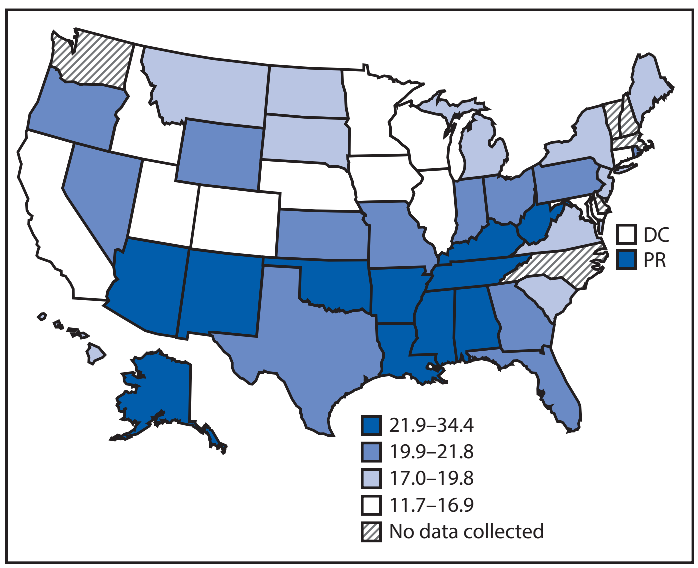
| | % (95% CI) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sex | Race/Ethnicity* | | | | Age group (yrs) | | | Education level | | Employment status | Marital status |
| State | Women | White | Black | Hispanic | Other | <45 | 45–64 | ≥65 | High school or less | Some college or more | Full/Part- time employment | Married/Living with partner |
| Oregon | 56.0 (51.8–60.2) | 82.5 (78.6–85.8) | 1.3 (0.5–3.3) | 7.1 (4.9–10.1) | 9.1 (6.8–12.1) | 40.8 (38.9–42.6) | 34.2 (32.5–35.9) | 25.1 (23.7–26.4) | 34.5 (30.4–38.8) | 65.5 (61.2–69.6) | 56.0 (54.4–57.6) | 62.0 (57.8–66.1) |
| Pennsylvania | 58.1 (53.8–62.4) | 81.4 (77.7–84.6) | 11.1 (8.5–14.3) | 4.5 (2.8–7.1) | 3.0 (1.9–4.8) | 40.0 (38.1–42.0) | 36.2 (34.5–38.0) | 23.7 (22.4–25.2) | 49.5 (45.2–53.8) | 50.5 (46.2–54.8) | 58.7 (57.0–60.3) | 59.3 (55.0–63.5) |
| Rhode Island | 58.8 (54.4–63.0) | 81.5 (77.6–84.8) | 4.4 (2.8–7.0) | 9.2 (6.8–12.3) | 5.0 (3.3–7.4) | 42.3 (40.2–44.4) | 35.3 (33.5–37.1) | 22.4 (21.2–23.7) | 35.2 (31.0–39.7) | 64.8 (60.3–69.0) | 57.1 (55.2–59.0) | 56.7 (52.4–60.9) |
| South Carolina | 57.8 (54.8–60.7) | 67.3 (64.6–70.0) | 26.9 (24.4–29.5) | 2.7 (1.7–4.3) | 3.1 (2.3–4.1) | 42.6 (41.2–44.0) | 34.7 (33.5–36.0) | 22.6 (21.8–23.5) | 44.7 (41.8–47.6) | 55.3 (52.4–58.2) | 55.6 (54.4–56.9) | 55.7 (52.8–58.6) |
| South Dakota | 59.5 (53.0–65.7) | 77.9 (71.0–83.6) | 1.0 (0.2–5.9) | 4.8 (1.9–11.4) | 16.3 (11.7–22.3) | 43.9 (41.6–46.3) | 33.8 (31.7–35.9) | 22.3 (20.7–23.9) | 44.6 (38.3–51.1) | 55.4 (48.9–61.7) | 66.1 (64.1–68.1) | 63.3 (56.8–69.4) |
| Tennessee | 58.3 (54.6–61.9) | 75.9 (72.4–79.2) | 17.5 (14.7–20.8) | 2.6 (1.3–5.0) | 4.0 (2.8–5.6) | 42.5 (40.5–44.5) | 35.0 (33.2–36.8) | 22.6 (21.3–23.9) | 47.1 (43.5–50.7) | 52.9 (49.3–56.5) | 56.1 (54.3–57.8) | 59.4 (55.7–63.0) |
| Texas | 58.7 (52.5–64.7) | 57.6 (50.9–64.0) | 10.9 (7.0–16.6) | 26.7 (21.4–32.7) | 4.8 (2.5–9.1) | 51.2 (48.4–54.0) | 31.9 (29.4–34.6) | 16.8 (15.3–18.4) | 36.4 (30.6–42.7) | 63.6 (57.3–69.4) | 57.5 (54.8–60.2) | 59.4 (53.0–65.5) |
| Utah | 62.2 (58.2–66.0) | 85.4 (82.1–88.2) | 0.5 (0.2–1.6) | 9.4 (7.2–12.3) | 4.6 (3.0–6.8) | 55.9 (54.2–57.7) | 28.3 (26.8–29.9) | 15.8 (14.7–16.8) | 31.0 (27.2–35.0) | 69.0 (65.0–72.8) | 64.8 (63.1–66.4) | 64.4 (60.3–68.4) |
| Virginia | 57.8 (54.4–61.1) | 69.6 (66.4–72.7) | 19.4 (17.0–22.1) | 5.9 (4.1–8.3) | 5.1 (3.6–7.1) | 43.9 (42.4–45.5) | 36.4 (34.9–37.8) | 19.7 (18.7–20.8) | 41.2 (38.0–44.5) | 58.8 (55.5–62.0) | 62.7 (61.3–64.1) | 59.2 (55.9–62.4) |
| West Virginia | 57.7 (54.5–60.9) | 92.4 (90.2–94.2) | 3.5 (2.4–5.2) | 0.9 (0.4–1.9) | 3.2 (2.1–4.8) | 40.9 (39.4–42.4) | 35.5 (34.1–36.9) | 23.6 (22.5–24.8) | 52.2 (49.0–55.3) | 47.8 (44.7–51.0) | 47.3 (45.8–48.8) | 60.5 (57.3–63.7) |
| Wisconsin | 55.1 (50.6–59.5) | 87.5 (83.5–90.6) | 7.0 (4.5–10.7) | 3.4 (1.9–6.0) | 2.1 (1.5–3.1) | 41.5 (39.5–43.5) | 36.9 (35.1–38.7) | 21.6 (20.4–23.0) | 39.7 (35.5–44.1) | 60.3 (55.9–64.5) | 61.9 (60.1–63.5) | 62.9 (58.4–67.2) |
| Wyoming | 55.2 (50.5–59.8) | 84.9 (79.8–88.8) | 0.6 (0.2–1.5) | 6.4 (3.9–10.3) | 8.1 (5.2–12.6) | 45.3 (42.9–47.6) | 35.1 (33.1–37.1) | 19.6 (18.4–20.9) | 38.7 (34.0–43.6) | 61.3 (56.4–66.0) | 61.1 (59.0–63.1) | 62.4 (57.4–67.1) |
| District of Columbia | 58.7 (53.9–63.4) | 27.3 (23.1–32.0) | 57.2 (52.1–62.1) | 9.3 (5.9–14.3) | 6.2 (4.1–9.4) | 54.0 (52.0–56.1) | 29.7 (28.0–31.4) | 16.3 (15.1–17.5) | 30.7 (26.4–35.3) | 69.3 (64.7–73.6) | 66.1 (64.2–68.0) | 33.1 (29.1–37.5) |
| Puerto Rico | 62.1 (57.0–67.0) | 0.8 (0.3–2.1) | 0.0 (0.0) | 98.9 (97.6–99.5) | 0.2 (0.0–1.1) | 46.3 (44.5–48.2) | 32.8 (31.1–34.5) | 20.9 (19.7–22.1) | 42.9 (38.1–47.9) | 57.1 (52.1–61.9) | 37.8 (36.1–39.6) | 57.9 (53.1–62.6) |
| **Total** | **58.1 (56.9–59.3)** | **67.2 (65.9–68.4)** | **12.9 (12.0–13.7)** | **13.8 (12.7–14.9)** | **6.2 (5.6–6.8)** | **44.8 (44.4–45.4)** | **34.4 (33.9–34.9)** | **20.7 (20.4–21.1)** | **39.0 (37.9–40.2)** | **61.0 (59.8–62.1)** | **56.8 (56.3–57.3)** | **57.6 (56.4–58.8)** |

**Abbreviation:** CI = confidence interval.
* Whites, blacks, and others were non-Hispanic; Hispanics could be of any race.

informal caregivers because of poor health exists and needs to be addressed to support caregivers and expanded offerings that allow caregivers to address their own health concerns. The possibility exists that caregivers with fair or poor health might have chosen caregiving because their health has rendered them unable to work in a conventional job. However, given that these data are cross-sectional, understanding this dynamic is beyond the scope of this investigation. Further, the state-to-state variation observed suggests that states and communities might need to tailor efforts to the specific needs of local caregivers.

The findings in this report are subject to at least three limitations. First, information about caregiving was self-reported and might be influenced by social desirability and recall bias. Second, many persons who perform caregiving tasks might not identify their actions as caregiving, but rather think of these responsibilities as part of family living, which could underestimate the number of caregivers. Finally, because BRFSS interviews only one participant per household, a family caregiver who is not the interviewee could be present, thereby undercounting caregivers.

**FIGURE 2. Adjusted percentage* of informal, unpaid caregivers reporting fair or poor health, by state — Behavioral Risk Factor Surveillance System, United States, 2015–2017**




**Abbreviations:** DC = District of Columbia; PR = Puerto Rico.
* Age-adjusted to the 2000 U.S. Census.

**Summary**

What is already known about this topic?

Informal, unpaid caregivers provide important support to family members, friends, and the health care system and might compromise their own health to provide this support.

What is added by this report?

During 2015–2017, approximately 20% of respondents to the Behavioral Risk Factors Surveillance System survey were classified as caregivers. Nearly 20% of caregivers reported fair or poor health, with wide interstate variation, ranging from 11.7% to 34.4%.

What are the implications for public health practice?

Because caregiving is a public health issue of increasing importance as the U.S. population ages, the health status of caregivers warrants special attention.

State-specific data might be used to estimate the current scope of caregiving, and for scaling and delivering interventions to support caregivers with state-specific programs. These are the first state-level estimates of self-rated caregiver health. Health care systems could use these data to make organizational updates that account for the important role caregivers have in supporting persons with chronic conditions and disabilities outside health care settings. At the federal level, these findings could inform discussions about ways that caregivers could be supported in federal programs and service delivery Additional data regarding demographics at the state level might aid in planning and supporting caregivers with evidence-based programs and assistance (https://www.cdc.gov/aging/publications/features/caring-for-yourself.html). In all cases, however, these data highlight the need to ensure that caregivers themselves maintain good health; their incapacitation potentially could lead to additional hospitalizations or earlier placement into long-term care of persons who could otherwise be cared for in their home. Proactively addressing the needs of families and caregivers might forestall or eliminate these outcomes. Caregiving can adversely affect the functioning of the caregiver in all domains of well-being (*2*). It can also provide benefits, such as the emotional satisfaction of caring for a loved one, a sense of purpose, financial savings compared with the cost of institutional care, new skills, and increased confidence (*1*,*6*). Caregiving is a public health issue of increasing importance as the U.S. population ages. As public health data systems are modernized, opportunities to analyze data that are more current will expand and should yield more accurate and timely findings to guide policy. Better understanding of caregivers and the challenges they face could inform implementation of improvements in support systems that could enhance not only the health of the caregiver, but that of the care recipient as well.

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# State and Territorial Laws Prohibiting Sales of Tobacco Products to Persons Aged <21 Years — United States, December 20, 2019

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Raising the minimum legal sales age (MLSA) for tobacco products to 21 years (T21) is a strategy to help prevent and delay the initiation of tobacco product use (*1*). On December 20, 2019, Congress raised the federal MLSA for tobacco products from 18 to 21 years. Before enactment of the federal T21 law, localities, states, and territories were increasingly adopting their own T21 laws as part of a comprehensive approach to prevent youth initiation of tobacco products, particularly in response to recent increases in use of e-cigarettes among youths (*2*). Nearly all tobacco product use begins during adolescence, and minors have cited social sources such as older peers and siblings as a common source of access to tobacco products (*1*,*3*). State and territorial T21 laws vary widely and can include provisions that might not benefit the public's health, including penalties to youths for purchase, use, or possession of tobacco products; exemptions for military populations; phase-in periods; and preemption of local laws. To understand the landscape of U.S. state and territorial T21 laws before enactment of the federal law, CDC assessed state and territorial laws prohibiting sales of all tobacco products to persons aged <21 years. As of December 20, 2019, 19 states, the District of Columbia (DC), Guam, and Palau had enacted T21 laws, including 13 enacted in 2019. Compared with T21 laws enacted during 2013–2018, more laws enacted in 2019 have purchase, use, or possession penalties; military exemptions; phase-in periods of 1 year or more; and preemption of local laws related to tobacco product sales. T21 laws could help prevent and reduce youth tobacco product use when implemented as part of a comprehensive approach that includes evidence-based, population-based tobacco control strategies such as smoke-free laws and pricing strategies (*1*,*4*).

Information regarding T21 laws enacted as of December 20, 2019, was obtained from the CDC State Tobacco Activities Tracking and Evaluation (STATE) System for the 50 states, DC, American Samoa, Guam, Marshall Islands, the Commonwealth of the Northern Mariana Islands, Palau, Puerto Rico, and the U.S. Virgin Islands.* Legislation information collected quarterly from the Lexis online legal research database is analyzed, coded, and entered into STATE by CDC. Provisions of T21 laws assessed in STATE include purchase, use, or possession penalties; entities responsible for enforcement; and enacted and effective dates.† In addition, T21 laws were examined to ascertain the inclusion or exemption of military populations; and state T21 and licensing statutes were assessed to determine whether the state prohibits localities from enacting laws to address retail tobacco product sales (i.e., "preemption"). Using STATE, cigarette tax rates (per pack of 20 cigarettes) and comprehensive smoke-free laws prohibiting smoking in all indoor areas of worksites, restaurants, and bars were also assessed as an indicator of the state's current implementation of evidence-based tobacco control strategies (*4*).

The number of state-level jurisdictions with T21 laws increased from one (Palau) in 2013 to 22 (including 19 states, DC, Guam, and Palau) as of December 20, 2019 (Figure). Six states, DC, Guam, and Palau enacted T21 laws during 2013–2018, and 13 states enacted T21 laws in 2019 (Table). Compared with 2013–2018, more laws enacted during 2019 contained purchase, use, or possession penalties (six versus nine, respectively); military exemptions (one versus six, respectively); or phase-in periods of 1 year or more (two versus four, respectively). Six states with T21 laws enacted in 2019 preempt local laws to address tobacco product sales, compared with four with such laws enacted before 2019.

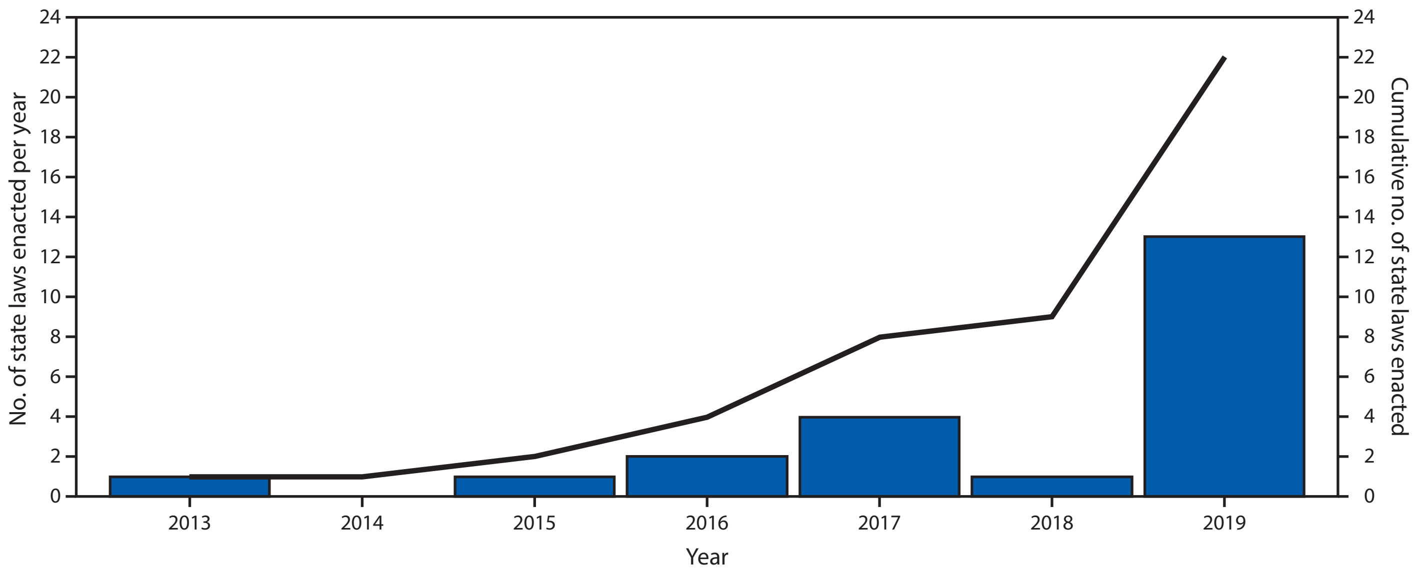
Compared with 2013–2018, more T21 laws enacted in 2019 occurred in states and territories without comprehensive smoke-free laws (two versus five, respectively), or with a cigarette tax rate of <$2.00 per pack (one versus five, respectively). Among the 19 states, DC, Guam, and Palau that had T21 laws as of December 2019, 13 states, DC, and Guam impose a range of penalties for youths, whereas six states and Palau do not impose penalties for youths. Similarly, T21 laws place responsibility for enforcement on a range of entities, most commonly law enforcement (eight states and Palau) and health entities (seven states and Guam).

## Discussion

Before Congress enacted a federal T21 law in December 2019, 19 states, DC, Guam, and Palau had enacted T21 laws. Provisions contained within these state and territorial T21 laws varied widely, and many of the more recently enacted laws contain provisions that could minimize their public health impact. For example, research indicates that purchase, use, or possession penalties might not be effective for changing behavior (*5*), and African-American and Hispanic youths are more likely to be cited for violations than their peers (*6*). In addition, military exemptions exclude young adults at risk for

* https://www.cdc.gov/STATESystem/.
† Information is also available in STATE regarding penalties to retailers for violations of minimum legal age of sale laws.

**FIGURE. Number of states and territories that have enacted laws prohibiting sales of tobacco products to persons aged <21 years — United States, 2013–2019**




tobacco product use and limit the population-level impact of T21 laws (*7*), and preemption impedes localities from implementing future evidence-based tobacco control strategies (*4*,*8*). In contrast, the federal T21 law, which became effective immediately upon passage, does not include purchase, use, or possession penalties or military exemptions. Adequately enforced T21 policies, coupled with evidence-based tobacco control strategies, such as comprehensive smoke-free laws and high prices for tobacco products, can help prevent and reduce youth use of tobacco products (*1*,*4*,*8*).

A well-enforced, nationwide T21 law has been projected to result in a 12% decrease in tobacco product use prevalence and to avert 223,000 premature deaths (*1*). However, the impact of recently enacted state T21 laws is still being evaluated, and a 2015 Institute of Medicine report noted that "evidence on the independent effect of youth access policies in the context of other tobacco control policies is mixed" (*1*). T21 laws are therefore complements to, but not substitutes for, other evidence-based tobacco control strategies (*1*,*8*). However, despite evidence that population-level strategies such as comprehensive smoke-free laws and high prices for tobacco products prevent youth tobacco product use (*4*,*8*), of the 19 states, DC, and two territories with T21 laws, five states, Guam, and Palau do not have comprehensive smoke-free laws and six states have cigarette tax rates below the national average (mean) tax per pack.

Similar to the federal T21 law, most state T21 laws do not exempt military populations or feature extended phase-in periods. In 2015, Hawaii became the first state to enact a T21 law that included military populations, which was implemented within 7 months. Given that tobacco product use adversely impacts military readiness, T21 laws without military exemptions help promote both public health and national security goals. In 2019, the surgeons general of the Air Force, Army, Navy, and United States wrote a joint letter recommending that Department of Defense leadership make tobacco product use less convenient and coordinate with local, state, and national efforts to reduce tobacco product use.[§]

In recent years, the tobacco industry, including e-cigarette manufacturers, has voiced public support for T21 laws (*9*). However, industry-sponsored tobacco control laws have historically featured provisions that undermine youth tobacco prevention goals (*8*). In 2012, the U.S. Surgeon General noted that tobacco industry–supported youth access bills tend to include provisions that preempt stricter local laws; place responsibility for enforcement on agencies without necessary capabilities; complicate prosecution of retailers for violations; and focus penalties on youths for tobacco product purchase, use, or possession (*8*). In 2014, the Surgeon General concluded that the epidemic of tobacco use was initiated and has been sustained by the tobacco industry (*4*). Therefore, it is important to closely monitor provisions within industry-supported strategies and to assess their potential to adversely affect public health objectives.

The findings in this report are subject to at least one limitation. STATE does not account for local laws, bills under consideration, regulations, or opinions of attorneys general, and it does not systematically account for case law decisions. For example, at least 470 localities have enacted T21 laws,

[§] https://www.stripes.com/opinion/tobacco-product-use-threatens-military-readiness-1.589063.

**TABLE. Provisions of state and territorial laws prohibiting tobacco sales to persons aged <21 years (T21) — United States, December 20, 2019**

| Jurisdiction | Provisions of T21 laws: Penalize youths for purchase, use, and/or possession | Potential youth penalties | Exemption for members of the armed services | Entity responsible for enforcement* | Enacted date | Effective date | Preemption of local laws that address retail sales of tobacco products† | Comprehensive smoke-free law | Cigarette tax rate ($/pack) |
|---|---|---|---|---|---|---|---|---|---|
| Arkansas | Purchase, Use, Possession | Community service and educational program; Fine | Yes | Substance control board | 3/28/2019 | 12/31/2021 | Prohibits MLSA >21,† Other local retail policies | No | 1.15 |
| California | Purchase, Possession | Fine or community service | Yes | Health entity | 5/4/2016 | 6/9/2016 | Prohibits MLSA >21 | Yes (includes e-cigarettes) | 2.87 |
| Connecticut | None | None | No | Financial entity | 6/18/2019 | 10/1/2019 | None | No | 4.35 |
| Delaware | None | None | No | Law enforcement | 4/17/2019 | 7/16/2019 | Prohibits MLSA >21, Other local retail policies | Yes (includes e-cigarettes) | 2.10 |
| District of Columbia | Purchase, Possession | Civil penalty | No | None explicitly listed | 11/29/2016 | 11/29/2016 | N/A | Yes (includes e-cigarettes) | 4.94 |
| Guam | Purchase, Use, Possession | Educational program | No | Health entity; Financial entity | 3/23/2017 | 1/1/2018 | N/A | No | 4.00 |
| Hawaii | Purchase, Use, Possession | Fine | No | None explicitly listed | 6/19/2015 | 1/1/2016 | Prohibits MLSA >21, Other retail policies | Yes (includes e-cigarettes) | 3.20 |
| Illinois | Purchase | Petty offense | No | Law enforcement | 4/8/2019 | 7/1/2019 | None | Yes | 2.98 |
| Maine | Purchase | Civil penalty; educational program | No | Law enforcement | 8/2/2017 | 7/1/2021 | None | Yes | 2.00 |
| Maryland | None | None | Yes | Health entity | 5/13/2019 | 10/1/2019 | Inconclusive | Yes | 2.00 |
| Massachusetts | None | None | No | None explicitly listed | 7/27/2018 | 12/31/2021 | Prohibits MLSA >21 | Yes (includes e-cigarettes) | 3.51 |
| New Jersey | None | None | No | Health entity, Law enforcement | 7/21/2017 | 11/1/2017 | None | Yes (includes e-cigarettes) | 2.70 |
| New York | None | None | No | Health entity, Law enforcement | 7/16/2019 | 11/13/2019 | None | Yes (includes e-cigarettes) | 4.35 |
| Ohio | Purchase, Use, Possession | Community service | No | None explicitly listed | 7/18/2019 | 10/17/2022 | None | Yes | 1.60 |
| Oregon | Purchase, Possession | Misdemeanor | No | Health entity | 8/9/2017 | 1/1/2018 | Prohibits other local retail policies | Yes (includes e-cigarettes) | 1.33 |
| Palau | None | None | No | Law enforcement | 5/27/2013 | 6/6/2013 | N/A | No | 5.00 |
| Pennsylvania | Purchase | Summary offense; community service, cessation program, and/or a fine | Yes | Health entity, Substance control board | 11/27/2019 | 07/01/2020 | Prohibits MLSA >21, Other local retail policies | No | 2.60 |
| Texas | Purchase, Use, Possession | Fine; educational program or community service | Yes | Law enforcement, Financial entity | 6/7/2019 | 8/31/2022 | Prohibits MLSA >21, Other local retail policies | No | 1.41 |
| Utah | Purchase, Possession | Misdemeanor; fine and educational program | Yes; also exempts spouses and dependents aged ≥19 yrs | Health entity | 3/25/2019 | 7/1/2021 | Prohibits MLSA >21, Other local retail policies | Yes (includes e-cigarettes) | 1.70 |
| Vermont | Purchase, Possession | Fine or community service | No | Substance control board | 5/16/2019 | 9/1/2019 | None | Yes (includes e-cigarettes) | 3.08 |
| Virginia | Purchase, Possession | Civil penalty; fine or community service | Yes | Law enforcement, Substance control board | 2/21/2019 | 7/1/2019 | Inconclusive | No | 0.30 |
| Washington | Purchase, Possession | Civil penalty; fine and/or community service | No | Substance control board, Law enforcement | 4/5/2019 | 1/1/2020 | Prohibits MLSA >21, Other local retail policies | Yes | 3.03 |
| **Total** | **None: 6 states and Palau** | **None: 6 states and Palau** | **No exemption: 12 states, DC, Guam, Palau** | **Law enforcement: 8 states, Palau; Health entity: 7 states, Guam; Substance control board: 5 states; Financial entity: 2 states, Guam; None specified: 3 states, DC** | **2013: Palau; 2015: 1 state; 2016: 1 state, DC; 2017: 3 states, Guam; 2018: 1 state; 2019: 13 states** | **Phase-in period of <1 year: 13 states, DC, Guam, Palau** | **No preemption: 7 states** | **Yes, includes e-cigarettes: 9 states, DC; Yes, smoking only: 5 states** | **>3.00: 6 states, DC, Guam, Palau** |

**Abbreviation:** MLSA = minimum legal sales age.

* "Law enforcement" includes law enforcement officers (Maine, New Jersey, New York, Texas, and Virginia), Department of Safety and Homeland Security (Delaware), State's Attorney (Illinois), Bureau of Public Safety (Palau), and peace officers (Washington); "Health entity" includes state and local health departments (California, Maryland, New Jersey, New York, Oregon, and Utah) and Departments of Mental Health and Substance Abuse (Guam); "Substance control board" includes Tobacco Control Board (Arkansas), Tobacco Settlement Act contractor (Pennsylvania), Board of Liquor and Lottery (Vermont), Alcohol Beverage Control Agents (Virginia), and State Liquor and Cannabis Board (Washington); "Finance entity" includes Commissioner of Revenue Services (Connecticut), Director of Revenue and Taxation (Guam), and Comptroller (Texas).

† State T21 and licensing statutes were assessed to determine whether local laws that address retail tobacco product sales are preempted. "Prohibits MLSA >21" indicates states that prohibit localities from raising the MLSA for tobacco products above age 21 years; "Other local retail policies" indicates states that preempt local regulations of tobacco product sales and distribution other than minimum sales age, including retailer licensing (Arkansas, Delaware, Hawaii, Pennsylvania, Utah, and Washington), preemption of local retailer licensing (Texas), and preemption of local vending machine regulations (Oregon); "Inconclusive" indicates states with no explicit preemption, but unclear scope of local authority based on case law; and "N/A" includes District of Columbia and territories.

**Summary**

What is already known about this topic?

Raising the minimum legal sales age for tobacco products to 21 years (T21) is a strategy to help prevent and delay the initiation of tobacco product use.

What is added by this report?

Before Congress enacted a federal T21 law on December 20, 2019, 19 states, DC, and two territories had enacted T21 laws, including 13 in 2019. Several state and territorial T21 laws include penalties for youth purchase, use, or possession of tobacco products; military exemptions; phase-in periods; or preemption of local tobacco retail laws.

What are the implications for public health practice?

A strategy combining comprehensive smoke-free laws, pricing strategies, and T21 laws free of purchase, use, or possession penalties, preemption, or military exemptions, can help prevent and reduce youth tobacco product use.

beginning in 2005 onward, many in states that subsequently enacted statewide T21 laws (*10*). The federal T21 law that went into effect on December 20, 2019, applies to the sale of all tobacco products to all persons aged <21 years throughout the United States, its territories, and on tribal lands. Enforcement of the law is focused on retailer, rather than youth, compliance. The federal T21 law does not preempt more stringent state, local, territorial, or tribal MLSA laws, nor limit state or local authority to regulate the sale of tobacco products; however, if those laws are not as strong as federal law, retailers still must comply with the federal law. Jurisdictions may continue to adopt their own T21 laws to help bolster compliance or may raise the MLSA to >21 years.[¶] The law requires the Food and Drug Administration to publish a final rule updating the current age of sale regulations within 180 days.

Even though youth cigarette smoking has been steadily declining for 2 decades, overall tobacco product use among youths has increased in recent years, driven primarily by unprecedented increases in current e-cigarette use (*2*). A comprehensive strategy that combines evidence-based strategies, such as comprehensive smoke-free laws and pricing strategies, as well as newer strategies such as T21 laws, can help prevent and reduce tobacco product use among U.S. youths (*1*,*4*).

[¶] https://www.fda.gov/tobacco-products/retail-sales-tobacco-products/selling-tobacco-products-retail-stores.

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# Autochthonous Chagas Disease — Missouri, 2018

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On December 13, 2017, the Missouri Department of Health and Senior Services (MDHSS) was notified of a suspected case of Chagas disease in a Missouri woman. The patient had donated blood, and laboratory screening revealed antibodies to *Trypanosoma cruzi*, the parasite that causes Chagas disease. Evaluation by physicians found no clinical symptoms consistent with Chagas disease. The patient had no travel history that would have suggested a significant risk for Chagas disease risk and had no occupational exposure to the disease agent. She had never received a blood transfusion or organ transplant. Confirmatory testing of the patient's serum at CDC for *T. cruzi* antibody was consistent with infection. These findings raise the possibility that the exposure to *T. cruzi* occurred locally (autochthonously) in Missouri. Although the insect vector for the parasite *T. cruzi*, triatomines (commonly known as "kissing bugs"), has been identified previously in Missouri, no locally acquired human cases of Chagas disease have been identified in the state. Health care providers and public health professionals should be aware of the possibility of locally acquired Chagas disease in the southern United States.

## Case Report

In October 2017, a woman aged 53 years visited her local blood donation center to donate blood. On October 25, 2017, she was notified that a screening test (Abbott Prism Chagas; Abbott Laboratories) of the collected blood was positive for antibodies to *T. cruzi*. The follow-up confirmatory multistep enzyme strip immunoassay test (Abbott ESA Chagas; Abbott Laboratories) performed on November 8, 2017, also yielded a positive result. The patient was referred by her physician to an infectious disease specialist for further evaluation.

The patient reported no known triatomine bites. Her travel history was remarkable for a trip to California approximately 28 years earlier, when she crossed the Mexican border for a few hours to go shopping. She also traveled to Florida and Alabama for vacation but could not recall the specific year. She reported no insect bites or any medical complaints during those trips.

The patient underwent diagnostic testing at a commercial laboratory on November 28, 2017, with an enzyme-linked immunosorbent assay (ELISA) for *T. cruzi* immunoglobulin G (IgG), and the results were positive. After discussion with subject matter experts at CDC, confirmatory diagnostic testing was done on September 6, 2018. All diagnostic tests were developed at CDC's Parasitic Diseases laboratory. A Wiener recombinant antigen enzyme immunoassay (EIA) for *T. cruzi* antibody was positive, and the trypomastigote excreted secreted antigen (TESA) immunoblot assay, a laboratory-developed test, was negative. Because the first two test results were discordant, related to limitations of specificity and sensitivity associated with differences in *T. cruzi* strains endemic in different geographic areas, a third test, a laboratory-developed immunofluorescence assay (IFA) for *T. cruzi* IgG antibody, was conducted, and the result was positive.

Given the potential for *T. cruzi* infection to cause cardiomyopathy, an electrocardiogram was obtained, which showed arrhythmias, including primary atrioventricular block with prolonged PR interval (increased time between the beginning of the P wave and the start of the QRS complex). The patient also underwent echocardiography, which showed mild concentric left ventricular hypertrophy. Both findings were consistent with the chronic phase of infection. After all confirmatory testing, the patient completed a 60-day course of benznidazole (5 mg/kg/day) as treatment for Chagas disease. The patient's blood cell count and liver enzyme levels were monitored closely during her trypanocidal course for treatment side effects.

## Public Health Investigation

The patient had lived in Missouri her entire life and moved to her current county of residence in 1999. From 1999 to 2012, she had lived in three different houses of varying structural integrity and had moved into her current (fourth) house in 2012. The patient reported seeing boxelder bugs, which do not transmit disease, but had never seen a "kissing bug" at any of the four properties. The patient's husband recalled seeing some insects consistent with the digital images of triatomine bug in one of their residences but could not recall specific time and location.

An environmental evaluation was conducted by MDHSS and local public health agency staff members at all four residencies. Brush, woodpiles, and construction debris were found on most properties. Time-worn, nonresidential structures (e.g., sheds) that provided opportunities for animal nesting were also present at all properties. Two of the older residential structures had sufficient external damage to allow easy insect access to the interior. There were crawl spaces under the two houses. No triatomine insects were detected at any of the properties.

## Discussion

The protozoan parasite *T. cruzi* can be transmitted by infected insect vectors, from mother to baby (congenital) and, much less commonly, through organ transplantation or blood transfusion from an infected donor. Transmission through the oral route has also been described (*1*). Mammals, especially rodents and marsupials, are reservoirs of *T. cruzi* in a sylvatic cycle, but humans, dogs, and cats can also serve as reservoirs in areas where the parasite is endemic. Acute *T. cruzi* infection is rarely identified because it usually causes a mild nonspecific illness or is asymptomatic. Without treatment, infection persists for the lifetime of the infected person and can result in gastrointestinal disease or serious cardiac manifestations, including heart failure, stroke, or life-threatening ventricular arrhythmias in approximately 30% of those who are chronically infected (*2*).

An enzootic *T. cruzi* transmission involving at least 11 triatomine species and 24 species of wild animals has been well documented in the southern United States going back approximately 150 years (*3*). Historical records of triatomine findings show species distributed across at least 29 states in the United States (*4*). There are an estimated 300,000 persons with Chagas disease in the United States, but only 28 autochthonous infections had been documented from 1955 to 2015 (*5*). Triatomine species in the United States are primarily sylvatic and typically not found colonizing human dwellings. Prevalence of *T. cruzi* infection in triatomines can vary and transmission is not efficient; the parasite is passed in the triatomine's feces and infection occurs when feces contaminate a break in the skin or conjunctiva. In Missouri, *Triatoma sanguisuga* vectors have been identified during 2012–2016 and as recently as July 2019 (MDHSS surveillance, unpublished data, 2019) (*6*). In 2018, a single finding of *T. lecticularia* in Missouri was confirmed by molecular typing at CDC.

Blood donor screening for *T. cruzi* antibodies in the U.S. blood supply was first implemented in 2007 (*3*). Positive results from blood donor screening for *T. cruzi* antibodies should be followed by diagnostic testing. Diagnosis of chronic Chagas disease is based on positive results from at least two serologic tests that use different techniques and different antigen preparations because no single test is sufficiently sensitive and specific for diagnosis.* Commonly used techniques include ELISA using recombinant antigens, TESA, and IFA. This patient's results were positive with EIA and negative with TESA. CDC's testing algorithm employs a third test when results of the first two tests are discordant. In the Missouri patient, the IFA result was positive for *T. cruzi* antibody. Based on the patient's testing results, history and presentation, this patient likely represents the first documented autochthonous case of Chagas disease in Missouri.

Most persons with Chagas disease acquired their infection in the parts of Latin America where Chagas disease is endemic (*5*). Currently, more than a century after its discovery in Latin America, Chagas disease has a global distribution including the United States because of migration from areas with endemic disease. Few cases of locally acquired vectorborne infection have been reported in the United States. The likely autochthonous case described in this report underscores importance of health care provider awareness of possible Chagas disease even in the states considered low risk for this infection and need for the careful consideration of the patient's history to identify possible risks for *T. cruzi* infection.

* https://www.cdc.gov/parasites/chagas/health_professionals/dx.html.

**Summary**

What is already known about this topic?

Locally acquired cases of Chagas disease are exceedingly rare in the United States. Only 28 autochthonous infections were documented from 1955 to 2015.

What is added by this report?

In 2017, a blood donation in Missouri screened positive for antibodies to *Trypanosoma cruzi*, the parasite that causes Chagas disease. Based on the epidemiologic, clinical, and laboratory data, the reported case likely represents the first documented autochthonous case of Chagas disease in Missouri.

What are the implication for public health practice?

Although most documented cases are among persons originally from Latin America, health care providers and public health professionals should be aware of the possibility of locally acquired Chagas disease in the southern United States.

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# Notes from the Field

## Characteristics of Million Hearts Hypertension Control Champions, 2012–2019

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Million Hearts is a national initiative co-led by CDC and the Centers for Medicare & Medicaid Services that aims to prevent 1 million heart attacks, strokes, and other related acute cardiovascular events by 2022 (*1*,*2*). On November 19, 2019, the initiative recognized 17 Million Hearts Hypertension Control Champions for achieving ≥80% blood pressure control rates among their patients with hypertension. These Champions include clinicians, practices, health centers, and health systems from 15 states that provide care for 201,045 adult patients, approximately one third (68,019) of whom have hypertension. The Hypertension Control Challenge is held annually to identify new Champions, with a call for applications in the spring, review and vetting in the summer, and announcement of Champions in the late fall. Since 2012, Million Hearts has recognized 118 Champions from 36 states and the District of Columbia who care for more than 15 million adult patients, including 5 million with hypertension (Table).*

Hypertension is a leading modifiable risk factor for heart disease and stroke (*1*–*3*). In light of this risk and the potential impact on preventing cardiovascular events by controlling hypertension, Million Hearts focuses on improving control of blood pressure among persons with hypertension. The Hypertension Control Challenge is an opportunity to call attention to the importance of controlling blood pressure in preventing cardiovascular disease and to create a sense of urgency around hypertension control, encouraging clinicians and health systems to share their achievements and promote their successful strategies.

To be eligible for recognition as a 2019 Champion, applicants were required to have an adult patient population of at least 500 persons and a hypertension control rate of 80% or higher among patients aged 18–85 years with diagnosed hypertension during a 12-month reporting period starting on or after January 1, 2018. Hypertension control was defined as a last blood pressure reading of <140/90 mm Hg, which aligns with current clinical performance measure specifications used by the health care sector to track progress in hypertension control.† Using definitions consistent with these specifications nationally, approximately 75 million adults have hypertension, and only one half of these persons have their hypertension controlled (*4*). Applicants submitted information on their patient population size, demographic characteristics, and hypertension prevalence and control rates. Applicants' eligibility status was assessed, and a subset of their submitted hypertension control data was validated through a formal external review.§

All 17 Champions identified in 2019 were from the private sector, including nine (53%) who had a rural-only service area and five health centers funded by the Health Resources and Services Administration. Among the 17 Champions, the median adult patient population size was 2,639 (range = 574–137,415) (Table). The median hypertension prevalence was 34% (range = 21%–52%), and the median hypertension control rate was 84% (range = 80%–98%).

This national recognition program demonstrates that achieving high hypertension control rates is possible across a range of health care settings and among patient populations at high risk for uncontrolled hypertension (*1*–*5*). Various strategies have been reported by past Champions that supported their achievement of high control rates (*5*). Specific strategies highlighted by this year's Champions included identifying a clinician within their organization who was dedicated to leading their hypertension management quality improvement efforts, arranging frequent office visits until blood pressure control was achieved, using hypertension treatment protocols and electronic health record–supported patient registries to guide patient treatment and follow-up, and providing clinician feedback through performance reports. In addition, Champions reported engaging patients in self-measured blood pressure monitoring to assess progress, inform decision-making, and encourage treatment adherence. A broader application of the strategies used by the Champions identified through the Hypertension Control Challenge could help to improve hypertension control rates nationally and decrease the incidence of heart disease and stroke.

* https://millionhearts.hhs.gov/partners-progress/champions/list.html.
† http://www.qualityforum.org.

§ https://www.federalregister.gov/documents/2019/02/12/2019-01914/announcement-of-requirements-and-registration-for-the-2019-million-hearts-hypertension-control.

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**TABLE. Characteristics of patient populations treated by Million Hearts Hypertension Control Champions, 2012–2019**

| Characteristic | 2019 | 2012–2018* | Total |
|---|---|---|---|
| **Champions (total no.)** | 17 | 101 | 118 |
| **States represented, no.** | 15† | 35 | 37§ |
| **Sector, no.** | | | |
| Private | 17 | 98 | 115 |
| Federal | 0 | 3 | 3 |
| **Service area type, no. (%)** | | | |
| Urban | 7 (41) | 50 (50) | 57 (48) |
| Rural | 9 (53) | 19 (19) | 28 (24) |
| Both urban and rural | 1 (6) | 32 (32) | 33 (28) |
| **HRSA-funded health centers, no. (%)** | 5 (29) | 31 (31)¶ | 36 (31)¶ |
| **No. of adult patients treated annually** | | | |
| Median (range) | 2,639 (574–137,415) | 6,682 (550–6,100,000) | 5,706 (550–6,100,000) |
| Total | 201,045 | 15,049,386 | 15,250,431 |
| **Self-reported patient population characteristics, median percentage (no. of Champions with response; percentage range)** | | | |
| Minority** | 20 (17; 0–92) | 27 (98; 0–100) | 25 (115; 0–100) |
| English as a second language | 3 (17; 0–85) | 3 (96; 0–95) | 3 (113; 0–95) |
| Medicaid beneficiary | 15 (17; 0–75) | 18 (98; 0–85) | 17 (115; 0–85) |
| Uninsured | 5 (17; 0–21) | 5 (18; 0–33) | 5 (35; 0–33) |
| **No. of adult patients with hypertension treated annually** | | | |
| Median among Champions (range) | 838 (189–45,704) | 1,676 (96–2,900,000) | 1,474 (96–2,900,000) |
| Total | 68,019 | 5,023,114 | 5,091,133 |
| **Median hypertension prevalence, % (range)** | 34 (21–52) | 30 (7–86) | 31 (7–86) |
| **Median blood pressure control rate,†† % (range)** | 84 (80–98) | 80 (70–99) | 81 (70–99) |

**Abbreviation:** HRSA = Health Resources and Services Administration.
* Excludes 2016.
† California, Connecticut, Florida, Illinois, Iowa, Kentucky, New Jersey, New York, Pennsylvania, Rhode Island, Texas, Utah, Virginia, Washington, and Wisconsin.
§ In addition to the states in which 2019 Champions were recognized, also includes the District of Columbia, Colorado, Georgia, Hawaii, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, New Hampshire, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, South Carolina, Tennessee, West Virginia, and Wyoming; the U.S. Department of Veterans Affairs was also recognized as a Champion in 2013 and has coverage throughout the United States.
¶ Information on HRSA-funded health center status was not consistently collected during 2012–2017; therefore, it might be underreported.
** Minority status of the patient population was determined by the applicant. No formal definition was recommended for use.
†† During 2012–2017, Champions were recognized for having blood pressure control rates of 70% or higher.

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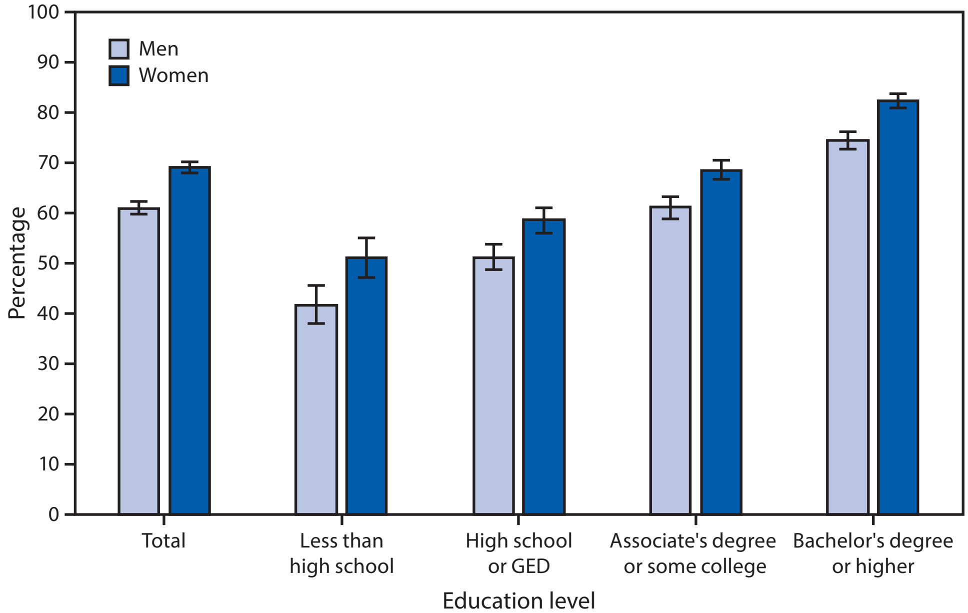
# QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

## Age-Adjusted Percentage* of Adults Aged ≥25 Years Who Saw a Dentist in the Past Year,† by Education Level and Sex — National Health Interview Survey,§ 2018




**Abbreviation:** GED = general educational development certificate.

* With 95% confidence intervals shown with error bars.

† Based on a response of "6 months or less" or "More than 6 months, but not more than 1 year ago" to the question "About how long has it been since you last saw a dentist? Include all types of dentists, such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists."

§ Estimates are based on household interviews of a sample of the noninstitutionalized U.S. civilian population aged ≥25 years and are derived from the National Health Interview Survey Sample Adult component. Estimates are age-adjusted using the projected 2000 U.S. population as the standard population and using four age groups: 25–34, 35–44, 45-64, and ≥65 years.

In 2018, among adults aged ≥25 years, women (69.4%) were more likely than men (61.2%) to have seen a dentist in the past year. The percentage of men and women who saw a dentist in the past year increased as education level increased. Among women, those with a Bachelor's degree or higher were the most likely to have seen a dentist in the past year (82.5%) and those with less than a high school education were least likely (51.4%). Among men, the same pattern prevailed (74.6% compared with 41.9%). Within each education group, the percentage of women who saw a dentist in the past year was higher than the percentage for men.

**Source:** National Health Interview Survey, 2018. https://www.cdc.gov/nchs/nhis/index.htm.

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