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Current Cigarette Smoking Among Adults — United States, 2016

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The U.S. Surgeon General has concluded that the burden of death and disease from tobacco use in the United States is overwhelmingly caused by cigarettes and other combusted tobacco products (*1*). Cigarettes are the most commonly used tobacco product among U.S. adults, and about 480,000 U.S. deaths per year are caused by cigarette smoking and secondhand smoke exposure (*1*). To assess progress toward the *Healthy People 2020* target of reducing the proportion of U.S. adults aged ≥18 years who smoke cigarettes to ≤12.0% (objective TU-1.1),* CDC analyzed data from the 2016 National Health Interview Survey (NHIS). In 2016, the prevalence of current cigarette smoking among adults was 15.5%, which was a significant decline from 2005 (20.9%); however, no significant change has occurred since 2015 (15.1%). In 2016, the prevalence of cigarette smoking was higher among adults who were male, aged 25–64 years, American Indian/Alaska Native or multiracial, had a General Education Development (GED) certificate, lived below the federal poverty level, lived in the Midwest or South, were uninsured or insured through Medicaid, had a disability/limitation, were lesbian, gay, or bisexual (LGB), or had serious psychological distress. During 2005–2016, the percentage of ever smokers who quit smoking increased from 50.8% to 59.0%. Proven population-based interventions are critical to reducing the health and economic burden of smoking-related diseases among U.S. adults, particularly among subpopulations with the highest smoking prevalences (*1*,*2*).

NHIS is an annual, nationally representative in-person survey of the noninstitutionalized U.S. civilian population. The NHIS core questionnaire is administered to a randomly selected adult in the household (the sample adult). In 2016, the NHIS was administered to 33,028 adults aged ≥18 years; the response rate was 54.3%. Current cigarette smokers were respondents who reported having smoked ≥100 cigarettes during their lifetime and were smoking every day or some days at the time of interview. Former smokers were respondents who reported having smoked ≥100 cigarettes during their lifetime but were not smoking at the time of interview. The mean number of cigarettes smoked per day was calculated among daily smokers. Quit ratios were defined as the ratio of former smokers to ever smokers (i.e., persons who had smoked ≥100 cigarettes during their lifetime).

Data were weighted to adjust for differences in the probability of selection and nonresponse and to provide nationally representative estimates. Current smoking was assessed overall

* https://www.healthypeople.gov/2020/topics-objectives/topic/tobacco-use/objectives.

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and by sex, age, race/ethnicity, education, poverty status,[†] U.S. Census region,[§] health insurance coverage at the time of survey,[¶] disability/limitation status,[**] sexual orientation,[††] and presence or absence of serious psychological distress.[§§]

[†] Based on reported family income and family size: 2005 estimates are based on reported family income and family size, using the 2004 poverty thresholds published by the U.S. Census Bureau, and 2016 estimates are based on reported family income and family size, using the 2015 poverty thresholds published by the U.S. Census Bureau.

[§] *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[¶] Private coverage: Includes adults who had any comprehensive private insurance plan (including health maintenance organizations and preferred provider organizations). Medicaid: For adults aged <65 years, includes adults who do not have private coverage, but who have Medicaid or other state-sponsored health plans including Children's Health Insurance Program (CHIP). For adults aged ≥65 years, includes adults who do not have any private coverage but have Medicare and Medicaid or other state-sponsored health plans including CHIP; Medicare only: Includes older adults who only have Medicare coverage; Other coverage: Includes adults who do not have private insurance, Medicaid, or other public coverage, but who have any type of military coverage or Medicare (for those aged <65 years). This category also includes adults who are covered by other government programs. Uninsured: Includes adults who have not indicated that they are covered at the time of the interview under private health insurance, Medicare, Medicaid, CHIP, a state-sponsored health plan, other government programs, or military coverage.

[**] Disability/limitation was defined based on self-reported presence of selected impairments including vision, hearing, cognition, and movement. Limitations in performing activities of daily living was defined based on response to the question, "Does [person] have difficulty dressing or bathing?" Limitations in performing instrumental activities of daily living was defined based on response to the question, "Because of a physical, mental, or emotional condition, does [person] have difficulty doing errands alone such as visiting a doctor's office or shopping?" Any disability/limitation was defined as a "yes" response pertaining to at least one of the disabilities/limitations listed (e.g., vision, hearing, cognition, movement, activities of daily living, or instrumental activities of daily living). A random sample of half the respondents from the 2016 Person File were asked about disability/limitation. Disability/limitation estimates (%, population estimate) were obtained using the specific adult disability weight.

[††] Starting in 2013, sexual orientation questions were added to NHIS for the first time. To determine sexual orientation, adult respondents were asked, "Which of the following best represents how you think of yourself?" with a response options of gay ("lesbian or gay" for female respondents), straight, that is, "not gay" ("not lesbian or gay" for female respondents), bisexual, something else, and I don't know the answer.

[§§] The six-question K6 scale was developed to identify persons with a high likelihood of having a diagnosable mental illness and associated functional limitations. The K6 scale asked how often during the past 30 days the respondents felt a) so sad that nothing could cheer them up; b) nervous; c) restless or fidgety; d) hopeless; e) that everything was an effort; and f) worthless. Responses were on a five-point Likert scale ranging from none of the time to all of the time. For each question, a value of zero, one, two, three, or four was assigned to the response "none of the time," "a little of the time," "some of the time," "most of the time," or "all of the time," respectively. Responses to the six items were summed to yield a K6 score between 0 and 24, with a score of 13 or higher indicating serious psychological distress. Additional information available at https://www.cdc.gov/nchs/data/databriefs/db203.pdf.

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Differences between groups were assessed using a Wald F test, with statistical significance defined as p<0.05. Population counts were estimated from extrapolated probability weights, rounded down to the nearest 10,000 persons. Quit ratios were calculated overall and by age group. Logistic regression was used to assess overall trends in prevalence, cigarettes smoked per day, and quit ratios during 2005–2016, controlling for sex, age, and race/ethnicity. T-tests were performed to examine differences between 2015 and 2016.

In 2016, 15.5% (37.8 million) of U.S. adults were current cigarette smokers (Table). Overall, smoking prevalence did not change significantly from 2015 (15.1%) to 2016 (15.5%). Current cigarette smoking prevalence was higher among males (17.5%) than among females (13.5%). By age group, prevalence was higher among adults aged 25–44 years (17.6%) and 45–64 years (18.0%) than among those aged 18–24 years (13.1%) or ≥65 years (8.8%). Prevalence was highest among American Indian/Alaska Natives (31.8%) and lowest among non-Hispanic Asians (9.0%). Among adults aged ≥25 years, prevalence was highest among persons with a GED (40.6%) and lowest among those with a graduate degree (4.5%). Prevalence was higher among persons living below the poverty level (25.3%) than those at or above this level (14.3%). By region, prevalence was higher in the Midwest (18.5%) and South (16.9%) than the West (12.3%) or Northeast (13.3%). By insurance status, prevalence was higher among Medicaid enrollees (25.3%) and uninsured adults (28.4%) than among those covered by private insurance (11.8%), Medicare only (10.2%), or other public insurance (19.8%). Prevalence was higher among adults with a disability/limitation (21.2%) than among those with no disability/limitation (14.4%). Prevalence was higher among LGB adults (20.5%) than among heterosexual adults (15.3%) and among adults with serious psychological distress (35.8%) than among those without serious psychological distress (14.7%).

Among current smokers, the proportion of daily smokers was 76.1% in 2016, which declined from 2005 (80.8%, p-value for trend <0.05) (data not shown). Whereas mean number of cigarettes smoked per day declined from 2005 (16.7) to 2016 (14.1) among daily smokers (p-value for trend <0.05), no change occurred between 2015 (14.2) and 2016 (14.1) (data not shown). During 2005–2016, increases occurred in the proportion of daily smokers who smoked 1–9 cigarettes per day (from 16.4% to 25.0%) or 10–19 (from 36.0% to 39.0%) cigarettes per day (Figure 1). At the same time, decreases occurred in the proportion of daily smokers who smoked 20–29 (from 34.9% to 28.4%) or ≥30 (from 12.7% to 7.5%) cigarettes per day during 2005–2016 (p-value for trend <0.05). No significant changes in any category of number of cigarettes smoked per day occurred during 2015–2016.

Summary

What is already known about this topic?

The U.S. Surgeon General has concluded that the burden of death and disease from tobacco use in the United States is overwhelmingly caused by cigarettes and other combusted tobacco products. Cigarettes are the most commonly used tobacco product among U.S. adults, and about 480,000 deaths per year are caused by cigarette smoking and secondhand smoke exposure.

What is added by this report?

The proportion of U.S. adults who smoke cigarettes declined from 20.9% in 2005 (45.1 million smokers) to 15.5% in 2016 (37.8 million smokers), but cigarette smoking prevalence did not change significantly during 2015–2016. Sociodemographic disparities in cigarette smoking persist. During 2005–2016, increases occurred in the proportion of adult ever smokers who quit smoking (50.8% to 59.0%).

What are the implications for public health practice?

Proven population-based interventions, including tobacco price increases, comprehensive smoke-free laws, high-impact anti-tobacco media campaigns, and barrier-free access to tobacco cessation counseling and medications, are critical to reducing cigarette smoking and smoking-related disease and death among U.S. adults, particularly among subpopulations with the highest smoking prevalence.

The overall quit ratio increased from 50.8% in 2005 to 59.0% in 2016 (p<0.05). During 2005–2016, the largest increase in quit ratios occurred among adults aged 25–44 years (from 37.0% to 48.9% [p<0.05]) (Figure 2).

Discussion

During 2005–2016, the prevalence of cigarette smoking among U.S. adults declined from 20.9% to 15.5%, and the proportion of ever smokers who had quit increased. However, during 2015–2016, cigarette smoking prevalence did not change significantly. In 2016, 37.8 million U.S. adults were current cigarette smokers, and marked sociodemographic differences in smoking prevalence persist. Proven population-based interventions, including tobacco price increases, comprehensive smoke-free laws, anti-tobacco mass media campaigns, and barrier-free access to tobacco cessation counseling and medications, are critical to reduce cigarette smoking and smoking-related disease and death among U.S. adults, particularly among subpopulations with the highest prevalences.

The observed disparities in smoking prevalence are likely attributable to multiple factors (*1*). Racial or ethnic differences might be partly explained by sociocultural influences and norms related to the acceptability of tobacco use and variations in exposure to tobacco marketing, whereas disparities by education might be partly attributable to variations in

TABLE. Characteristics of current adult cigarette smokers* — National Health Interview Survey, United States, 2016

Characteristic	Males (n = 14,991)		Females (n = 18,037)		Total (n = 33,028)	
	Weighted % (95% CI)	Population estimate†	Weighted % (95% CI)	Population estimate	Weighted % (95% CI)	Population estimate
Overall	**17.5 (16.6–18.5)**	**20,660,000**	**13.5 (12.8–14.3)**	**17,110,000**	**15.5 (14.8–16.1)**	**37,770,000**
Age group (yrs)						
18–24	14.7 (12.1–17.3)	2,180,000	11.5 (9.4–13.7)	1,700,000	13.1 (11.4–14.8)	3,890,000
25–44	20.6 (19.0–22.3)	8,480,000	14.6 (13.3–15.9)	6,170,000	17.6 (16.5–18.7)	14,660,000
45–64	19.3 (17.9–20.8)	7,820,000	16.8 (15.5–18.0)	7,190,000	18.0 (17.0–19.0)	15,020,000
≥65	10.1 (8.8–11.5)	2,160,000	7.7 (6.7–8.7)	2,030,000	8.8 (8.0–9.6)	4,200,000
Race/Ethnicity§						
White	17.8 (16.8–18.8)	13,570,000	15.5 (14.6–16.5)	12,530,000	16.6 (15.9–17.4)	26,100,000
Black	20.2 (17.2–23.2)	2,600,000	13.5 (11.5–15.5)	2,130,000	16.5 (14.7–18.3)	4,730,000
Hispanic	14.5 (11.8–17.2)	2,780,000	7.0 (5.6–8.3)	1,350,000	10.7 (9.2–12.3)	4,140,000
AI/AN	29.3 (19.3–39.4)	230,000	34.3 (24.4–44.2)	260,000	31.8 (24.1–39.5)	490,000
Asian¶	14.0 (10.7–17.3)	910,000	4.6 (2.8–6.4)	340,000	9.0 (7.1–10.9)	1,260,000
Multirace	27.7 (19.9–35.5)	520,000	22.9 (16.5–29.2)	460,000	25.2 (20.4–30.0)	990,000
Education level**						
0–12 yrs (no diploma)	28.9 (25.7–32.1)	3,760,000	19.5 (17–22)	2,590,000	24.1 (22.1–26.2)	6,360,000
≤8th grade	22.4 (16.9–27.8)	1,100,000	10.4 (7.7–13.1)	530,000	16.2 (13.3–19.2)	1,630,000
9th–11th grade	35.1 (30.4–39.8)	2,070,000	26.2 (22.5–29.8)	1,530,000	30.7 (27.6–33.7)	3,610,000
12th grade (no diploma)	26.7 (20.7–32.8)	580,000	22.8 (14.8–30.9)	520,000	24.8 (19.8–29.7)	1,100,000
GED	45.5 (38.7–52.2)	1,350,000	36.1 (30.1–42.0)	1,140,000	40.6 (36.1–45.1)	2,490,000
High school graduate	23.1 (21.1–25.1)	5,120,000	16.5 (14.9–18.2)	3,860,000	19.7 (18.4–21.1)	8,980,000
Some college (no degree)	19.8 (17.6–22.1)	3,420,000	18.1 (16.4–19.8)	3,370,000	18.9 (17.6–20.3)	6,790,000
Associate degree	17.1 (14.7–19.6)	1,990,000	16.4 (14.4–18.5)	2,330,000	16.8 (15.2–18.3)	4,330,000
Undergraduate degree	9.1 (7.7–10.5)	1,990,000	6.4 (5.4–7.5)	1,530,000	7.7 (6.8–8.6)	3,520,000
Graduate degree	5.5 (4.1–6.9)	730,000	3.5 (2.5–4.5)	510,000	4.5 (3.6–5.3)	1,250,000
Poverty status††						
At or above poverty level	16.4 (15.4–17.3)	16,380,000	12.3 (11.5–13.0)	12,650,000	14.3 (13.6–14.9)	29,030,000
Below poverty level	28.8 (25.8–31.9)	3,500,000	22.7 (20.4–25.0)	3,770,000	25.3 (23.4–27.2)	7,270,000
Unspecified	14.2 (10.9–17.5)	770,000	10.2 (7.5–12.8)	690,000	12.0 (9.8–14.1)	1,470,000
U.S. Census region§§						
Northeast	15.2 (13.3–17.0)	3,260,000	11.5 (9.9–13.1)	2,640,000	13.3 (11.9–14.6)	5,910,000
Midwest	19.2 (17.4–20.9)	4,950,000	17.8 (16.2–19.5)	5,050,000	18.5 (17.2–19.7)	10,000,000
South	19.7 (17.9–21.5)	8,310,000	14.2 (12.8–15.6)	6,370,000	16.9 (15.5–18.2)	14,680,000
West	14.6 (13.0–16.3)	4,120,000	10.1 (8.7–11.4)	3,030,000	12.3 (11.1–13.4)	7,160,000
Health insurance coverage¶¶						
Private insurance	13.5 (12.5–14.4)	10,490,000	10.1 (9.4–10.9)	8,170,000	11.8 (11.1–12.4)	18,670,000
Medicaid	27.7 (24.5–30.9)	3,260,000	23.9 (21.6–26.2)	4,650,000	25.3 (23.4–27.3)	7,910,000
Medicare only (≥65)	11.8 (9.4–14.2)	830,000	9.1 (7.4–10.8)	910,000	10.2 (8.8–11.7)	1,750,000
Other public insurance	21.9 (18.8–25.1)	1,540,000	17.1 (14.0–20.3)	970,000	19.8 (17.4–22.2)	2,510,000
Uninsured	32.8 (29.5–36.1)	4,270,000	22.6 (19.7–25.6)	2,250,000	28.4 (26.1–30.7)	6,530,000

See table footnotes on page 57.

understanding of the range of health hazards caused by smoking (*3*,*4*). Variations in access to evidence-based tobacco cessation treatments through insurance coverage might partially explain the differences observed across insurance types (*5*). Smoking prevalence was higher among persons with severe psychological distress (*6*,*7*), potentially because of higher levels of addiction and dependence, lack of financial resources, less access to cessation treatments, and stressful living conditions among these persons (*6*,*7*). Assessing the smoking status of all patients served in psychiatric inpatient and outpatient settings, integrating evidence-based cessation interventions into mental health treatment plans, and implementing tobacco-free campus policies in mental health care facilities could help reduce smoking in this population (*6*,*7*).

During 2005–2016, an increasing proportion of adults who ever smoked cigarettes had quit smoking. However, following consecutive significant annual declines during 2013–2014 and 2014–2015 (*8*), no change in smoking prevalence was observed between 2015 and 2016. Moreover, longstanding declines in the proportion of daily smokers who smoked ≥20 cigarettes per day have stalled in recent years. These findings could be the result of multiple factors, including slowed progress in the adoption of proven interventions (*9*), or increased nicotine dependence from the concurrent use of other tobacco products (*1*). These findings underscore the importance of enhanced and sustained implementation of proven population-level interventions to continue previously observed annual declines in adult cigarette smoking (*2*).

TABLE. (*Continued*) Characteristics of current adult cigarette smokers* — National Health Interview Survey, United States, 2016

Characteristic	Males (n = 14,991)		Females (n = 18,037)		Total (n = 33,028)	
	Weighted % (95% CI)	Population estimate†	Weighted % (95% CI)	Population estimate	Weighted % (95% CI)	Population estimate
Disability/Limitation***						
Yes	25.5 (22.8–28.2)	2,470,000	18.0 (16.1–20.0)	2,320,000	21.2 (19.6–22.9)	4,790,000
No	16.4 (15.3–17.6)	6,360,000	12.6 (11.6–13.6)	5,630,000	14.4 (13.6–15.2)	11,990,000
Sexual orientation†††						
Straight	17.3 (16.3–18.2)	19,230,000	13.5 (12.7–14.2)	15,920,000	15.3 (14.6–16.0)	35,160,000
Gay/Lesbian/Bisexual	23.8 (17.6–30.1)	620,000	17.9 (13.8–22.0)	600,000	20.5 (16.7–24.3)	1,230,000
Serious psychological distress (Kessler Scale)§§§						
Yes	39.3 (33.3–45.2)	1,290,000	33.6 (28.8–38.5)	1,720,000	35.8 (32.1–39.6)	3,010,000
No	16.8 (15.9–17.8)	18,610,000	12.7 (11.9–13.5)	14,850,000	14.7 (14.0–15.4)	33,460,000

Abbreviations: AI/AN = American Indian/Alaska Native; CI = confidence interval; GED = General Education Development certificate.

* Persons who reported smoking ≥100 cigarettes during their lifetime and who, at the time of interview, reported smoking every day or some days. Excludes 111 respondents whose smoking status was unknown.

† Population estimates are calculated from extrapolated probability weights and are rounded down to the nearest 10,000 persons. Therefore, they may not add up to the overall population estimate.

§ Excludes 89 respondents of non-Hispanic unknown race. Unless otherwise indicated, all racial/ethnic groups are non-Hispanic; Hispanics can be of any race.

¶ Does not include Native Hawaiians or Other Pacific Islanders.

** Among persons aged ≥25 years. Excludes 107 persons whose education level was unknown.

†† Family income is reported by the family respondent who might or might not be the same as the sample adult respondent from whom smoking information is collected. 2016 estimates are based on reported family income and family size, based on the 2015 poverty thresholds published by the U.S. Census Bureau.

§§ *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

¶¶ Private coverage: Includes adults who had any comprehensive private insurance plan (including health maintenance organizations and preferred provider organizations). Medicaid: For adults aged <65 years, includes adults who do not have private coverage, but who have Medicaid or other state-sponsored health plans including Children's Health Insurance Program (CHIP). For adults aged ≥65 years, includes adults who do not have any private coverage but have Medicare and Medicaid or other state-sponsored health plans including CHIP; Medicare only: Includes older adults who only have Medicare coverage; Other coverage: Includes adults who do not have private insurance, Medicaid, or other public coverage, but who have any type of military coverage or Medicare (for those aged <65 years). This category also includes adults who are covered by other government programs. Uninsured: Includes adults who have not indicated that they are covered at the time of the interview under private health insurance, Medicare, Medicaid, CHIP, a state-sponsored health plan, other government programs, or military coverage.

*** Disability/limitation was defined based on self-reported presence of selected impairments including vision, hearing, cognition, and movement. Limitations in performing activities of daily living was defined based on response to the question, "Does [person] have difficulty dressing or bathing?" Limitations in performing instrumental activities of daily living was defined based on response to the question, "Because of a physical, mental, or emotional condition, does [person] have difficulty doing errands alone such as visiting a doctor's office or shopping?" Any disability/limitation was defined as a "yes" response pertaining to at least one of the disabilities/limitations listed (e.g., vision, hearing, cognition, movement, activities of daily living, or instrumental activities of daily living). A random sample of half the respondents from the 2016 Person File were asked about disability/limitation. Disability/limitation estimates (%, population estimate) were obtained used the specific adult disability weight.

††† Response options provided on the National Health Interview Survey were "straight, that is, not gay" for men, and "straight, that is, not gay or lesbian" for women.

§§§ The Kessler psychological distress scale is a series of six questions that ask about feelings of sadness, nervousness, restlessness, worthlessness, and feeling like everything is an effort in the past 30 days. Participants were asked to respond on a Likert Scale ranging between "None of the time" (score = 0) and "All of the time" (score = 4). Responses were summed over the six questions; any person with a score of ≥13 was coded as having serious psychological distress, and respondents with a score <13 were coded as not having serious psychological distress.

The findings in this report are subject to at least five limitations. First, smoking status was self-reported and not validated by biochemical testing; however, self-reported smoking status is correlated with serum cotinine levels (*10*). Second, because NHIS does not include institutionalized populations and persons in the military, results are not generalizable to these groups. Third, the NHIS response rate of 54.3% might have resulted in nonresponse bias, even after adjustment for nonresponse. Fourth, the assessment of broad racial/ethnic populations (e.g., Asians and Hispanics) can mask differences in smoking prevalence among subgroups of these populations.¶¶ Finally, these estimates might differ from those reported from other surveys. These differences can be partially explained by varying survey methodologies and definitions of current smoking; however, trends in prevalence are comparable across surveys (*1*).

Sustained implementation of comprehensive state tobacco control programs can accelerate progress toward reducing adult smoking prevalence (*2*). Targeted interventions are warranted to reach subpopulations with the highest incidence of use, and can result in substantial reductions in tobacco-related disease and death and billions of dollars in savings from averted medical costs (*1*).

Conflict of Interest

No conflicts of interest were reported.

¶¶ https://www.cdc.gov/mmwr/volumes/65/wr/mm6530a1.htm.

[1]Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, CDC.

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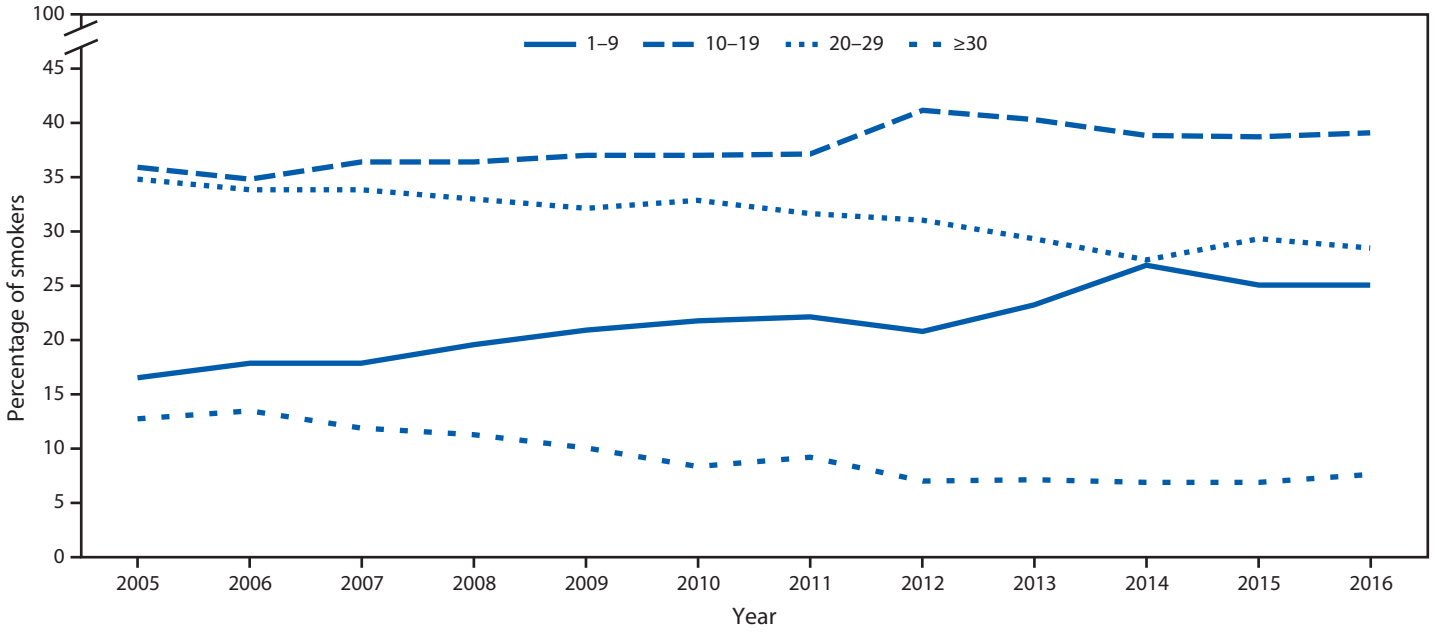
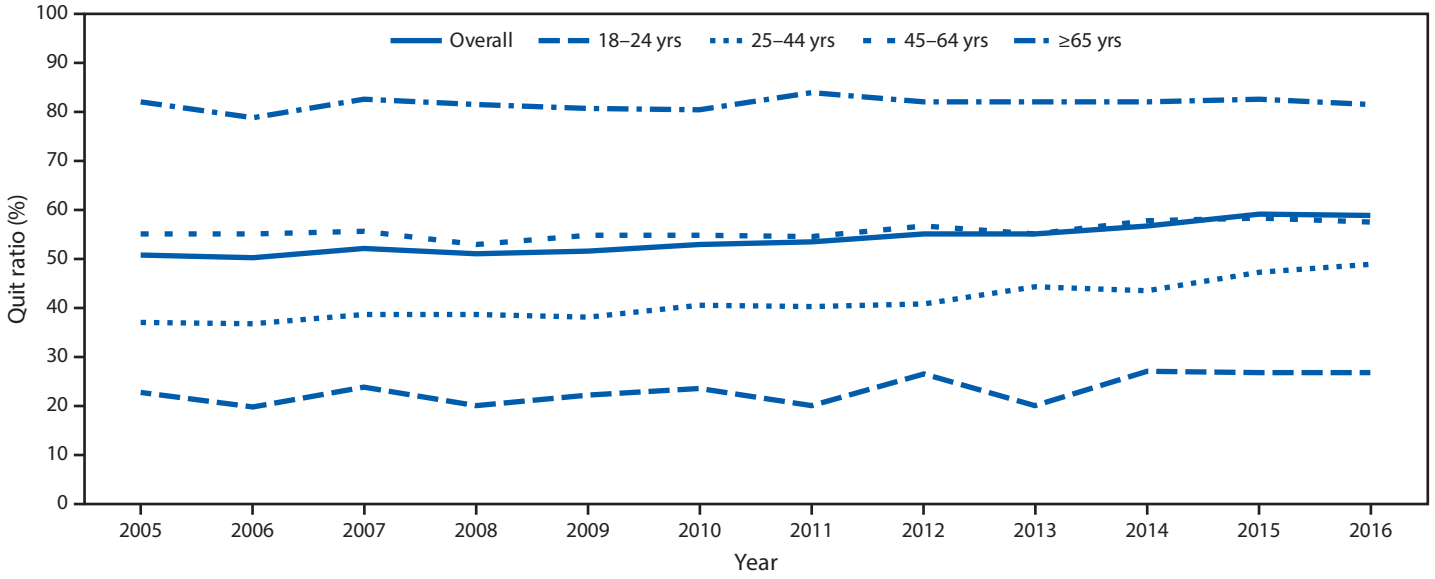
FIGURE 1. Percentage of daily smokers* aged ≥18 years who smoked 1–9, 10–19, 20–29, and ≥30 cigarettes per day — National Health Interview Survey, United States, 2005–2016



* Persons who had smoked ≥100 cigarettes during their lifetime and reported smoking cigarettes every day at the time of interview.

FIGURE 2. Quit ratios* among ever smokers† aged ≥18 years, overall and by age group — National Health Interview Survey, United States, 2005–2016§



* Quit ratios defined as the ratio of former smokers to ever smokers for each survey year.
† Respondents aged ≥18 years who reported having smoked ≥100 cigarettes during their lifetime.
§ p-value for trend 2005–2016 adjusted for sex and race/ethnicity: overall: p<0.0001; 18–24 years: p = 0.0064; 25–44 years: p<0.0001; 45–64 years: p = 0.0002; ≥65 years: p = 0.0874.

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Asthma Mortality Among Persons Aged 15–64 Years, by Industry and Occupation — United States, 1999–2016

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In 2015, an estimated 18.4 million U.S. adults had current asthma, and 3,396 adult asthma deaths were reported (*1*). An estimated 11%–21% of asthma deaths might be attributable to occupational exposures (*2*). To describe asthma mortality among persons aged 15–64 years,* CDC analyzed multiple cause-of-death data† for 1999–2016 and industry and occupation information collected from 26 states§ for the years 1999, 2003, 2004, and 2007–2012. Proportionate mortality ratios (PMRs)¶ for asthma among persons aged 15–64 years were calculated. During 1999–2016, a total of 14,296 (42.9%) asthma deaths occurred among males and 19,011 (57.1%) occurred among females. Based on an estimate that 11%–21% of asthma deaths might be related to occupational exposures, during this 18-year period, 1,573–3,002 asthma deaths in males and 2,091–3,992 deaths in females might have resulted from occupational exposures. Some of these deaths might have been averted by instituting measures to prevent potential workplace exposures. The annual age-adjusted asthma death rate** per 1 million persons aged 15–64 years declined from 13.59 in 1999 to 9.34 in 2016 (p<0.001) among females, and from 9.14 (1999) to 7.78 (2016) (p<0.05) among males. The highest significantly elevated asthma PMRs for males were for those in the food, beverage, and tobacco products manufacturing industry (1.82) and for females were for those in the social assistance industry (1.35) and those in community and social services occupations (1.46). Elevated asthma mortality among workers in certain industries and occupations underscores the importance of optimal asthma management and identification and prevention of potential workplace exposures.

National Vital Statistics System's multiple cause-of-death data for 1999–2016 were analyzed to examine asthma mortality among persons aged 15–64 years. Asthma deaths were identified from death certificates using *International Classification of Diseases, 10th Revision* underlying cause-of-death codes J45 (asthma) and J46 (status asthmaticus). Death rates per 1 million persons aged 15–64 years by sex, race, ethnicity, and year were age-adjusted using the 2000 U.S. Census standard population. Time trends were assessed using a first-order autoregressive linear regression model to account for the serial correlation. Industry and occupation information available from 26 states for the years 1999, 2003, 2004, and 2007–2012†† was coded§§ using the U.S. Census 2000 Industry and Occupation Classification System. PMRs, adjusted by 5-year age groups and race, were generated by industry and occupation for males and females. In addition, 95% confidence intervals (CIs) were calculated assuming Poisson distribution of the data. Retired, unemployed, and nonpaid workers and those with information that was unknown or not reported for industry or occupation were excluded from PMR analyses.

During 1999–2016, a total of 33,307 U.S. decedents aged 15–64 years had asthma or status asthmaticus assigned as the underlying cause of death (Table 1) for an overall death rate of 8.89 per 1 million persons. The highest asthma death rates were among adults aged 55–64 years (16.32 per 1 million persons), females (9.95 per 1 million persons), persons who were not Hispanic or Latino (9.39 per 1 million), and blacks or African Americans (25.60 per 1 million persons). The age-adjusted asthma death rate per 1 million persons aged 15–64 years decreased 24.6% from 11.41 in 1999 to 8.60 in 2016 (p<0.01). The age-adjusted asthma death rates among females aged 15–64 years decreased from 13.59 per 1 million in 1999 to 9.34 in 2016 (p<0.001), and among males decreased from 9.14 (1999) to 7.78 (2016) (p<0.05). By state, annualized age-adjusted asthma death rates ranged from 4.59 per 1 million in Maine to 14.72 in the District of Columbia for males and from 6.70 per 1 million in North Dakota to 15.30 in Mississippi for females (Figure).

Industry and occupation data were available for 3,393¶¶ (97.2%) of 3,491 asthma deaths, (1,398 of 1,435 [97.4%]

* https://www.dol.gov/general/topic/youthlabor/agerequirements.

† Decedents who had the *International Classification of Diseases, 10th Revision* codes J45 (asthma) or J46 (status asthmaticus) assigned as the underlying cause of death (the disease or injury that initiated the chain of events that led directly and inevitably to death). https://wonder.cdc.gov/.

§ Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Louisiana, Michigan, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, Texas, Utah, Vermont, Washington, West Virginia, and Wisconsin. States represent the state where the death took place.

¶ PMR was defined as the observed number of deaths from asthma in a specified industry/occupation, divided by the expected number of deaths from asthma. The expected number of deaths was the total number of deaths in industry or occupation of interest multiplied by a proportion defined as the number of asthma deaths in all industries and/or occupations, divided by the total number of deaths in all industries/occupations. The asthma PMRs for each sex were internally adjusted by 5-year age groups and race.

** Age-adjusted death rates were calculated by applying age-specific death rates to the 2000 U.S. Census standard population age distribution. https://wonder.cdc.gov/wonder/help/mcd.html#Age-AdjustedRates.

†† Information on industry and occupation was available only for decedents from 26 states for the years 1999, 2003, 2004, and 2007–2012. https://www.cdc.gov/niosh/topics/noms/default.html.

§§ https://webappa.cdc.gov/ords/norms-glossary.html#ind-occ.

¶¶ For 98 residents of these 26 states, deaths occurred in states that did not provide the industry and occupation information to the National Institute for Occupational Safety and Health. Retired, unemployed, and non-paid (229 males and 687 females) and unknown or not reported (90 males and 78 females) industries, and retired, students, volunteers, homemakers and unemployed (233 males and 688 females) and unknown or not reported (78 males and 68 females) occupations were excluded from PMR analyses.

TABLE 1. Number of asthma deaths* and age-adjusted asthma death rates† among persons aged 15–64 years, by sex and selected characteristics — United States, 1999–2016§

Characteristic	Males		Females		Overall	
	No. of deaths (% of asthma deaths)	Death rate	No. of deaths (% of asthma deaths)	Death rate	No. of deaths (% of asthma deaths)	Death rate
Overall (% of all asthma deaths)	**14,296 (42.9)**	**7.78**	**19,011 (57.1)**	**9.95**	**33,307 (100.0)**	**8.89**
Age group (yrs)¶						
15–24	1,731 (12.1)	4.42	1,035 (5.4)	2.78	2,766 (8.3)	3.62
25–34	2,272 (15.9)	6.12	1,818 (9.6)	4.97	4,090 (12.3)	5.55
35–44	2,874 (20.1)	7.55	3,692 (19.4)	9.60	6,566 (19.7)	8.58
45–54	3,853 (27.0)	10.28	6,284 (33.1)	16.22	10,137 (30.4)	13.30
55–64	3,566 (24.9)	12.39	6,182 (32.5)	19.98	9,748 (29.3)	16.32
Race**						
American Indian or Alaska Native	138 (1.0)	6.28	198 (1.0)	9.15	336 (1.0)	7.75
Asian or Pacific Islander	525 (3.7)	5.67	439 (2.3)	4.23	964 (2.9)	4.92
Black or African American	5,695 (39.8)	25.21	6,463 (34.0)	25.76	12,158 (36.5)	25.60
White	7,938 (55.5)	5.28	11,911 (62.7)	7.74	19,849 (59.6)	6.52
Ethnicity††						
Hispanic or Latino	1,348 (9.4)	5.49	1,474 (7.8)	6.37	2,822 (8.5)	5.96
Not Hispanic or Latino	12,862 (90.0)	8.21	17,468 (91.9)	10.48	30,330 (91.1%)	9.39
Unknown	86 (0.6)	N/A	69 (0.4)	N/A	155 (0.5)	N/A
Year						
1999	824	9.14	1,257	13.59	2,081	11.41
2000	878	9.60	1,150	12.24	2,028	10.95
2001	792	8.47	1,192	12.41	1,984	10.49
2002	872	9.14	1,148	11.71	2,020	10.49
2003	828	8.54	1,162	11.62	1,990	10.12
2004	770	7.82	1,044	10.21	1,814	9.06
2005	720	7.21	1,102	10.59	1,822	8.96
2006	721	7.12	1,039	9.81	1,760	8.52
2007	745	7.22	908	8.51	1,653	7.89
2008	667	6.47	931	8.54	1,598	7.52
2009	699	6.69	996	9.08	1,695	7.92
2010	747	7.04	982	8.86	1,729	7.97
2011	732	6.82	953	8.45	1,685	7.67
2012	850	7.91	988	8.71	1,838	8.31
2013	852	8.01	999	8.77	1,851	8.43
2014	875	8.19	1,089	9.63	1,964	8.94
2015	885	8.14	997	8.65	1,882	8.43
2016	839	7.78	1,074	9.34	1,913	8.60
p-value§§	0.72	<0.05	0.004	<0.001	0.11	<0.001

Abbreviation: N/A = not available.

* Decedents who had *International Classification of Diseases, 10th Revision* codes J45 (asthma) or J46 (status asthmaticus) assigned as the underlying cause of death (i.e., the disease or injury that initiated the chain of morbid events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury).

† Age-adjusted asthma death rates per 1 million persons calculated using the 2000 U.S. Census standard population.

§ National Vital Statistics System. https://wonder.cdc.gov/.

¶ Age-specific asthma death rates per 1 million persons.

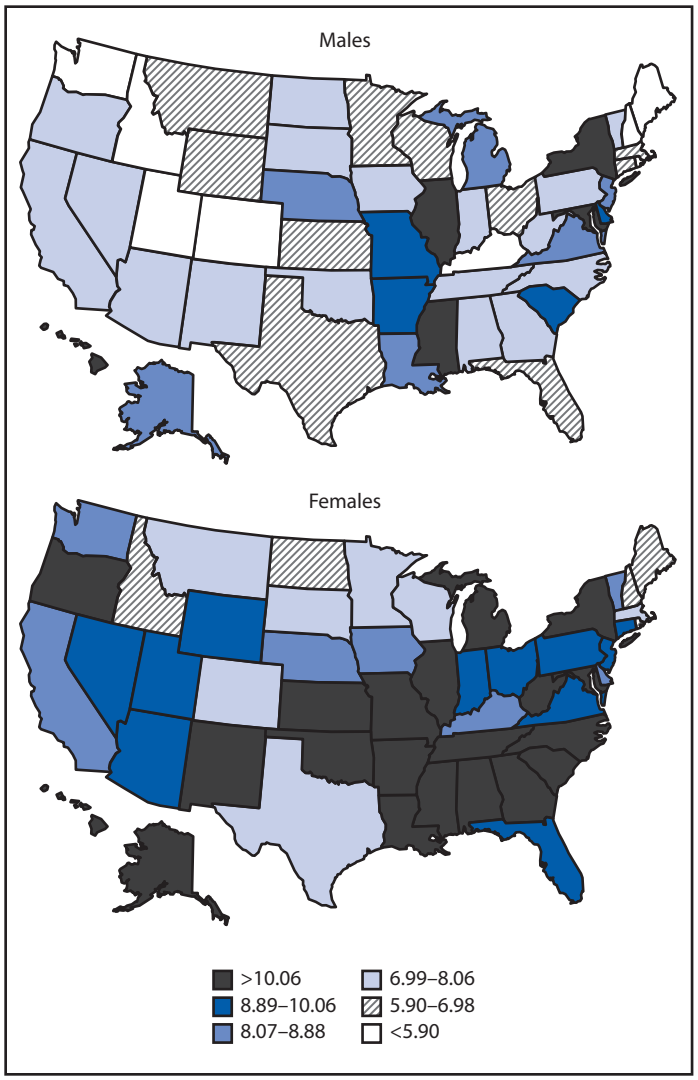
** Race and Hispanic origin are reported separately on the death certificate in accordance with standards set forth by the Office of Management and Budget. The American Indian or Alaska Native race category includes: North, Central, and South American Indians, Eskimos, and Aleuts. The Asian or Pacific Islander race category includes Chinese, Filipino, Hawaiian, Japanese, and Other Asian or Pacific Islanders. https://wonder.cdc.gov/wonder/help/mcd.html.

†† Deaths with Hispanic origin not stated are excluded from death rates calculation by Hispanic origin.

§§ For 1999–2016 linear time trend (examined using a first-order autoregressive linear regression model to account for the serial correlation).

males and 1,995 of 2,056 [97.0%] females) among persons aged 15–64 years that occurred in residents of 26 states during 1999, 2003, 2004, and 2007–2012 (Table 2). By industry, the highest number of asthma deaths occurred among males in the construction industry (184; 13.2% of asthma deaths in males) and among females in the health care industry (279; 14.0% of asthma deaths in females). By occupation, the highest number of asthma deaths occurred among male construction trades workers (149; 10.7%) and among female office and administrative support workers (186; 9.3%). By industry, PMRs were

FIGURE. Annualized age-adjusted asthma death rate* per 1 million population aged 15–64 years,† by sex and state§ — United States, 1999–2016¶



* Age-adjusted death rates were calculated by applying age-specific death rates to the 2000 U.S. Census standard population age distribution. https://wonder.cdc.gov/wonder/help/mcd.html#Age-Adjusted Rates.
† Decedents aged 15–64 years for whom the *International Classification of Diseases, 10th Revision* codes J45 (asthma) or J46 (status asthmaticus) were listed on death certificates as the underlying cause of death.
§ States represent the place of legal residence at the time of death.
¶ National Vital Statistics System. https://wonder.cdc.gov/.

significantly elevated among males working in food, beverage, and tobacco products manufacturing (1.82; CI = 1.22–2.61), other retail trade (1.65; CI = 1.29–2.10), and miscellaneous manufacturing (1.45; CI = 1.13–1.86); and among females working in social assistance (e.g., individual and family services and child day care services) (1.35; CI = 1.00–1.79). By occupation, the PMR was significantly elevated among female community and social services workers (1.46; CI = 1.02–2.01).

Discussion

The annual number of asthma deaths among persons aged 15–64 years has declined significantly from 1999 through 2016, most likely reflecting improvements in asthma management and effectiveness of prevention efforts (*3*,*4*). For example, replacing powdered latex gloves with powder-free natural rubber latex or nonlatex gloves reduced latex allergen exposure and substantially reduced work-related asthma*** among health care workers (*4*). Differences in asthma mortality by age, sex, and race/ethnicity have been previously reported (*5*). Based on an estimate that 11%–21% of asthma deaths might be attributable to occupational exposures (*2*), an estimated 3,664–6,994 asthma deaths during 1999–2016 (1,573–3,002 among males and 2,091–3,992 among females) might have been job-related, and therefore potentially preventable.

Female workers in the health care industry and male workers in the construction industry accounted for the highest industry-related numbers of asthma deaths. The PMRs were significantly elevated among males in the food, beverage, and tobacco products manufacturing, other retail trade, and miscellaneous manufacturing industries; and among females in the social assistance industry and in the community and social services occupations. A higher proportion of females with current asthma and a high frequency of exposures associated with work-related respiratory diseases have been observed in the health care and social assistance industries (*6*,*7*). National survey data indicate that approximately 9.1% (1.3 million) of 13.9 million female workers in the health care and social assistance industries, and 4.2% (394,000) of 9.4 million male workers in the construction industry, have current asthma.††† Approximately 13.4% of health care and social assistance workers, 51.1% of construction workers, 31.8% of food manufacturing workers, 36.1% of beverage and tobacco product manufacturing workers, 40.0% of miscellaneous manufacturing workers, 21.5% of retail trade workers, and 3.7% of community and social services workers are frequently exposed to vapors, gas, dust, or fumes in the workplace (*6*). Workplace exposures to asthma-causing agents,§§§ such as cleaners, disinfectants, antibiotics, natural rubber latex among health care workers, and welding fumes and isocyanates (e.g., paints) among construction workers¶¶¶ have been associated with work-related asthma (*8*,*9*). Higher

*** Work-related asthma includes occupational asthma (i.e., new-onset asthma caused by factors related to work) and work-exacerbated asthma (i.e., preexisting or concurrent asthma worsened by factors related to work). https://www.cdc.gov/niosh/topics/asthma/default.html.
††† https://wwwn.cdc.gov/eworld/Grouping/Asthma/97.
§§§ Association of Occupational and Environmental Clinics list of occupational asthmagens. http://www.aoecdata.org/ExpCodeLookup.aspx.
¶¶¶ Occupational Safety and Health Administration. Health Hazards in Construction. https://www.osha.gov/dte/grant_materials/fy09/sh-19495-09/health_hazards_workbook.pdf.

TABLE 2. Industries and occupations with ≥25 asthma* deaths among persons aged 15–64 years, by sex — 26 states,† 1999, 2003, 2004, and 2007–2012

Characteristic	No. of deaths	PMR§,¶ (95% CI)
Industry		
Male (n = 1,079)		
Food, beverage, and tobacco products manufacturing	29	1.82 (1.22–2.61)**
Other retail trade	69	1.65 (1.29–2.10)**
Miscellaneous manufacturing	66	1.45 (1.13–1.86)**
Arts, entertainment and recreation	29	1.30 (0.88–1.87)
Public administration	52	1.09 (0.83–1.45)
Health care	40	1.04 (0.74–1.42)
Repair and maintenance	46	1.01 (0.73–1.34)
Professional, scientific, technical and management services	34	1.00 (0.69–1.39)
Transportation and warehousing	89	0.98 (0.79–1.21)
Accommodation and food services	66	0.96 (0.75–1.23)
Educational services	29	0.95 (0.64–1.37)
Construction	184	0.92 (0.79–1.07)
Transportation equipment	28	0.78 (0.52–1.12)
Administrative and support, and waste management services	36	0.66 (0.46–0.91)
All other industries	282	—
Female (n = 1,230)		
Social assistance	49	1.35 (1.00–1.79)**
Arts, entertainment and recreation	26	1.29 (0.84–1.89)
Food and beverage stores	27	1.19 (0.78–1.73)
Private households	31	1.16 (0.79–1.64)
Health care	279	1.12 (1.00–1.27)
Other retail trade	96	1.10 (0.89–1.34)
Public administration	69	1.06 (0.83–1.35)
Accommodation and food services	116	1.01 (0.84–1.21)
Administrative and support, and waste management services	42	0.97 (0.70–1.31)
Transportation and warehousing	37	0.90 (0.63–1.24)
Finance and Insurance	48	0.90 (0.66–1.19)
Personal and laundry services	29	0.86 (0.58–1.24)
Educational services	94	0.85 (0.69–1.04)
Miscellaneous manufacturing	29	0.75 (0.50–1.07)
Professional, scientific, technical and management services	35	0.66 (0.46–0.92)
All other industries	223	—

See table footnotes on page 64.

PMRs in certain groups might also be explained in part by workers leaving employment in industries and occupations with workplace exposures that exacerbate their asthma and moving to jobs with fewer workplace exposures (*10*). Likewise, retired, unemployed, and nonpaid workers might have left the workforce because of workplace exposures.

Differences in asthma mortality by industry and occupation underscore the need for identifying workplace exposures, early diagnosis, and treatment and management of asthma cases, especially among industries and occupations with higher mortality. Pharmaceutical treatment of asthma related to occupational exposures is similar to that for asthma that is not work-related (*3*). Early identification and elimination of exposures is the preferred means of primary prevention to reduce asthma related to occupational exposures; however, reduction of exposure might be considered when elimination of exposures is not possible (*4*). Establishing an accurate diagnosis and recommending appropriate management for workers with asthma related to occupational exposures is necessary to improve outcomes and could prevent asthma deaths (*4*).

The findings in this report are subject to at least five limitations. First, asthma and status asthmaticus diagnoses could not be validated. It is possible that some decedents were misdiagnosed. However, given the potential impact of asthma diagnosis and status asthmaticus on patients' lives, it seems likely that asthma would be accurately recorded on death certificates. Second, no information was available to assess whether workplace exposures triggered asthma attacks that led directly to death. Some attacks might have been triggered by exposures outside of the work environment. Third, to the extent that asthma attacks were triggered by workplace exposures, industry and occupation information reported on death certificates might not be the industry and occupation in which workplace exposures actually occurred because guidelines for reporting industry and occupation on death certificates**** instruct recorders to report decedent's "usual" industry and occupation (i.e., "the type of job the individual was engaged in for most of his or her working life"). Fourth, no work history was available to assess changes in employment. Retired and

**** https://www.cdc.gov/nchs/data/misc/hb_occup.pdf.

TABLE 2. (*Continued*) Industries and occupations with ≥25 asthma* deaths among persons aged 15–64 years, by sex — 26 states,† 1999, 2003, 2004, and 2007–2012

Characteristic	No. of deaths	PMR§,¶ (95% CI)
Occupation		
Male (n = 1,087)		
Office and administrative support occupations	62	1.25 (0.97–1.61)
Other production occupations, including supervisors	51	1.21 (0.91–1.61)
Sales and related occupations	89	1.17 (0.95–1.45)
Laborers and material movers, hand	92	1.09 (0.88–1.34)
Motor vehicle operators	74	1.07 (0.85–1.36)
Metal workers and plastic workers	35	0.95 (0.66–1.33)
Food preparation and serving related occupations	46	0.91 (0.66–1.21)
Construction trades workers	149	0.89 (0.76–1.05)
Management occupations, except agricultural	61	0.89 (0.69–1.15)
Building and grounds cleaning and maintenance occupations	54	0.88 (0.67–1.16)
Electrical equipment mechanics and other installation, maintenance, and repair workers	26	0.85 (0.56–1.25)
Vehicle and mobile equipment mechanics, installers, and repairers	32	0.82 (0.56–1.15)
All other occupations	316	—
Female (n = 1,239)		
Community and social services occupations	36	1.46 (1.02–2.01)**
Laborers and material movers, hand	47	1.19 (0.88–1.59)
Healthcare support occupations	110	1.15 (0.95–1.39)
Food preparation and serving related occupations	100	1.12 (0.92–1.37)
Personal care and service occupations	75	1.09 (0.87–1.38)
Sales and related occupations	134	1.09 (0.92–1.30)
Health diagnosing and treating practitioners and technical occupations	59	1.00 (0.77–1.31)
Building and grounds cleaning and maintenance occupations	62	1.00 (0.78–1.30)
Management occupations, except agricultural	85	0.99 (0.80–1.24)
Business operations specialists	25	0.96 (0.62–1.42)
Education, training, and library occupations	70	0.93 (0.73–1.18)
Health technologists and technicians	28	0.91 (0.61–1.32)
Office and administrative support occupations	186	0.90 (0.77–1.04)
All other occupations	222	—

Abbreviations: CI = confidence interval; PMR = proportionate mortality ratio.

* Decedents who had the *International Classification of Diseases, 10th Revision* codes J45 (asthma) or J46 (status asthmaticus) assigned as the underlying cause of death (i.e., the disease or injury that initiated the chain of morbid events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury).

† Colorado, Florida, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Louisiana, Michigan, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, Texas, Utah, Vermont, Washington, West Virginia, and Wisconsin. States represent the state where the death took place.

§ PMR is defined as the observed number of deaths from asthma in a specified industry/occupation, divided by the expected number of deaths from asthma. The expected number of deaths is the total number of deaths in industry or occupation of interest multiplied by a proportion defined as the number of asthma deaths in all industries or occupations, divided by the total number of deaths in all industries/occupations. The asthma PMRs were internally adjusted by 5-year age groups and race. CIs were calculated assuming Poisson distribution of the data.

¶ Retired, unemployed, and unpaid (229 males and 687 females) and unknown or not reported (90 males and 78 females) workers in industries, and retired, students, volunteers, homemakers and unemployed (233 males and 688 females) and unknown or not reported (78 males and 68 females) occupations were excluded from PMR analyses.

** Statistically significant elevated PMR

unemployed persons might have left the workforce because of severe asthma in relation to work. Finally, information on industry and occupation might not be nationally representative because only selected states provided information on industry and occupation, and only for certain years.

Effective asthma management tools are available from CDC at https://www.cdc.gov/asthma/tools_for_control.htm, and information on the evaluation and treatment of asthma is available from the American Thoracic Society at https://www.thoracic.org/statements/allergy-asthma.php. Additional guidance for diagnosing work-related asthma is available from the Occupational Safety and Health Administration at https://www.osha.gov/SLTC/occupationalasthma/. The elevated asthma mortality among workers in certain industries and occupations underscores the importance of optimal asthma management, and identification and elimination or reduction of potential workplace exposures (*3*,*4*,*9*).

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Summary

What is already known about this topic?

In 2015, a total of 3,396 asthma deaths were reported among adults aged ≥18 years in the United States. An estimated 11%–21% of asthma deaths might be attributable to occupational exposures. Asthma deaths are preventable with proper asthma management and rapid response to asthma attacks.

What is added by this report?

Among U.S. adults aged 15–64 years, 33,307 deaths from asthma occurred during 1999–2016, including an estimated 3,664–6,994 (approximately 204–389 annually) that could be attributable to occupational exposures and were therefore potentially preventable. The highest asthma death rates were among adults aged 55–64 years, females, persons who were not Hispanic or Latino, and blacks or African Americans. By industry, asthma mortality was significantly elevated among males in food, beverage, and tobacco products manufacturing, other retail trade, and miscellaneous manufacturing, and among females in social assistance. By occupation, asthma mortality was significantly elevated among females in community and social services.

What are the implications for public health practice?

Elevated asthma mortality among male and female workers in certain industries and occupations highlights the importance of optimal asthma management, and identification and prevention of workplace exposures.

New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Rhode Island, South Carolina, Texas, Utah, Vermont, Washington, West Virginia, and Wisconsin.

Conflict of Interest

No conflicts of interest were reported.

[1]Association of Schools and Programs of Public Health/CDC Public Health Fellowship Program; [2]Respiratory Health Division, National Institute for Occupational Safety and Health, CDC.

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Attention-Deficit/Hyperactivity Disorder Medication Prescription Claims Among Privately Insured Women Aged 15–44 Years — United States, 2003–2015

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Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder that affects individuals across the lifespan. ADHD medication use among pregnant women is increasing (*1*), but consensus about the safety of ADHD medication use during pregnancy is lacking. Given that nearly half of U.S. pregnancies are unintended (*2*), and early pregnancy is a critical period for fetal development, examining trends in ADHD medication prescriptions among reproductive-aged women is important to quantify the population at risk for potential exposure. CDC used the Truven Health MarketScan Commercial Database* for the period 2003–2015 to estimate the percentage of women aged 15–44 years with private employer-sponsored insurance who filled prescriptions for ADHD medications each year. The percentage of reproductive-aged women who filled at least one ADHD medication prescription increased 344% from 2003 (0.9% of women) to 2015 (4.0% of women). In 2015, the most frequently filled medications were mixed amphetamine salts, lisdexamfetamine, and methylphenidate. Prescribing ADHD medications to reproductive-aged women is increasingly common; additional research on ADHD medication safety during pregnancy is warranted to inform women and their health care providers about any potential risks associated with ADHD medication exposure before and during pregnancy.

CDC used the Truven Health MarketScan Commercial Database to examine outpatient pharmacy prescription drug claims for ADHD medications among reproductive-aged (15–44 years) women during 2003–2015. These data represent a convenience sample of persons with private employer-sponsored insurance and their dependents in the United States. Demographic data are available for all persons enrolled at any point during the year, regardless of whether a claim is filed, and are linkable to submitted outpatient pharmacy claims. This analysis was restricted to women aged 15–44 years with ≥11 months of enrollment in a private health insurance plan that included prescription drug coverage during the year of interest. Outpatient pharmacy claims for ADHD medications were identified using national drug codes, irrespective of the indication for use. Data were analyzed to assess the annual percentage of reproductive-aged women who filled any ADHD medication prescription during 2003–2015, as well as by age group, U.S. geographic region, and medication class. To examine time trends, the percentage change in the percentage of reproductive-aged women dispensed ADHD medications from 2003 to 2015 was estimated. Among women who filled at least one ADHD medication prescription in the given year, CDC examined the distribution of specific medications and average number of prescriptions filled per year.

Approximately 2.3–6.8 million privately insured reproductive-aged women constituted the analytic sample each year during 2003–2015 (median = 4.6 million). The percentage of reproductive-aged women with private employer-sponsored insurance who filled a prescription for any ADHD medication increased 344% from 2003 (0.9%) to 2015 (4.0%). The increase in the percentage of women prescribed ADHD medications was confined to a rise in the prescribing of stimulant medications† (388% increase from 2003 to 2015); the percentage of women prescribed the nonstimulant medication atomoxetine was stable over time (0% change from 2003 to 2015) (Figure).

The percentage of reproductive-aged women who filled a prescription for any ADHD medication increased over time for all age groups and geographic regions (Table 1). In 2015, the highest percentage of ADHD medication prescriptions filled among reproductive-aged women were for those aged 15–19 (5.4%), 20–24 (5.5%), and 25–29 (4.0%) years. From 2003 to 2015, the largest increase in ADHD prescriptions filled occurred among women aged 25–29 years (700%). In 2015, the highest percentage of ADHD medication prescriptions were filled by reproductive-aged women who resided in the South (4.8%) and North Central (4.0%) U.S. regions; the largest increase from 2003 to 2015 occurred in the South (380%).

In 2015, among reproductive-aged women who filled any ADHD prescription, 60.8% filled a prescription for mixed amphetamine salts, 26.7% filled a prescription for lisdexamfetamine, and 18.1% filled a prescription for methylphenidate (Table 2). Among reproductive-aged women who filled any ADHD medication prescription in the given year, the percentage who filled a prescription for mixed amphetamine salts and

*Truven Health Analytics, Atlanta, Georgia.

†In this analysis, stimulant medications include amphetamine, mixed amphetamine salts, dexmethylphenidate, dextroamphetamine, lisdexamfetamine, methamphetamine, methylphenidate, and pemoline.

FIGURE. Percentage of women aged 15–44 years with private employer-sponsored insurance who filled one or more prescriptions for an attention-deficit/hyperactivity disorder (ADHD) medication, by medication class — United States, 2003–2015

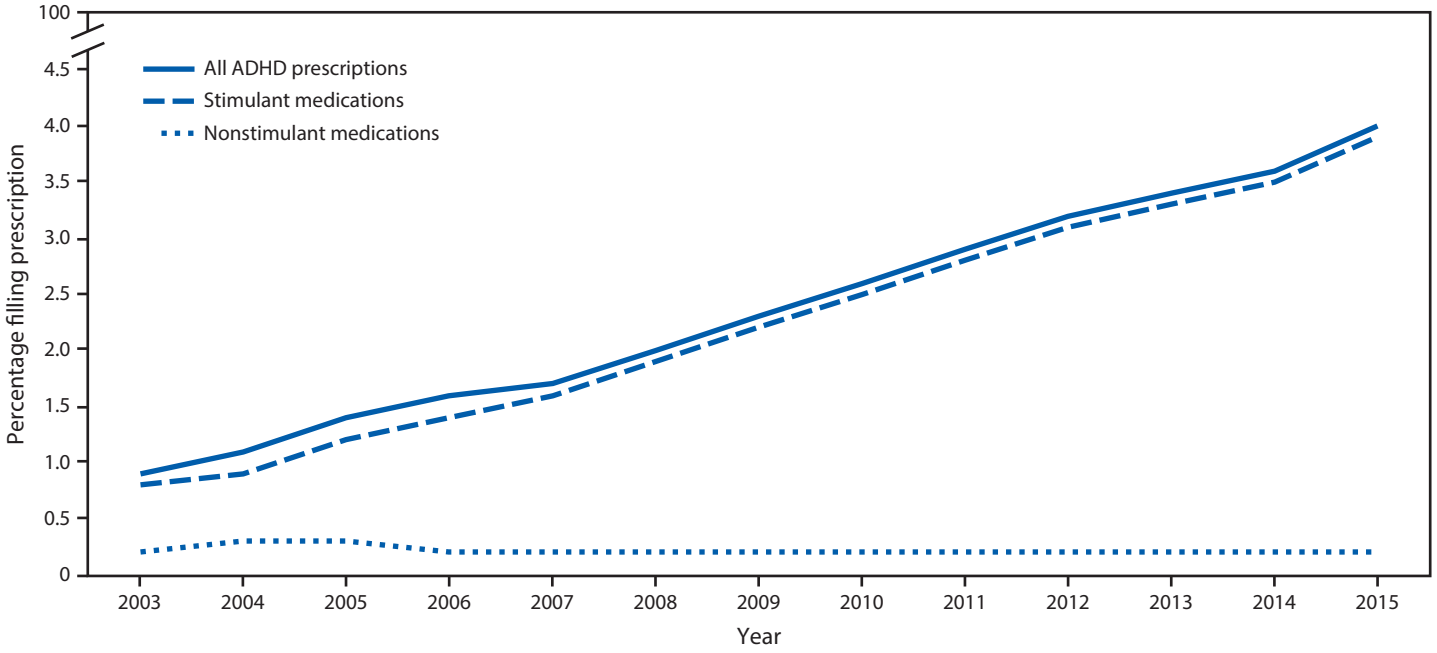

TABLE 1. Percentage of women aged 15–44 years with private employer-sponsored insurance who filled a prescription for a medication commonly prescribed for attention-deficit/hyperactivity disorder (ADHD), by selected demographic characteristics — United States, 2003–2015

Characteristic	% by year													% Increase 2003 to 2015*
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Age group (yrs)†														
15–19	2.0	2.6	3.0	3.4	3.4	3.9	4.2	4.4	4.6	4.8	4.9	5.1	5.4	170
20–24	1.0	1.4	1.8	2.3	2.5	3.1	3.5	4.1	4.5	4.8	5.0	5.2	5.5	450
25–29	0.5	0.6	0.8	1.0	1.2	1.5	1.9	2.2	2.7	3.0	3.3	3.5	4.0	700
30–34	0.5	0.6	0.8	1.0	1.0	1.3	1.5	1.8	2.1	2.3	2.6	2.9	3.3	560
35–39	0.6	0.7	0.9	1.1	1.1	1.3	1.6	1.8	2.0	2.2	2.4	2.6	3.0	400
40–44	0.6	0.8	1.0	1.1	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.6	2.9	383
U.S. region†,§,¶,**														
Northeast	0.8	1.0	1.3	1.4	1.4	1.7	1.9	2.3	2.6	2.8	3.0	3.1	3.2	300
North Central	1.0	1.3	1.5	1.7	1.7	2.0	2.2	2.6	3.0	3.3	3.6	3.7	4.0	300
South	1.0	1.4	1.6	1.9	2.0	2.4	2.7	3.1	3.5	3.8	4.2	4.4	4.8	380
West	0.6	0.7	0.8	1.0	1.1	1.2	1.4	1.6	1.9	2.0	2.1	2.3	2.6	333
Medication class														
Any ADHD	0.9	1.1	1.4	1.6	1.7	2.0	2.3	2.6	2.9	3.2	3.4	3.6	4.0	344
Stimulant	0.8	0.9	1.2	1.4	1.6	1.9	2.2	2.5	2.8	3.1	3.3	3.5	3.9	388
Nonstimulant	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0
No. of eligible women††	2,508,874	2,502,007	2,464,780	2,347,850	4,123,520	4,644,384	5,443,982	5,843,448	6,662,828	6,822,137	5,889,264	6,063,330	4,580,924	—

Source: Truven Health MarketScan Commercial Database

* The same woman could be included in multiple years of data; the percentage change estimation describes the overall percentage change in the percentage of reproductive-aged women who filled ADHD medication prescriptions from 2003 to 2015 by each demographic characteristic.

† Percentage with prescriptions dispensed was calculated among the total population of eligible women (i.e., women aged 15–44 years enrolled ≥11 member months per year in a plan that includes prescription drug coverage) who met the particular demographic characteristic for each age group and geographic region, respectively.

§ Among women eligible for the analytic sample, data for U.S. geographic region were missing for 0.2%–2.9%; data are not presented here.

¶ The U.S. region categories used by the Truven Health MarketScan Commercial Database align with the U.S. Census regions. The North Central region in the MarketScan Commercial Database is congruent with the Midwest Census region.

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

†† Women aged 15–44 years enrolled ≥11 member months per year in a plan that includes prescription drug coverage.

TABLE 2. Percentage of women who filled prescriptions for attention-deficit/hyperactivity disorder (ADHD) medications, by medication type, and average number of ADHD medication prescriptions filled per year, among women aged 15–44 years with private employer-sponsored insurance* who filled any ADHD prescription from outpatient pharmacies† — United States, 2003–2015

	% by year§												
ADHD medication¶	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Amphetamine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Mixed amphetamine salts	44.6	45.4	49.7	54.6	57.0	56.1	55.8	56.5	57.3	58.0	59.4	60.3	60.8
Dexmethylphenidate	1.0	1.1	2.2	4.1	4.7	4.4	4.1	3.8	3.7	3.5	3.2	3.1	3.1
Dextroamphetamine	6.0	4.3	3.5	3.1	3.2	2.9	2.7	2.4	2.4	1.9	1.7	1.6	1.5
Lisdexamfetamine**	0.0	0.0	0.0	0.0	4.0	12.9	17.6	20.9	23.3	24.2	24.4	24.6	26.7
Methamphetamine	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Methylphenidate	42.8	38.1	37.3	35.7	33.6	30.3	28.1	25.5	24.6	22.8	21.2	20.4	18.1
Pemoline**	1.1	0.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Atomoxetine	20.6	24.5	19.7	13.7	10.9	9.2	7.5	6.5	5.5	4.9	4.4	4.1	3.8
No. of eligible women with ≥1 ADHD prescription filled per year	21,333	28,003	33,189	37,595	69,518	92,424	123,404	149,340	194,466	216,496	199,574	219,860	183,053
Average no. of prescriptions filled per year (SD)††	5.5 (4.4)	5. 5 (4.4)	5.6 (4.4)	5.9 (4.6)	6.0 (4.7)	6.1 (4.7)	6.3 (4.7)	6.4 (4.8)	6.5 (4.8)	6.7 (4.9)	6.9 (5.0)	7.1 (5.1)	7.2 (5.1)

Source: Truven Health MarketScan Commercial Database.
Abbreviation: SD = standard deviation.
* Women aged 15–44 years enrolled ≥11 months per year in a plan that includes prescription drug coverage were defined as "eligible."
† The same woman could be included in multiple years of data.
§ Percentage of privately insured reproductive-aged women with each ADHD prescription medication dispensed was calculated among eligible women with at least one prescription filled for any ADHD medication in the given year.
¶ Not mutually exclusive; percentages might sum to >100% because multiple medications might have been prescribed to individual women within 1 calendar year. The first eight medications are stimulant ADHD medications and the last medication (atomoxetine) is a nonstimulant ADHD medication; these were the medications searched for in this analysis.
** Lisdexamfetamine was first approved by the FDA in 2007; pemoline was discontinued in 2005.
†† Among privately insured reproductive-aged women with at least one ADHD medication filled; this calculation is based on the average number of prescriptions filled each year from any type of ADHD medication.

lisdexamfetamine increased from 2003 to 2015, while the percentage who filled a prescription for methylphenidate and atomoxetine decreased over the same period. Among women who filled any ADHD medication prescription, the average number of prescriptions filled for any ADHD medication per year rose from an average of 5.5 prescriptions in 2003 (standard deviation [SD] = 4.4) to 7.2 in 2015 (SD = 5.1).

Discussion

The percentage of reproductive-aged women with private employer-sponsored insurance that included drug coverage who filled an ADHD medication prescription increased 344% from 2003 to 2015. In 2015, 4.0% of reproductive-aged women in this large convenience sample filled an ADHD medication prescription. A rise in stimulant ADHD medication prescriptions accounted for this increase; prescriptions for the nonstimulant atomoxetine have remained stable since 2003. The substantial increase in the percentage of reproductive-aged women filling ADHD medication prescriptions from 2003 to 2015, across age groups and U.S. geographic regions, is of public health concern given the high percentage of unintended pregnancies (*2*) and uncertainty concerning the safety of ADHD medication exposure before and during pregnancy (*3*). In studies with samples of U.S. pregnant women, ADHD medication use estimates have ranged from 0.4% (2000–2013 data) (*4*) to 1.3% (2013 data) (*1*). Although evidence is limited and findings are mixed (*3*), ADHD medication use during pregnancy might be linked to increased risk for poor pregnancy outcomes, including spontaneous abortion (*5*,*6*). The safety of ADHD medications with regard to risk for birth defects is largely unknown, with only one sufficiently powered published study (*4*).

ADHD medication prescription trends among reproductive-aged women in non-U.S. populations align with CDC's findings that an increased percentage of women are filling ADHD medication prescriptions, with the highest percentage among younger reproductive-aged women. In an analysis of 2003–2008 data from the United Kingdom (*7*), the prevalence of ADHD medication prescriptions increased over time among women aged 18–24 years (from 0.12 to 0.34 per 1,000 women) and women aged 25–45 years (from 0.01 to 0.05 per 1,000 women). In an analysis of Canadian adults during 2005–2015 (*8*), the prevalence of ADHD medication prescriptions increased over time for men and women aged 18–25 years (from 0.7% in 2005 to 3.2% in 2015) and 26–35 years (from 0.3% in 2005 to 1.6% in 2015). CDC's

estimates were higher than those from the United Kingdom and Canadian data sets, which might reflect higher ADHD medication prescribing in the United States or differences in the types of ADHD medications either prescribed across countries or included in the analyses. Most adult ADHD medication use prevalence estimates use older data (*5*,*7*), whereas results from this analysis demonstrate a continued increase in ADHD medication prescribing into 2015.

CDC's findings indicate that mixed amphetamine salts, lisdexamfetamine, and methylphenidate are among the ADHD medications most commonly prescribed to privately insured U.S. reproductive-aged women. In the United States, mixed amphetamine salts and methylphenidate are the most frequently prescribed ADHD medications among children (*9*) and pregnant women (*1*). Data from this analysis similarly suggests that mixed amphetamine salts and methylphenidate are two of the three most commonly prescribed medications among reproductive-aged women. However, in this analysis, lisdexamfetamine, which was approved by the Food and Drug Administration in 2007, was the second most commonly prescribed medication among reproductive-aged women. This is noteworthy given that most analyses that have examined ADHD medication safety among women before and during pregnancy have not included lisdexamfetamine as a medication of interest (*3*–*6*).

The findings in this report are subject to at least four limitations. First, although this analysis included 2.3–6.8 million reproductive-aged women per year, data are from a convenience sample of privately insured women with prescription drug coverage. Approximately 45% of U.S. births occur to women with Medicaid coverage (*10*); ADHD medication prevalence estimates might differ between publicly and privately insured women of reproductive age. Second, data are based on outpatient pharmacy claims and no information is available on women who paid for prescriptions out-of-pocket or who obtained ADHD medications from someone other than their prescribing physician. Third, although data represent ADHD medications dispensed, verification that women took the medications after the prescription was filled is not available. Finally, this analysis focused on women aged 15–44 years and did not identify pregnant women or women's risk for pregnancy.

This analysis used a large database to estimate the percentage of privately insured reproductive-aged women who filled an ADHD medication prescription during 2003–2015. The increasing trend toward prescribing ADHD medications to reproductive-aged women highlights the importance of research examining ADHD medication safety in this population, including safety before and during pregnancy. CDC's Treating for Two: Safer Medication Use in Pregnancy initiative (https://www.cdc.gov/treatingfortwo) helps address this need by conducting research on medication safety before and during pregnancy to help women and their health care providers make evidence-based decisions regarding the risks and benefits of pharmacologic and behavioral treatment options for common conditions, including ADHD.

Summary

What is already known about this topic?

Attention-deficit/hyperactivity disorder (ADHD) medication use has increased among U.S. pregnant women, and consensus about its safety during pregnancy is lacking. Given that half of U.S. pregnancies are unintended, ADHD medication use among reproductive-aged women might result in early pregnancy exposure, a critical period for fetal development.

What is added by this report?

The percentage of privately insured reproductive-aged women who filled a prescription for an ADHD medication increased 344% from 2003 (0.9%) to 2015 (4.0%). ADHD medication prescriptions increased across all age groups and U.S. geographic regions, and the increase was confined to stimulant medications.

What are the implications for public health practice?

ADHD medication prescriptions are increasingly common among privately insured, reproductive-aged women. Additional research on ADHD medication safety among this population, including safety before and during pregnancy, could help women and their health care providers make evidence-based decisions concerning the risks and benefits of pharmacologic and behavioral treatment options for common conditions, including ADHD.

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Conflict of Interest

No conflicts of interest were reported.

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Respiratory Syncytial Virus Seasonality — United States, 2014–2017

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Respiratory syncytial virus (RSV) is a leading cause of lower respiratory tract infection in young children worldwide (*1*–*3*). In the United States, RSV infection results in >57,000 hospitalizations and 2 million outpatient visits each year among children aged <5 years (*3*). Recent studies have highlighted the importance of RSV in adults as well as children (*4*). CDC reported RSV seasonality nationally, by U.S. Department of Health and Human Services (HHS) regions* and for the state of Florida, using a new statistical method that analyzes polymerase chain reaction (PCR) laboratory detections reported to the National Respiratory and Enteric Virus Surveillance System (NREVSS) (https://www.cdc.gov/surveillance/nrevss/index.html). Nationally, across three RSV seasons, lasting from the week ending July 5, 2014 through July 1, 2017, the median RSV onset occurred at week 41 (mid-October), and lasted 31 weeks until week 18 (early May). The median national peak occurred at week 5 (early February). Using these new methods, RSV season circulation patterns differed from those reported from previous seasons (*5*). Health care providers and public health officials use RSV circulation data to guide diagnostic testing and to time the administration of RSV immunoprophylaxis for populations at high risk for severe respiratory illness (*6*). With several vaccines and other immunoprophlyaxis products in development, estimates of RSV circulation are also important to the design of clinical trials and future vaccine effectiveness studies.

Participating clinical and public health laboratories voluntarily report the number of aggregate and positive RSV tests to NREVSS each week. In previous years, the RSV season was defined by consecutive weeks when RSV antigen-based tests exceeded 10% positivity (*5*); however, since 2008, laboratories have shifted away from antigen-based RSV testing, and since 2014 the majority of tests and RSV detections among consistently reporting laboratories are determined by PCR (*7*). From July through the following June of 2014–15, 2015–16 and 2016–17, approximately 56%, 62%, and 72% of RSV detections, respectively, were reported by PCR methods. To account for these observed changes in testing practice and to more accurately reflect recent circulation patterns, only results from PCR detection methods are included in this report.

The method that consistently captured the highest percentage of PCR detections for retrospectively characterizing RSV seasons was determined to be the retrospective slope 10 (RS10) method (*7*). This method uses a centered 5-week moving average of RSV detections normalized to a season peak of 1,000 detections. The season onset was defined as the second of 2 consecutive weeks when the slope, or normalized 5-week moving average of RSV detections between subsequent weeks, exceeded 10. The season offset was the last week when the standardized (normalized) detections exceeded the standardized detections at onset. The peak was the week with the most standardized detections. The season duration was the inclusive weeks between onset and offset.

Because patterns of weekly RSV circulation in Florida are different from regional and national patterns, Florida data are reported separately from other national data. RSV circulation patterns also appear to differ for Hawaii compared with other states in Region 9 based on limited antigen testing. Therefore, onset, offset, peak, and duration were summarized using the median of the three seasons nationally (with and without Florida and Hawaii), by HHS region, and for Florida. There are an insufficient number of Hawaii laboratories consistently reporting PCR data to present the state data separately with confidence. Laboratories were included in the analysis if they consistently conducted PCR testing, as defined by the following criteria: 1) reported RSV PCR testing results for ≥30 weeks during the 12-month NREVSS surveillance year and 2) averaged ≥10 PCR tests per week during the 52 weeks of the NREVSS season.†

* Listed by region number and headquarters city. *Region 1* (*Boston*): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; *Region 2* (*New York*): New Jersey and New York; *Region 3* (*Philadelphia*): Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; *Region 4* (*Atlanta*): Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; *Region 5* (*Chicago*): Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *Region 6* (*Dallas*): Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; *Region 7* (*Kansas City*): Iowa, Kansas, Missouri, and Nebraska; *Region 8* (*Denver*): Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; *Region 9* (*San Francisco*): Arizona, California, Hawaii, and Nevada; *Region 10* (*Seattle*): Alaska, Idaho, Oregon, and Washington. Delaware, District of Columbia, Idaho, Iowa, Maine, Maryland, Mississippi, Nebraska, New Hampshire, New Mexico, North Carolina, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2014–15 season analysis. District of Columbia, Idaho, Maine, Mississippi, Nebraska, Nevada, New Hampshire, North Carolina, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2015–16 season analysis. District of Columbia, Maine, Nevada, New Hampshire, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2016–17 season analysis.

† The 12 months included in a particular reporting season run from July through June.

From the week ending July 5, 2014 through July 1, 2017, there were three distinct RSV seasons: 2014–15, 2015–16, and 2016–17 (Figure). For each of these seasons, 135, 218, and 244 laboratories, respectively, reported at least 1 week of RSV testing by PCR to NREVSS. This analysis was limited to 80 (59%), 108 (50%), and 118 (48%) qualifying laboratories for 2014–15, 2015–16, and 2016–17, respectively (Table 1). The seasons as determined by the RS10 method captured 98% of reported RSV PCR detections during the 2014–15 reporting period and 97% of those reported during the 2015–16 and 2016–17 reporting periods.

Nationally, across the three seasons, the median RSV onset occurred at surveillance week 41 (mid-October), and lasted 31 weeks until surveillance week 18 (early May) (Table 2). The median national peak occurred at week 5 (early February). When Florida and Hawaii are excluded, the national onset occurred 1 week later and the season duration decreased by 1 week. Median onset for the 10 HHS regions (excluding Florida and Hawaii) ranged from week 37 to week 48 (mid-September to early December) and offset ranged from week 15 to week 21 (mid-April to late May) (Figure). The median season peaks ranged from week 52 to week 7 (late December to mid-February), and the median duration ranged from 22 to 37 weeks (Table 2). Region 9 had the shortest season (median = 22 weeks), and Region 4 had the longest (37 weeks). The median onset for Florida occurred at week 37 (mid-September), and the season continued through week 16 (mid-April) (Table 2).

Summary

What is already known about this topic?

For most of the United States, the respiratory syncytial virus (RSV) season lasts from fall through spring but varies from year to year and by geographic region.

What is added by this report?

This report uses a new statistical method that analyzes polymerase chain reaction laboratory detections reported to the National Respiratory and Enteric Virus Surveillance System (NREVSS) to determine RSV seasonality nationally and by region for three recent seasons (2014–2017). Nationally, lasting from the week ending July 5, 2014 through July 1, 2017, the median RSV onset occurred at week 41 (mid-October), and lasted 31 weeks until week 18 (early May). The median national peak occurred at week 5 (early February). Onsets for the 2014–17 seasons occurred approximately 2 weeks earlier than did those for the 2012–2014 seasons (early to mid-October versus late October to early November), which were determined using antigen data.

What are the implications for public health practice?

RSV seasonality data can guide diagnostic testing and inform policy decisions regarding administration of currently available immunoprophylaxis products, when indicated, and the timing of clinical trials and future evaluations of vaccines and immunoprophylaxis products currently under development.

Discussion

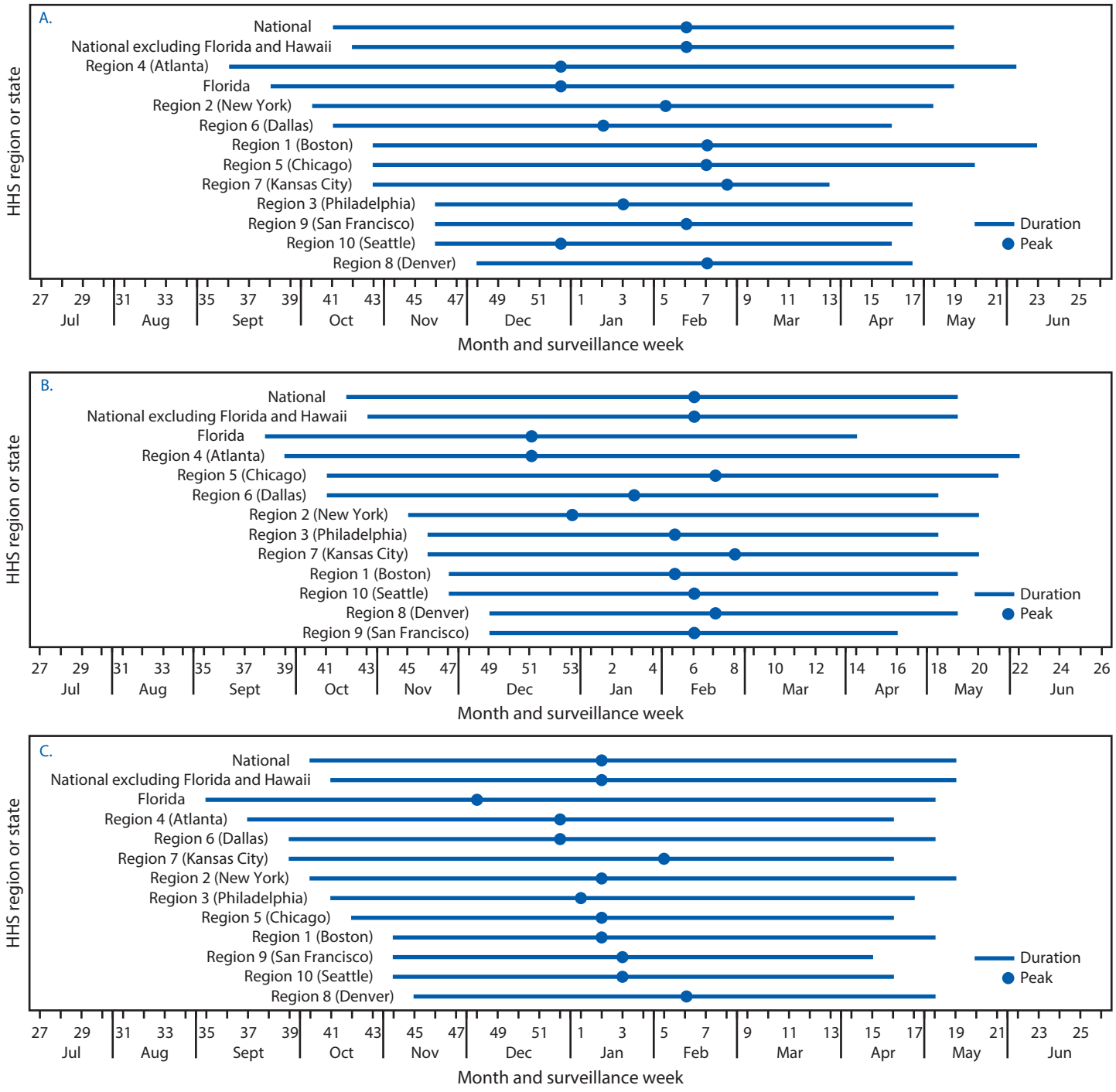
The national RSV season onsets and offsets reported here occurred in different surveillance weeks than those reported in previous seasons (*5*). Using PCR data reported to NREVSS, onsets for the 2014–15, 2015–16, and 2016–17 seasons occurred approximately 2 weeks earlier than did those for the 2012–13 and 2013–2014 seasons (early to mid-October versus late October to early November), which were determined using antigen data; similarly, offsets occurred approximately 4 weeks later (late April to early May versus late March). These differences largely reflect the adoption of a statistical method that identifies a consistent inflection point in weekly RSV detections, rather than a threshold of weekly positivity influenced heavily by the volume of tests performed (*7*). The differences inherent in evaluating PCR tests, many of which detect several viral respiratory pathogens, compared with RSV antigen tests, that exclusively detect RSV, necessitated the adoption of a new statistical method to capture a consistently high proportion of RSV detections within the defined season (*7*). This change in methodology has resulted in a relative lengthening of the RSV seasons.

Using antigen-based methods, in past years Florida has been observed to have an earlier onset than other states in the country (*8*). However, using the RS10 method, this earlier onset was not consistently observed. This report included fewer consistently reporting laboratories in Florida compared with previous seasons, and the observed patterns might not represent the entire state. Previous limited antigen-based testing shows that seasonality in Hawaii might differ from that in other states in Region 9, but too few laboratories have consistently reported PCR data during the analysis period to present these data separately (https://www.cdc.gov/surveillance/nrevss/rsv/state.html#HI). Many factors might influence national, regional, and county-level RSV activity, including social and demographic factors, population density, pollution, and climate (*8–10*).

NREVSS surveillance data reflect recent circulation patterns of RSV and might inform policy decisions regarding administration of palivizumab for immunoprophylaxis. Palivizumab is a monoclonal antibody recommended by the American Academy of Pediatrics for administration during the RSV season to infants at high risk and young children likely to benefit from immunoprophylaxis, based on their gestational age at birth and the presence of certain underlying medical conditions during the RSV season (*6*).[§] In addition, RSV seasonality data might inform the timing of clinical trials for several RSV vaccines and immunoprophlyaxis products in development, as well as the evaluation of product effectiveness after licensure.

[§] CDC does not make recommendations regarding the administration of RSV immunoprophylaxis.

FIGURE. Respiratory syncytial virus season duration and peak, by U.S. Department of Health and Human Services (HHS) Region (headquarters),*,†,§ and in Florida — National Respiratory and Enteric Virus Surveillance System, United States, July 2014–June 2015 (A), July 2015–June 2016 (B), and July 2016–June 2017 (C)



* Listed by region number and headquarters city. *Region 1* (*Boston*): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; *Region 2* (*New York*): New Jersey and New York; *Region 3* (*Philadelphia*): Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; *Region 4* (*Atlanta*): Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; *Region 5* (*Chicago*): Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *Region 6* (*Dallas*): Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; *Region 7* (*Kansas City*): Iowa, Kansas, Missouri, and Nebraska; *Region 8* (*Denver*): Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; *Region 9* (*San Francisco*): Arizona, California, Hawaii, and Nevada; *Region 10* (*Seattle*): Alaska, Idaho, Oregon, and Washington. Delaware, District of Columbia, Idaho, Iowa, Maine, Maryland, Mississippi, Nebraska, New Hampshire, New Mexico, North Carolina, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2014–15 season analysis. District of Columbia, Idaho, Maine, Mississippi, Nebraska, Nevada, New Hampshire, North Carolina, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2015–16 season analysis. District of Columbia, Maine, Nevada, New Hampshire, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2016–17 season analysis.

† Region 4 (Atlanta) excludes data from Florida.

§ Region 9 (San Francisco) excludes data from Hawaii.

TABLE 1. Summary of 2014–15, 2015–16, and 2016–17 respiratory syncytial virus (RSV) seasons, by U.S. Departments of Health and Human Services (HHS) Region,* and in Florida — National Respiratory and Enteric Virus Surveillance System, July 2014–June 2017

HHS region (headquarters) or state/RSV season	No. of laboratories reporting	Onset week ending	Peak week ending	Offset week ending	Season duration (wks)
National					
2014–15†	80	10/11/2014	02/07/2015	05/09/2015	31
2015–16§	108	10/17/2015	02/13/2016	05/14/2016	31
2016–17¶	118	10/08/2016	01/14/2017	04/29/2017	30
National without Florida and Hawaii					
2014–15†	77	10/18/2014	02/07/2015	05/09/2015	30
2015–16§	104	10/24/2015	02/13/2016	05/14/2016	30
2016–17¶	113	10/15/2016	01/14/2017	04/29/2017	29
Region 1 (Boston)					
2014–15†	4	10/25/2014	02/14/2015	06/06/2015	33
2015–16§	5	11/21/2015	02/06/2016	05/14/2016	26
2016–17¶	7	11/05/2016	01/14/2017	05/06/2017	27
Region 2 (New York)					
2014–15†	6	10/04/2014	01/31/2015	05/02/2015	31
2015–16§	8	10/31/2015	01/02/2016	05/21/2016	30
2016–17¶	7	10/08/2016	01/14/2017	05/13/2017	32
Region 3 (Philadelphia)					
2014–15†	5	11/15/2014	01/10/2015	04/25/2015	24
2015–16§	10	11/07/2015	02/06/2016	05/07/2016	27
2016–17¶	9	10/15/2016	01/07/2017	04/29/2017	29
Region 4 (Atlanta)**					
2014–15†	6	09/06/2014	12/27/2014	05/30/2015	39
2015–16§	7	09/26/2015	12/19/2015	06/04/2016	37
2016–17¶	7	09/17/2016	12/31/2016	04/22/2017	32
Region 5 (Chicago)					
2014–15†	22	10/25/2014	02/14/2015	05/16/2015	30
2015–16§	29	10/10/2015	02/20/2016	05/28/2016	34
2016–17¶	28	10/22/2016	01/14/2017	04/22/2017	27
Region 6 (Dallas)					
2014–15†	10	10/11/2014	01/10/2015	04/18/2015	28
2015–16§	11	10/10/2015	01/23/2016	05/07/2016	31
2016–17¶	14	10/01/2016	12/31/2016	05/06/2017	32
Region 7 (Kansas City)					
2014–15†	3	10/25/2014	02/21/2015	05/16/2015	30
2015–16§	5	11/14/2015	02/27/2016	05/21/2016	34
2016–17¶	7	10/01/2016	02/04/2017	04/22/2017	30
Region 8 (Denver)					
2014–15†	7	11/29/2014	02/14/2015	04/25/2015	22
2015–16§	10	12/05/2015	02/20/2016	05/14/2016	24
2016–17¶	11	11/12/2016	02/11/2017	05/06/2017	26
Region 9†† (San Francisco)					
2014–15†	9	11/15/2014	02/07/2015	04/11/2015	22
2015–16§	13	12/05/2015	02/13/2016	04/23/2016	21
2016–17¶	14	11/05/2016	01/21/2017	04/15/2017	24
Region 10 (Seattle)					
2014–15†	6	11/15/2014	01/31/2015	04/18/2015	23
2015–16§	7	11/21/2015	02/13/2016	05/07/2016	25
2016–17¶	10	11/05/2016	01/21/2017	04/22/2017	25

See table footnotes on page 75.

As testing methods and practices continue to evolve, CDC might further refine the approach to ascertaining RSV seasons.

The findings in this report are subject to at least four limitations. First, reporting to NREVSS is voluntary, and analysis is limited to consistently reporting laboratories, which might not fully represent local and regional circulation. Second, low RSV circulation might not be captured within the NREVSS onset and offset, although at least 97% of detections were accounted for using the RS10 method. Third, this report only includes PCR detections. Although this represents a majority of detections among consistent reporters, 28%–44% of detections are by antigen methods. Finally, although the number of positive detections is dependent upon the number of tests ordered, the RS10 method minimizes this bias by normalizing the detections. Despite these limitations, NREVSS provides useful information to clinicians regarding RSV circulation

TABLE 1. (*Continued*) Summary of 2014–15, 2015–16, and 2016–17 respiratory syncytial virus (RSV) seasons, by U.S. Departments of Health and Human Services (HHS) Region,* and in Florida — National Respiratory and Enteric Virus Surveillance System, July 2014–June 2017

HHS region (headquarters) or state/RSV season	No. of laboratories reporting	Onset week ending	Peak week ending	Offset week ending	Season duration (wks)
Florida					
2014–15†	2	09/20/2014	12/27/2014	05/09/2015	34
2015–16§	3	09/19/2015	12/19/2015	04/09/2016	30
2016–17¶	4	09/03/2016	12/03/2016	04/22/2017	34

* Listed by region number and headquarters city. *Region 1* (*Boston*): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; *Region 2* (*New York*): New Jersey and New York; *Region 3* (*Philadelphia*): Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; *Region 4* (*Atlanta*): Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; *Region 5* (*Chicago*): Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *Region 6* (*Dallas*): Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; *Region 7* (*Kansas City*): Iowa, Kansas, Missouri, and Nebraska; *Region 8* (*Denver*): Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; *Region 9* (*San Francisco*): Arizona, California, Hawaii, and Nevada; *Region 10* (*Seattle*): Alaska, Idaho, Oregon, and Washington.
† Delaware, District of Columbia, Idaho, Iowa, Maine, Maryland, Mississippi, Nebraska, New Hampshire, New Mexico, North Carolina, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2014–15 season analysis.
§ District of Columbia, Idaho, Maine, Mississippi, Nebraska, Nevada, New Hampshire, North Carolina, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2015–16 season analysis.
¶ District of Columbia, Maine, Nevada, New Hampshire, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2016–17 season analysis.
** Excludes data from Florida.
†† Excludes data from Hawaii.

TABLE 2. Summary of 2014–15, 2015–16, and 2016–17 respiratory syncytial virus seasons by median and range, by U.S. Departments of Health and Human Services (HHS) Region,* and in Florida — National Respiratory and Enteric Virus Surveillance System, July 2014–June 2017

	2014–2017 season median and range (surveillance week number)							
HHS region or state	Onset median surveillance week (mo)	Onset range surveillance weeks (mos)	Peak median surveillance week (mo)	Peak range surveillance weeks (mos)	Offset median surveillance week (mo)	Offset range surveillance weeks (mos)	Median duration (wks)	Duration range (wks)
National	41 (mid-Oct)	40–41 (Oct)	5 (early Feb)	2–6 (Jan–Feb)	18 (early May)	17–19 (Apr–May)	31	30–31
National (excluding Florida and Hawaii)	42 (mid-Oct)	41–42 (Oct)	5 (early Feb)	2–6 (Jan–Feb)	18 (early May)	17–19 (Apr–May)	30	29–30
Region 1	44 (late Oct)	43–46 (Oct–Nov)	5 (early Feb)	2–6 (Jan–Feb)	19 (mid-May)	18–22 (May)	27	26–33
Region 2	40 (early Oct)	40–43 (Oct)	2 (mid-Jan)	52–4 (Dec–Jan)	19 (mid-May)	17–20 (Apr–May)	31	30–32
Region 3	44 (late Oct)	41–46 (Oct–Nov)	1 (mid-Jan)	1–5 (Jan–Feb)	17 (late Apr)	16–18 (Apr–May)	27	24–29
Region 4†	37 (mid-Sep)	36–38 (Sep)	52 (late Dec)	50–52 (Dec)	21 (late May)	16–22 (Apr–May)	37	32–39
Region 5	42 (mid-Oct)	40–43 (Oct)	6 (mid-Feb)	2–7 (Jan–Feb)	19 (mid-May)	16–21 (Apr–May)	30	27–34
Region 6	40 (early Oct)	39–41 (Sep–Oct)	1 (mid-Jan)	52–3 (Dec–Jan)	18 (early May)	15–18 (Apr–May)	31	28–32
Region 7	43 (late Oct)	39–45 (Sep–Nov)	7 (mid-Feb)	5–8 (Feb)	19 (mid-May)	16–20 (Apr–May)	30	30–34
Region 8	48 (late Nov)	45–48 (Nov)	6 (mid-Feb)	6–7 (Feb)	18 (early May)	16–19 (Apr–May)	24	22–26
Region 9§	46 (mid-Nov)	44–48 (Nov)	5 (early Feb)	3–6 (Jan–Feb)	15 (mid-Apr)	14–16 (Apr)	22	21–24
Region 10	46 (mid-Nov)	44–46 (Nov)	4 (late Jan)	3–6 (Jan–Feb)	16 (mid-Apr)	15–18 (Apr–May)	25	23–25
Florida	37 (mid-Sep)	35–38 (Aug–Sep)	50 (mid-Dec)	48–52 (Dec)	16 (mid-Apr)	14–18 (Apr–May)	34	30–34

* Listed by region number and headquarters city. Region 1 (Boston): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; *Region 2* (*New York*): New Jersey and New York; *Region 3* (*Philadelphia*): Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; *Region 4* (*Atlanta*): Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; *Region 5* (*Chicago*): Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *Region 6* (*Dallas*): Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; *Region 7* (*Kansas City*): Iowa, Kansas, Missouri, and Nebraska; *Region 8* (*Denver*): Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; *Region 9* (*San Francisco*): Arizona, California, Hawaii, and Nevada; *Region 10* (*Seattle*): Alaska, Idaho, Oregon, and Washington. Delaware, District of Columbia, Idaho, Iowa, Maine, Maryland, Mississippi, Nebraska, New Hampshire, New Mexico, North Carolina, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2014–15 season analysis. District of Columbia, Idaho, Maine, Mississippi, Nebraska, Nevada, New Hampshire, North Carolina, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2015–16 season analysis. District of Columbia, Maine, Nevada, New Hampshire, Rhode Island, Tennessee, and Wyoming did not have laboratories meeting the inclusion criteria for the 2016–17 season analysis.
† Excludes data from Florida.
§ Excludes data from Hawaii.

and to researchers designing clinical trials for vaccines and immunoprophylaxis products under development.

The RS10 method used here captures a high proportion of RSV PCR detections for retrospectively determining RSV seasonality, but cannot be used to determine seasonal onset and offset in real time, and can only be employed after the season ends. Alternative statistical methods, including the tenfold baseline or 3% threshold methods (*7*) might be used to determine seasonality in real time or near real time. Timely NREVSS data and updates of RSV activity at the national,

regional, and state levels are published online weekly at https://www.cdc.gov/surveillance/nrevss. Surveillance data collected by state and local health departments might more accurately describe local RSV circulation trends.

Conflict of Interest

No conflicts of interest were reported.

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Notes from the Field

Legionellosis Outbreak Associated with a Hotel Aquatics Facility — Tennessee, 2017

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On June 26, 2017, the Tennessee Department of Health (TDH) was notified by CDC of two travel-associated cases of legionellosis. The patients resided in Florida and the United Kingdom but had a common hotel exposure in Memphis, Tennessee. On June 27, the Shelby County Health Department identified a third case in a Shelby County resident with the same hotel exposure. All three persons had positive *Legionella* urinary antigen tests and reported using the hotel hot tub. A joint state and local investigation was launched, which included environmental health, epidemiologic, and laboratory components. Shelby County environmental health specialists conducted an assessment of the hotel aquatics facility and identified improper water treatment monitoring and low chlorine residuals (0 ppm; acceptable range = 1–3 ppm). On June 28, TDH was notified of four additional travel companions with illness after exposure to the hotel aquatics facility, including two persons with confirmed *Legionella*, one of whom died.

A public health directive was issued to the hotel on June 28, closing the aquatics facility and requiring consultation with an environmental engineering firm familiar with CDC *Legionella* reduction guidance for the assessment, testing, and remediation of the water distribution systems (*1*). Aquatics area water sampling was also conducted by a TDH environmental health specialist. Laboratory testing of the aquatics facility water samples identified three *Legionella* polymerase chain reaction–positive samples from the pool, pool sand filter, and hot tub sand filter, and isolated *Legionella pneumophila* serogroup 1 from the hot tub sand filter. The remediation firm isolated two nonpneumophila *Legionella* species, including an isolate from the aquatics facility sprinkler system.

An online survey was created to capture epidemiologic and exposure information among hotel guests. A guest roster (including hotel guests before and after the official opening of the aquatics facility on May 27 [i.e., from May 15 to June 27]) was requested. On July 6, approximately 4,000 emails and 209 letters containing the survey link were sent to guests with available contact information. As of July 31, the survey end date, 983 responses were received. Through survey responses, CDC reciprocal notification of non-Tennessee cases, and calls received at the health department, 92 cases were identified, including nine laboratory-confirmed (urinary antigen positive) cases, 19 probable (self-reported pneumonia) cases, and 64 suspected (self-reported fever and ≥1 compatible symptom*) cases. All persons reported hotel stay dates during May 15–June 27. Cases represented persons from 29 states, the United Kingdom, Canada, and Australia. Median age of the persons was 55 years (range = 13–81 years), and 26 (28%) persons reported being a current or former smoker. Sixteen persons were hospitalized, and one aforementioned person died. In a case-control analysis, illness was strongly associated with the aquatics facility (odds ratio = 11.2 [95% confidence interval = 3.4–37.4]).

The incidence of legionellosis has increased approximately 4.5-fold in the United States since 2000, and an increasing number of *Legionella* outbreaks have been reported (*2*,*3*). Hotels are a commonly reported site of *Legionella* outbreaks; however, prompt identification of clusters can be challenging because of the transient nature of the exposed population. Approximately 10% of *Legionella* infections are fatal; therefore, timely investigation of cases is critical (*4*).

This outbreak highlights the importance of rapid case notification and collaboration among environmental health, epidemiologic, and laboratory disciplines during legionellosis outbreaks. In this outbreak, rapid reporting of domestic and international travel-associated cases to CDC and reciprocal notification facilitated rapid identification of the common hotel exposure and initiation of an outbreak investigation, potentially preventing additional morbidity and mortality. Within 3 days of notification, an environmental assessment was performed, and within 12 days, preliminary epidemiologic analyses and laboratory results were available. The combined environmental health, epidemiologic, and laboratory findings helped identify and implicate the hotel aquatics facility.

This outbreak investigation also highlights the need for ongoing health care provider education regarding the importance of obtaining clinical isolates for public health legionellosis investigations. No appropriate clinical specimens were identified or available for culture, which is required for subtyping and comparison with environmental isolates. That 70 (76%) persons reported seeking medical care and 16 (17%) were hospitalized during this outbreak suggests missed opportunities for specimen collection. Provider education around testing methods and the need for clinical isolates during outbreaks could improve future *Legionella* outbreak investigations.

* Compatible symptoms included myalgia, cough, fatigue/malaise/weakness, loss of appetite, headache, abdominal pain or cramps, diarrhea, and vertigo.

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Conflict of interest

No conflicts of interest were reported.

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Notes from the Field

Baylisascaris procyonis Encephalomyelitis in a Toddler — King County, Washington, 2017

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On May 1, 2017, in Washington, Public Health—Seattle & King County (PHSKC) was notified of a possible *Baylisascaris procyonis* infection in a previously healthy male child aged 19 months. The patient had been evaluated on April 26 for a 1-week history of irritability followed by tremors of his extremities, ataxia, and decreased interactivity. On examination, the patient was afebrile with an inability to sit or stand unaided; complete blood count revealed eosinophilia (absolute eosinophils = 5,080; reference range = 0–250); magnetic resonance imaging (MRI) of the brain indicated diffuse, patchy white matter lesions, alongside patchy, enhancing lesions in both cerebellar hemispheres. The patient was transferred to a tertiary care hospital on April 27 for further evaluation and management; spinal MRI and ophthalmologic exams were normal. Cerebrospinal fluid (CSF) was notable for 4 white blood cells (reference range = 0–5); however, increased eosinophils were noted on cytologic review.

The patient's parents reported that the child had ingested soil and animal feces in their backyard several weeks before symptom onset. After consultation with CDC, empirical treatment with oral albendazole (25 mg/kg/day) and intravenous steroids for suspected baylisascariasis was initiated on April 29, while *B. procyonis* antibody test results were pending. The patient exhibited neurologic improvement on May 1 and was discharged on May 2.

Serum and CSF specimens collected during hospitalization were positive for *B. procyonis*–specific immunoglobulin antibodies at CDC; results of Toxocara and Toxoplasma serologies and a stool ova and parasite exam conducted at private laboratories were negative. The assay for *B. procyonis* antibody, an immunoblot test using the recombinant antigen rBpRAG1, is specific and sensitive but cannot differentiate between current or previous infection or exposure (*1*). The patient completed 28 days of albendazole and a steroid taper. At 1-month follow up, the patient had marked reduction in tremors and improvements in mental status and ambulation.

B. procyonis is a roundworm parasite of the North American raccoon (*Procyon lotor*), the definitive host. Infection with *B. procyonis* is a rare cause of morbidity and mortality in humans, with 31 cases documented in North America (*2*,*3*). Infection occurs when humans ingest infective egg stages shed in raccoon feces or material contaminated with raccoon feces (*2*). Clinical signs of baylisascariasis depend on the dose of ingested eggs and their extraintestinal migration path (neural, ocular, or visceral tissue). Among the 31 documented North American cases of disease, 28 (90%) persons had meningoencephalitis or encephalopathy (*2*,*3*).

PHSKC conducted an environmental assessment of the patient's property on May 9. Dark, cylindrical feces were collected from elevated truncal forks (approximately 8.2 ft [2.5 m] and 13.1 ft [4 m] in height) and base of the tree at the site where the patient regularly played and was seen ingesting soil and animal feces. The fecal characteristics and location at multiple sites were consistent with a raccoon latrine (i.e., communal defecation site) (*4*). A fecal sample was also collected from the patient's healthy dog.

All fecal samples collected from the tree yielded microscopic eggs consistent in morphology and size to *B. procyonis*. No parasite ova were detected in the fecal sample collected from the dog. The patient's parents had not previously noticed any raccoon latrines on their property. PHSKC recommended restricting access to the tree and surrounding areas until it could be appropriately cleaned and consulting with a veterinarian about implementing regular deworming for their dog, because canines can be a definitive host for *B. procyonis* and can shed eggs in their feces (*3*).

This report describes the first laboratory-confirmed *B. procyonis* human infection in Washington. Children aged <2 years exhibit frequent hand-to-mouth behaviors and might be at increased risk for baylisascariasis through ingestion of soil and other potentially contaminated material (e.g., contents of sandboxes) (*2*). Among the 31 documented disease cases, 17 (55%) were among children aged <2 years (*2*,*3*). Prevention messages to parents of young children living in areas where raccoons might be present should include avoidance of soil ingestion, handwashing after outdoor play, and providing guidance on identifying and safely cleaning raccoon latrines (*4*).

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Conflict of Interest

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Errata

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In the report "Progress Toward Global Eradication of Dracunculiasis, January 2016–June 2017," on page 1328, the last sentence of the third paragraph should have read "The **14** *Dracunculus* specimens came from four baboons and nine dogs from Ethiopia and one dog from Chad."

On page 1331, under "Discussion," the first sentence of the second paragraph should have read "Additional interventions, including increased use of temephos and trials of potential **antihelminthic** treatments for infected dogs, are beginning or underway in Chad."

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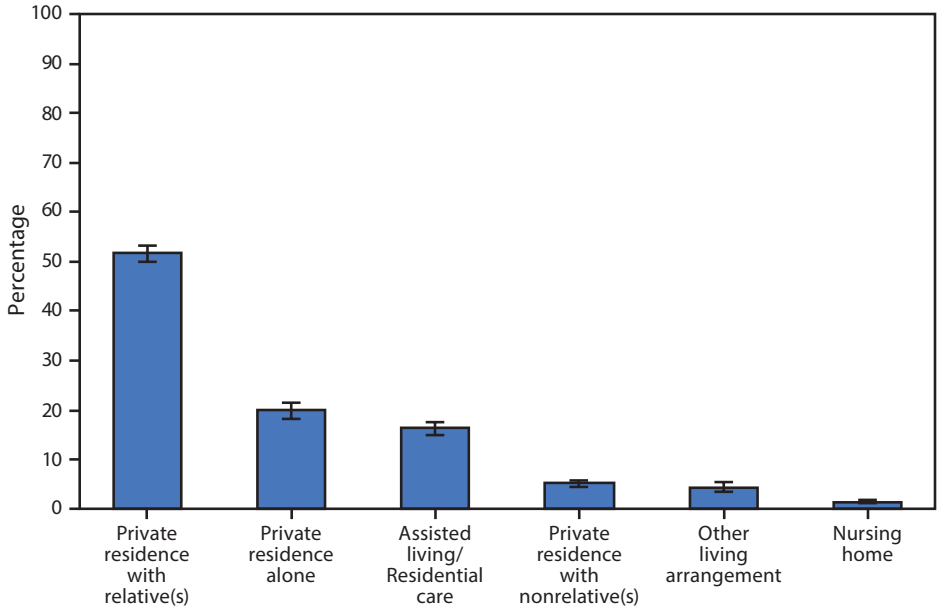
In the report "CDC Grand Rounds: National Amyotrophic Lateral Sclerosis (ALS) Registry Impact, Challenges, and Future Directions," on page 1382, the list of author affiliations should have read as follows:

[1]Environmental Health and Surveillance Branch, Division of Toxicology and Human Health Sciences, Agency for Toxic Substances and Disease Registry, CDC; [2]Cynthia Shaw Crispen Chair, ALS Research, Department of Neurology, Lexington, University of Kentucky; [3]person living with ALS; [4]Office of the Associate Director for Science, CDC; **[5]Office of the Associate Director for Communication, CDC**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage Distribution* of Adult Day Services Center Participants, by Place of Residence† — National Study of Long-Term Care Providers, United States, 2016



* With 95% confidence intervals shown with error bars.
† Based on the questions: "Of the participants currently enrolled at this center, how many live in each of the following places?" and "Of the participants currently enrolled at this center who live in a private residence, how many live with the following people?"

In 2016, 51.5% of adult day services center participants lived in a private residence with relative(s), 19.9% lived alone in a private residence, 16.3% lived in an assisted living/residential care community, 5.3% lived in a private residence with nonrelative(s), 4.5% had another living arrangement, and 1.5% lived in a nursing home.

Source: National Study of Long-Term Care Providers, 2016. https://www.cdc.gov/nchs/nsltcp.htm.

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