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Urban-Rural County and State Differences in Chronic Obstructive Pulmonary Disease — United States, 2015

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Chronic obstructive pulmonary disease (COPD) accounts for the majority of deaths from chronic lower respiratory diseases, the third leading cause of death in the United States in 2015 and the fourth leading cause in 2016.* Major risk factors include tobacco exposure, occupational and environmental exposures, respiratory infections, and genetics.† State variations in COPD outcomes (*1*) suggest that it might be more common in states with large rural areas. To assess urban-rural variations in COPD prevalence, hospitalizations, and mortality; obtain county-level estimates; and update state-level variations in COPD measures, CDC analyzed 2015 data from the Behavioral Risk Factor Surveillance System (BRFSS), Medicare hospital records, and death certificate data from the National Vital Statistics System (NVSS). Overall, 15.5 million adults aged ≥18 years (5.9% age-adjusted prevalence) reported ever receiving a diagnosis of COPD; there were approximately 335,000 Medicare hospitalizations (11.5 per 1,000 Medicare enrollees aged ≥65 years) and 150,350 deaths in which COPD was listed as the underlying cause for persons of all ages (40.3 per 100,000 population). COPD prevalence, Medicare hospitalizations, and deaths were significantly higher among persons living in rural areas than among those living in micropolitan or metropolitan areas. Among seven states in the highest quartile for all three measures, Arkansas, Kentucky, Mississippi, and West Virginia were also in the upper quartile (≥18%) for rural residents. Overcoming barriers to prevention, early diagnosis, treatment, and management of COPD with primary care provider education, Internet access, physical activity and self-management programs, and improved access to pulmonary rehabilitation and oxygen therapy are needed to improve quality of life and reduce COPD mortality.

The National Center for Health Statistics (NCHS) 2013 Urban-Rural Classification Scheme for Counties, which uses 2010 U.S. Census population data and the February 2013 Office of Management and Budget designations of metropolitan statistical area, micropolitan statistical area, or noncore area (*2*), was used to classify urban-rural status of BRFSS respondents, Medicare inpatient claims, decedents, and populations at risk based on reported county of residence. The six categories include large central metropolitan, large fringe metropolitan, medium metropolitan, small metropolitan, micropolitan, and

* Leading causes of death reported for 2015 at https://www.cdc.gov/nchs/data/nvsr/nvsr66/nvsr66_05.pdf and for 2016 at https://www.cdc.gov/nchs/products/databriefs/db293.htm.
† https://www.cdc.gov/copd.

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Continuing Education examination available at https://www.cdc.gov/mmwr/cme/conted_info.html#weekly.

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noncore (rural). Definitions and use of these categories have been described previously (*2*,*3*).

Prevalence of diagnosed COPD was estimated using the 2015 BRFSS survey, an annual state-based, random-digit–dialed cellular and landline telephone survey of the noninstitutionalized U.S. population aged ≥18 years§ that is conducted by state health departments in collaboration with CDC. In 2015, the median survey response rate for the 50 states and District of Columbia (DC) was 46.6% and ranged from 33.9% to 61.1%.¶ Diagnosed COPD was defined as an affirmative response to the question "Has a doctor, nurse, or other health professional ever told you that you had chronic obstructive pulmonary disease or COPD, emphysema, or chronic bronchitis?" State analyses included 426,838 (98.3%) respondents in the 50 states and DC after exclusions for missing information on COPD or age (Table 1). Urban-rural analyses included 426,736 (98.2%) respondents after excluding those who had missing information for COPD, age, or county code.

A multilevel regression and poststratification approach (*4*) was used to estimate model-predicted COPD prevalence for U.S. counties in 2015. High internal validity was determined by comparing modeled estimates with actual unweighted BRFSS survey estimates in 1,507 counties with ≥50 respondents (Pearson correlation coefficient = 0.68; p<0.001), and with weighted BRFSS survey estimates in 195 counties with ≥500 respondents and relative standard errors <0.30 (Pearson correlation coefficient = 0.74; p<0.001).

Medicare enrollment records and data from 100% of Part A (inpatient hospital) claims in 2015 were obtained from the Centers for Medicare & Medicaid Services. Analyses were limited to 30,212,024 living Medicare Part A enrollees aged ≥65 years who were eligible for fee-for-service hospitalizations on July 1, 2015, and all 335,362 fee-for-service inpatient hospital claims with a first-listed diagnosis of COPD that were submitted in 2015 for Medicare Part A enrollees aged ≥65 years. COPD was defined by *International Classification of Diseases, Ninth Edition, Clinical Modification* (ICD-9-CM) codes 490–492 or 496 or ICD-10-CM codes J40–J44.** Urban-rural analyses were limited to 335,102 (99.9%) hospital claims.

§ https://www.cdc.gov/brfss/annual_data/annual_2015.html.

¶ Response rates for BRFSS are calculated using standards set by American Association for Public Opinion Research response rate formula 4. The response rate is the number of respondents who completed the survey as a proportion of all eligible and likely eligible persons. http://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf. Response rates in 2015 for individual states are available at https://www.cdc.gov/brfss/annual_data/2015/pdf/2015-sdqr.pdf.

** *International Classification of Diseases, Ninth Edition, Clinical Modification* (ICD-9-CM) codes for COPD include 490 (bronchitis, not specified as acute or chronic), 491 (chronic bronchitis), 492 (emphysema), or 496 (chronic airway obstruction); ICD-10-CM codes include J40 (bronchitis, not specified as acute or chronic), J41 (simple and mucopurulent chronic bronchitis), J42 (unspecified chronic bronchitis), J43 (emphysema), or J44 (other COPD).

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TABLE 1. Age-adjusted estimates of selected COPD measures, by urban-rural status of county* — United States, 2015

COPD measure	Overall†	Large metropolitan center	Large fringe metropolitan	Medium metropolitan	Small metropolitan	Micropolitan	Noncore (rural)
Adult prevalence§							
BRFSS respondents	426,838	69,442	81,788	92,571	57,415	65,029	60,491
Estimated no. in population (rounded to 1,000s) with diagnosed COPD	15,460,000	3,566,000	3,406,000	3,452,000	1,661,000	1,796,000	1,576,000
% (95% CI)	5.9 (5.8–6.0)	4.7 (4.5–5.0)	5.3 (5.0–5.5)	6.4 (6.2–6.7)	7.0 (6.6–7.3)	7.6 (7.2–8.0)	8.2 (7.8–8.7)
Medicare hospitalizations¶							
Number of Medicare enrollees, aged ≥65 years, in fee-for-service plan	30,212,024	6,812,852	7,402,029	6,510,167	3,361,075	3,400,705	2,701,592
Hospital claims with COPD as first-listed diagnosis	335,362	74,616	78,220	68,291	35,798	41,653	36,524
Rate per 1,000 (95% CI)	11.5 (11.4-11.5)	11.4 (11.3-11.5)	11.0 (11.0-11.1)	10.8 (10.7-10.9)	10.9 (10.8-11.0)	12.5 (12.4-12.6)	13.8 (13.6-13.9)
Deaths**							
U.S. population (all ages)	321,418,820	98,997,449	79,867,097	67,041,154	29,346,517	27,260,617	18,905,986
Number of deaths with COPD as underlying cause	150,350	32,309	32,718	33,619	17,419	19,019	15,266
Rate per 100,000 (95% CI)	40.3 (40.1–40.5)	32.0 (31.6-32.3)	36.2 (35.8-36.6)	41.9 (41.5–42.4)	47.0 (46.3–47.7)	52.8 (52.1–53.6)	54.5 (53.6–55.4)

Abbreviations: BRFSS = Behavioral Risk Factor Surveillance System; CI = confidence interval; COPD = chronic obstructive pulmonary disease (includes emphysema and chronic bronchitis).

* As defined in the National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties.

† Numbers in urban-rural categories for prevalence and Medicare hospitalizations do not sum to the overall number because 0.02% of eligible BRFSS respondents, 0.08% of eligible Medicare enrollees, and 0.08% of COPD Medicare claims could not be assigned an urban-rural classification.

§ Percentage ever told by a doctor, nurse, or other health professional that respondent had COPD, emphysema, or chronic bronchitis among adults aged ≥18 years in the 2015 Behavioral Risk Factor Surveillance System survey. Age-adjusted to the 2000 U.S. projected population, aged ≥18 years, using five age groups (18–44, 45–54, 55–64, 65–74, and ≥75 years).

¶ Hospitalizations among adults aged ≥65 years with a first-listed diagnosis claim for COPD *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes 490–492, or 496 or ICD-10-CM codes J40–J44 in the 2015 Medicare Part A hospital claims records. Hospital rates per 1,000 Medicare fee-for-service enrollees aged ≥65 years were age-adjusted to the 2000 U.S. projected population aged ≥65 years, using two age groups (65–74 and ≥75 years).

** Death rate per 100,000 U.S. population (including children) for COPD (ICD-10 codes J40–J44) reported as the underlying cause of death on the death certificate; age-adjusted to the total 2000 U.S. projected population, using 11 age groups (<1, 1–4, 5–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–84, and ≥85 years).

Mortality data for all ages were analyzed using CDC WONDER, an interactive public-use Web-based tool.[††] CDC WONDER mortality data from NVSS contain information from all resident death certificates filed in the 50 states and DC. CDC WONDER queries generated numbers of deaths, age-adjusted death rates, 95% confidence intervals (CIs), and population denominators for groups defined by state and the 2013 NCHS urban-rural classification of decedents. Deaths caused by COPD were defined by ICD-10 codes J40–J44, in which COPD was the underlying cause of death on the death certificate. CDC also obtained population estimates for 2015 from CDC WONDER to calculate the percentage of U.S. and state residents who lived in a rural county as classified by the NCHS 2013 urban-rural county classification.

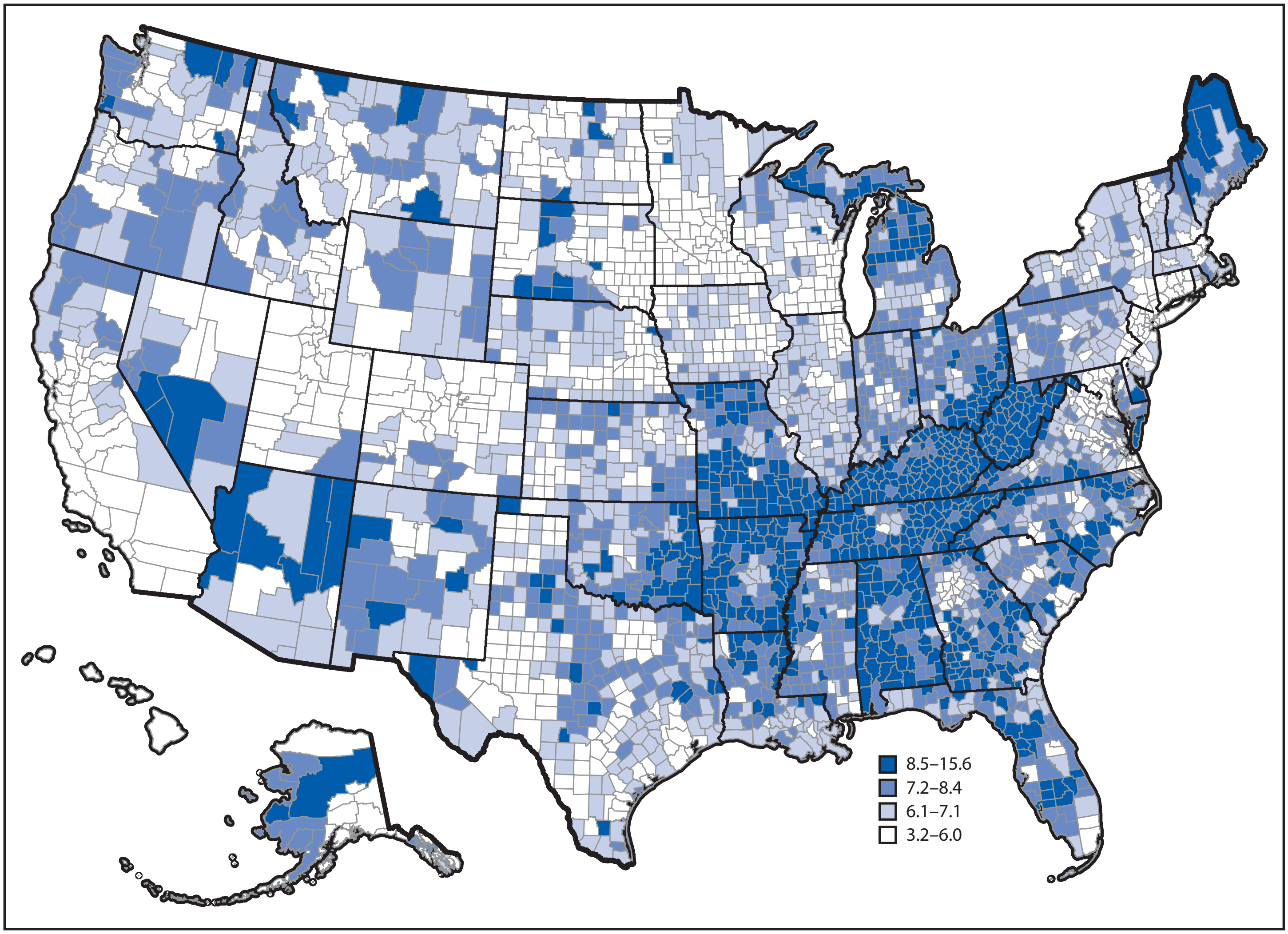
Age-adjusted prevalence of diagnosed COPD for persons aged ≥18 years, Medicare hospitalization rate for persons aged ≥65 years, death rate for all ages, and 95% CI for each estimate were calculated by urban-rural classification and state. For BRFSS analyses, statistical software was used to account for the complex sampling design. Differences in COPD prevalence among rural respondents compared with those of other urban-rural subgroups were determined by t-tests. Urban-rural differences in Medicare hospitalizations and death rates were determined by the Z-test. All two-sided tests were considered statistically significant at $\alpha = 0.05$.

In 2015, approximately 15.5 million adults aged ≥18 years (unadjusted prevalence = 6.3% and age-adjusted prevalence = 5.9%) had self-reported diagnosed COPD. County-level estimates of COPD prevalence ranged from 3.2% to 15.6% (Figure). U.S. counties within the highest quartile of county-level estimates (8.5%-15.6%) tended to be located in nonmetropolitan areas of Alabama, Arizona, Arkansas, Georgia, Kentucky, Maine, Michigan, Missouri, Ohio, Oklahoma, Tennessee, and West Virginia (Figure).

Age-adjusted prevalence of diagnosed COPD among adults aged ≥18 years increased with less urbanicity from 4.7% among

†† https://wonder.cdc.gov. Population estimates for groups defined by urban-rural status and state are bridged-race estimates of the July 1, 2015, resident population from the Vintage 2015 postcensal series that were released on June 28, 2016.

FIGURE. Unadjusted prevalence of diagnosed chronic obstructive pulmonary disease among adults aged ≥18 years, by county — United States, 2015



populations living in large metropolitan centers to 8.2% among adults living in rural areas (Table 1). Medicare hospitalizations (per 1,000 enrollees) for COPD were 11.4 among enrollees aged ≥65 years living in large metropolitan centers and 13.8 among those living in rural areas. Age-adjusted death rates (per 100,000 population) for COPD as the underlying cause also increased with less urbanicity from 32.0 for U.S. residents living in large metropolitan centers to 54.5 for those living in rural areas. There was a consistent pattern for significantly higher estimates of COPD measures from all three independent data systems among adults living in rural areas than among those living in micropolitan or metropolitan areas.

Overall 5.9% of U.S. residents lived in rural counties in 2015. State-specific percentages of rural residents ranged from zero percent in Connecticut, Delaware, District of Columbia, New Jersey, and Rhode Island to 34.7% in Montana (Table 2). State-specific age-adjusted prevalence of COPD among adults aged ≥18 years in 2015 ranged from 3.8% in Utah to 12.0% in West Virginia. State-specific age-adjusted Medicare hospitalization rates (per 1,000 enrollees) among enrollees aged ≥65 years ranged from 3.7 in Utah to 19.7 in West Virginia. State-specific age-adjusted death rates (per 100,000 population) in 2015 ranged from 15.8 in Hawaii to 64.3 in Oklahoma. Of the seven states (Alabama, Arkansas, Indiana, Kentucky, Mississippi, Tennessee, and West Virginia) that were in the highest quartiles for all three measures in 2015, four states (Arkansas, Kentucky, Mississippi, and West Virginia) were also in the highest quartile (≥18%) for percentage of rural residents.

Discussion

In 2015, rural U.S. residents experienced higher age-adjusted COPD prevalence, Medicare hospitalizations for COPD as the first-listed diagnosis, and deaths caused by COPD than did residents in micropolitan or metropolitan areas. In

TABLE 2. Percentage of rural residents and age-adjusted estimates of selected COPD measures, by state — United States, 2015

State	% rural residents*	Rank order in % rural residents	No. in U.S. population with COPD†	% (95% CI)§	No. of Medicare hospitalizations¶	Rate per 1,000 (95% CI)¶	No. of deaths	Rate per 100,000 (95% CI)**
Alabama	12.8	16	393,000	9.9 (9.0-10.9)	7,691	14.3 (14.0-14.6)	3,217	55.2 (53.3–57.1)
Alaska	26.1	5	22,000	4.1 (3.3–5.1)	380	6.3 (5.6–6.9)	193	36.1 (30.7–41.6)
Arizona	1.5	38	325,000	5.8 (5.2–6.5)	4,711	8.3 (8.1–8.5)	3,570	42.4 (41.0–43.8)
Arkansas	19.1	11	219,000	9.1 (8.0-10.5)	4,806	13.3 (12.9-13.7)	2,234	61.3 (58.7–63.8)
California	0.7	41	1,207,000	4.0 (3.6–4.4)	20,289	7.9 (7.8–8.1)	13,092	31.8 (31.3-32.4)
Colorado	5.6	26	179,000	4.2 (3.8–4.6)	2,376	6.4 (6.1–6.6)	2,514	46.6 (44.8–48.5)
Connecticut	0.0	43	143,000	4.6 (4.1–5.1)	3,798	9.7 (9.4-10.0)	1,309	28.4 (26.8-30.0)
Delaware	0.0	43	51,000	6.3 (5.3–7.5)	1,137	8.6 (8.1–9.1)	494	40.9 (37.3–44.6)
DC	0.0	43	28,000	5.9 (4.9–7.2)	445	7.5 (6.8–8.2)	134	21.5 (17.8-25.2)
Florida	1.7	37	1,117,000	6.0 (5.4–6.6)	32,274	15.9 (15.7-16.1)	11,461	37.4 (36.7-38.1)
Georgia	7.7	22	532,000	6.7 (6.0–7.6)	9.425	11.9 (11.7-12.2)	4,501	45.7 (44.3–47.1)
Hawaii	0.0	43	48,000	4.1 (3.5–4.9)	663	6.2 (5.7–6.7)	303	15.8 (14.0-17.6)
Idaho	8.3	21	59,000	4.5 (3.9–5.3)	942	6.3 (5.9–6.7)	817	44.8 (41.7–47.9)
Illinois	4.7	29	568,000	5.4 (4.7–6.3)	14,964	11.4 (11.2-11.6)	5,360	36.8 (35.8-37.8)
Indiana	7.0	23	400,000	7.4 (6.6–8.3)	9,048	13.1 (12.9-13.4)	4,096	53.7 (52.1–55.4)
Iowa	25.2	7	136,000	5.2 (4.6–6.0)	3,407	8.3 (8.0–8.6)	1,949	47.5 (45.4–49.7)
Kansas	13.5	15	134,000	5.8 (5.5–6.2)	2,764	8.0 (7.7–8.3)	1,665	48.5 (46.1–50.8)
Kentucky	22.3	8	410,000	11.2 (10.2-12.3)	8,618	19.1 (18.7-19.5)	3,280	63.2 (61.1–65.4)
Louisiana	7.7	22	265,000	7.1 (6.3–8.0)	5,452	13.5 (13.2-13.9)	2,125	42.1 (40.3–43.9)
Maine	31.8	2	86,000	7.0 (6.3–7.8)	1,986	11.3 (10.8-11.8)	1,003	52.5 (49.2–55.8)
Maryland	1.4	39	282,000	5.8 (5.1–6.5)	5,841	8.4 (8.2–8.6)	1,945	29.2 (27.9-30.5)
Massachusetts	0.2	42	303,000	5.3 (4.8–6.0)	8,566	11.4 (11.2-11.7)	2,668	31.6 (30.4-32.8)
Michigan	6.7	24	584,000	6.9 (6.3–7.6)	13,338	13.9 (13.7-14.1)	5,700	46.2 (45.0–47.4)
Minnesota	10.5	18	187,000	4.2 (3.8–4.5)	3,910	12.7 (12.3-13.1)	2,273	35.1 (33.7-36.6)
Mississippi	22.2	9	173,000	7.2 (6.4–8.2)	5,040	14.3 (13.9-14.7)	1,865	55.3 (52.8–57.8)
Missouri	13.7	14	387,000	7.9 (7.1–8.9)	7,587	12.2 (11.9-12.5)	3,843	51.4 (49.8–53.1)
Montana	34.7	1	45,000	5.0 (4.3–5.8)	918	7.0 (6.5–7.4)	663	48.8 (45.0–52.5)
Nebraska	18.0	12	77,000	5.0 (4.6–5.5)	2,061	8.9 (8.5–9.3)	1,127	50.0 (47.1–53.0)
Nevada	1.1	40	145,000	6.2 (5.1–7.6)	2,079	9.0 (8.6–9.4)	1,591	53.2 (50.5–55.8)
New Hampshire	3.6	32	70,000	6.1 (5.3–6.9)	1,794	9.5 (9.0–9.9)	681	40.3 (37.3–43.4)
New Jersey	0.0	43	341,000	4.6 (4.1–5.1)	10,454	10.1 (9.9-10.3)	3,057	28.2 (27.1-29.2)
New Mexico	4.4	30	94,000	5.5 (4.9–6.3)	1,530	8.1 (7.7–8.6)	1,079	43.4 (40.8–46.0)
New York	2.0	36	882,000	5.3 (4.8–5.8)	20,489	12.3 (12.2-12.5)	6,755	28.3 (27.6-29.0)
North Carolina	6.3	25	573,000	7.0 (6.3–7.7)	10,632	11.2 (11.0-11.4)	5,077	44.1 (42.9–45.3)
North Dakota	26.5	4	30,000	4.8 (4.2–5.6)	695	8.4 (7.8–9.0)	340	38.7 (34.5–42.9)
Ohio	3.9	31	705,000	7.1 (6.5–7.9)	16,189	16.7 (16.4-16.9)	7,000	48.0 (46.9–49.1)
Oklahoma	13.9	13	255,000	8.2 (7.4–9.1)	5,563	12.6 (12.3-12.9)	2,863	64.3 (61.9–66.7)
Oregon	2.4	34	174,000	5.1 (4.5–5.8)	2,442	7.6 (7.3–7.9)	2,037	40.7 (38.9–42.5)
Pennsylvania	3.2	33	701,000	6.2 (5.5–7.0)	17,795	14.9 (14.7-15.2)	6,457	36.7 (35.8-37.6)
Rhode Island	0.0	43	52,000	5.7 (4.9–6.5)	1,435	15.2 (14.4-16.0)	498	35.8 (32.6-39.0)
South Carolina	6.3	25	272,000	6.7 (6.1–7.3)	5,666	10.0 (9.7-10.2)	2,828	48.5 (46.6–50.3)
South Dakota	25.4	6	36,000	5.2 (4.4–6.1)	976	9.4 (8.8-10.0)	488	44.0 (40.0–47.9)
Tennessee	9.8	19	486,000	8.9 (8.0-10.0)	9,875	15.7 (15.3-16.0)	4,151	53.7 (52.1–55.4)
Texas	5.1	27	1,032,000	5.1 (4.6–5.7)	22,975	11.7 (11.5-11.9)	9,939	40.2 (39.4–41.0)
Utah	4.8	28	75,000	3.8 (3.4–4.3)	683	3.7 (3.4–4.0)	770	32.3 (30.0-34.6)
Vermont	26.1	5	31,000	5.6 (4.9–6.3)	660	6.9 (6.4–7.5)	345	41.0 (36.6–45.4)
Virginia	9.3	20	374,000	5.5 (5.0–6.0)	7,248	8.1 (7.9–8.2)	3,258	35.8 (34.6-37.1)
Washington	2.2	35	335,000	5.8 (5.3–6.3)	3,608	5.4 (5.3–5.6)	3,016	37.9 (36.5-39.3)
West Virginia	21.9	10	194,000	12.0 (11.1-13.0)	4,388	19.7 (19.1-20.2)	1,597	63.1 (60.0–66.3)
Wisconsin	12.5	17	209,000	4.2 (3.6–4.8)	5,179	10.3 (10.0-10.6)	2,761	38.1 (36.6-39.5)
Wyoming	27.4	3	32,000	6.8 (5.9–7.9)	570	7.7 (7.1–8.4)	361	55.9 (50.0–61.7)
50 states and DC	**5.9**	**—**	**15,460,000**	**5.9 (5.8–6.0)**	**335,362**	**11.5 (11.4-11.5)**	**150,350**	**40.3 (40.1–40.5)**

Abbreviations: BRFSS = Behavioral Risk Factor Surveillance System; CI = confidence interval; COPD = chronic obstructive pulmonary disease (includes emphysema and chronic bronchitis); DC = District of Columbia.

* Percentages of residents who live in rural (noncore) counties were calculated from 2015 bridged-race postcensal estimates (July 1, 2015) for populations that were defined by the 2013 National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties and obtained from CDC WONDER.

† Estimated number of adults with diagnosed COPD rounded to 1,000s.

§ Percentage ever told by a doctor, nurse, or other health professional that respondent had COPD, emphysema, or chronic bronchitis among adults aged ≥18 years in the 2015 Behavioral Risk Factor Surveillance System survey. Age-adjusted to the 2000 U.S. projected population, aged ≥18 years, using five age groups (18–44, 45–54, 55–64, 65–74, and ≥75 years).

¶ Hospitalizations among adults aged ≥65 years with a first-listed diagnosis claim for COPD *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes 490–492, or 496 or ICD-10-CM codes J40–J44 in the 2015 Medicare Part A hospital claims records. Hospital rates per 1,000 Medicare fee-for-service enrollees aged ≥65 years were age-adjusted to the 2000 U.S. projected population aged ≥65 years, using two age groups (65–74 and ≥75 years).

** Death rate per 100,000 U.S. population (including children) for COPD (ICD-10 codes J40–J44) reported as the underlying cause of death on the death certificate. Age-adjusted to the total 2000 U.S. projected population, using 11 age groups (<1, 1–4, 5–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–84, and ≥85 years).

addition to the major risk factors for COPD, which include tobacco smoke, environmental and occupational exposures, respiratory infections, and genetics, correlates include older ages, low socioeconomic status, and asthma history (*5*,*6*). Rural populations might have higher COPD risk because these populations have a greater proportion with a history of smoking (*3*), more secondhand smoke exposure but less access to smoking cessation programs,[§§] and higher proportions of uninsured or lower socioeconomic residents, which might have limited access to early diagnosis, treatment, and management of COPD.[¶¶] Rural respiratory exposures might include mold spores, organic toxic dust, and nitrogen dioxide, which are associated with COPD risk (*7*).

COPD management includes efforts to slow declining lung function, improve exercise tolerance, and prevent and treat exacerbations. Treatments include pulmonary rehabilitation, oxygen therapy, and medications. Smoking cessation programs, routine influenza and pneumococcal vaccinations, regular physical activity, and reductions in occupational and environmental exposures are also important. Barriers to health care in rural areas include cultural perceptions about seeking care, travel distance, absence of services, and financial burden (*8*). Access to early diagnosis, prompt treatment, and management of COPD by a pulmonologist is difficult for rural adults with COPD because of limited geographic accessibility to this COPD specialty (*9*). Therefore, much of the COPD in rural areas is diagnosed and managed by primary care providers (*9*). Level of care and patient-physician communication might vary, given that 27% of adults with COPD symptoms in 2016 reported that they had not talked with their physician about these symptoms (*10*). In a primary care physician survey, 71% said that they would use spirometry to assess patients with COPD symptoms, but they also reported that important barriers to diagnosing COPD included patient failure to report COPD symptoms or smoking history, poor treatment adherence, more immediate competing health issues, and diagnostic procedure costs (*10*). Whereas 68% of primary care physicians were aware that pulmonary rehabilitation programs were available to their patients, only 38% routinely prescribed this therapy for COPD patients (*10*). However, rural areas might have limited availability to these programs. Provision of online health care services (i.e., telemedicine) in rural areas could reduce some of these barriers by providing health education and support websites to patients and caregivers, appointment assistance, and ability to check assessment results online; however, lack of Internet access is still a barrier in some rural populations (*8*).

The findings in this report are subject to at least eight limitations. First, self-reported diagnosed COPD in BRFSS cannot be validated with medical records and might be subject to recall and social desirability biases; however, urban-rural variations in prevalence were similar to Medicare claims. Second, the BRFSS study population does not include adults who live in long-term care facilities, prisons, and other facilities; thus, findings are not generalizable to those populations. Third, state BRFSS response rates were relatively low, and response rates cannot be obtained by urban-rural classification. This might have resulted in overestimates or underestimates of COPD prevalence; however, a strength is that BRFSS provides large, stable sample sizes for all six urban-rural classifications. Fourth, the assumption that the six urban-rural classifications reflect consistent types of distinct populations and social environments within and across each state could potentially be incorrect. Fifth, county-level estimates are modeled and based on population characteristics such as distributions of older adults in the county; furthermore, it is not known how previous or current local interventions (e.g., tobacco cessation policies and programs) might have affected current COPD prevalence. Sixth, Medicare claims should not be interpreted as unique prevalent cases because some might reflect readmissions; however, these COPD estimates do reflect the actual Medicare burden for hospital facilities, pulmonary rehabilitation services, health care providers, caregivers, and other resources. Seventh, both Medicare hospital claims and death certificates might be subject to reporting preferences for certain diseases as the first-listed or underlying cause if there is a consistent regional or urban-rural preference. Finally, although the data reported here show higher COPD hospitalization and death rates for rural populations, they do not assess whether hospitalization and death rates among patients with COPD vary by urbanicity.

Higher burdens of COPD among rural U.S. residents highlight needs for continued tobacco cessation programs and policies to prevent COPD and improve pulmonary function among smokers. Known barriers to care in rural areas suggest a need for improved access for adults with COPD to treatment strategies (pulmonary rehabilitation and oxygen therapy) and comprehensive chronic disease self-management programs. Health care providers and community partners who serve rural residents can help adults with COPD increase access to and participation in health care interventions. Federal agencies are promoting collaborative and coordinated efforts to educate the public, providers, patients, and caregivers about COPD and improve the prevention, diagnosis, and treatment of COPD. The COPD National Action Plan[***] includes goals to expand

§§ http://www.lung.org/assets/documents/research/cutting-tobaccos-rural-roots.pdf.

¶¶ http://www.countyhealthrankings.org/reports/key-findings-2016.

*** https://www.nhlbi.nih.gov/health-pro/resources/lung/copd-national-action-plan.

Summary

What is already known about this topic?

Chronic obstructive pulmonary disease (COPD) is a leading cause of death and has been diagnosed in 15.5 million adults in 2015 in the United States. Risk factors include tobacco exposure, occupational and environmental exposures, respiratory infections, and genetics.

What is added by this report?

In 2015, rural U.S. residents had higher age-adjusted prevalence of COPD, of Medicare hospitalizations, and deaths caused by COPD than did residents living in micropolitan or metropolitan areas. Several states with the highest percentages of rural populations also had the highest estimates for all three measures.

What are the implications for public health practice?

Additional efforts are needed to prevent risk factors and overcome barriers to early diagnosis, and the appropriate treatment and management of COPD. Improving access to such health care might improve quality of life and reduce hospital readmissions among COPD patients and reduce COPD mortality.

access to online communities, develop clinical decision tools for primary health care providers, and conduct research to improve access to care for COPD in hard-to-reach areas. Promoting these efforts has the potential to improve quality of life for COPD patients and reduce hospital readmissions and COPD mortality.

Conflict of Interest

No conflicts of interest were reported.

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HIV Diagnoses Among Persons Aged 13–29 Years — United States, 2010–2014

M. Cheryl Bañez Ocfemia, MPH[1]; Richard Dunville, MPH[2]; Tianchi Zhang, MS[1]; Lisa C. Barrios, DrPH[2]; Alexandra M. Oster, MD[1]

In 2014, persons aged 13–29 years represented 23% of the U.S. population, yet accounted for 40% of diagnoses of human immunodeficiency virus (HIV) infection during the same year (*1*). During 2010–2014, the rates of diagnosis of HIV infection decreased among persons aged 15–19 years, were stable among persons aged 20–24 years, and increased among persons aged 25–29 years (*1*). However, these 5-year age groups encompass multiple developmental stages and potentially mask trends associated with the rapid psychosocial changes during adolescence through young adulthood. To better understand HIV infection among adolescents aged 13–17 years and young adults aged 18–29 years in the United States and identify ideal ages to target primary HIV prevention efforts, CDC analyzed data from the National HIV Surveillance System (NHSS)* using narrow age groups. During 2010–2014, rates of diagnosis of HIV infection per 100,000 population varied substantially among persons aged 13–15 years (0.7), 16–17 years (4.5), 18–19 years (16.5), and 20–21 years (28.6), and were higher, but less variable, among persons aged 22–23 years (34.0), 24–25 years (33.8), 26–27 years (31.3), and 28–29 years (28.7). In light of the remarkable increase in rates between ages 16–17, 18–19, and 20–21 years, and a recent study revealing that infection precedes diagnosis for young persons by an average of 2.7 years (*2*), these findings demonstrate the importance of targeting primary prevention efforts to persons aged <18 years and continuing through the period of elevated risk in their mid-twenties.

CDC analyzed data on persons aged 13–29 years who had HIV infection diagnosed during 2010–2014 and reported to NHSS through June 2016. Numbers and rates of diagnosed infections were calculated by year of diagnosis and by 2-year and 3-year age groups (ages 13–15, 16–17, 18–19, 20–21, 22–23, 24–25, 26–27, and 28–29 years) and selected characteristics. A single 3-year age group was required because of the odd number of years. All rates (per 100,000 population) were calculated using data from the U.S. Census Bureau for the denominators. Multiple imputation was used to assign a transmission category to persons reported without an identified risk factor (*3*). To assess trends during 2010–2014, the estimated annual percent change in HIV diagnosis rates was calculated using Poisson regression; changes were considered to be statistically significant if the 95% confidence interval (CI) excluded 0.

During 2010–2014, in 50 states and the District of Columbia, 78,337 persons aged 13–29 years had diagnosed HIV infection (Table 1). The overall HIV diagnosis rate was 21.3 per 100,000 population. By age group, HIV diagnosis rates varied substantially among persons aged 13–15 years (0.7), 16–17 years (4.5), 18–19 years (16.5), and 20–21 years (28.6). HIV diagnosis rates were higher, but less variable, among persons aged 22–23 years (34.0), 24–25 years (33.8), 26–27 years (31.3), and 28–29 years (28.7), with the highest rate in those aged 22–23 years (Table 1).

* CDC's National HIV Surveillance System (NHSS) is the primary source for monitoring HIV trends in the United States. Through NHSS, CDC collects, analyzes, and disseminates surveillance data on HIV infection.

TABLE 1. Diagnoses of HIV infection* among persons aged 13–29 years, by year of diagnosis and age group — National HIV Surveillance System, United States, 2010–2014

Age group (yrs) at diagnosis	2010		2011		2012		2013		2014		2010–2014		
	No.	Rate†	No.	Rate†	No.	Rate†	No.	Rate†	No.	Rate†	No.	Rate†	EAPC§ (95% CI)
13–15	90	0.7	100	0.8	98	0.8	72	0.6	78	0.6	438	0.7	-5.9 (-12.0 to 0.5)
16–17	434	5.0	393	4.6	364	4.3	367	4.4	348	4.2	1,906	4.5	-4.0 (-7.0 to -0.9)¶
18–19	1,605	17.7	1,555	17.4	1,467	16.7	1,296	14.9	1,335	15.6	7,258	16.5	-4.0 (-5.6 to -2.4)¶
20–21	2,695	30.1	2,730	29.7	2,511	27.3	2,489	27.5	2,518	28.3	12,943	28.6	-2.0 (-3.2 to -0.8)¶
22–23	2,999	35.3	2,938	33.7	3,144	34.6	3,047	32.7	3,177	34.1	15,305	34.0	-0.9 (-2.1 to 0.2)
24–25	2,763	32.4	2,772	32.6	2,966	34.4	3,007	34.0	3,262	35.4	14,770	33.8	2.3 (1.1 to 3.4)¶
26–27	2,535	30.2	2,558	30.1	2,586	29.9	2,800	32.4	2,965	33.9	13,444	31.3	3.2 (2.0 to 4.4)¶
28–29	2,443	28.9	2,461	28.9	2,450	28.9	2,373	27.6	2,546	29.1	12,273	28.7	-0.3 (-1.5 to 1.0)
Total	**15,564**	**21.3**	**15,507**	**21.1**	**15,586**	**21.2**	**15,451**	**20.9**	**16,229**	**21.8**	**78,337**	**21.3**	**0.4 (-0.1 to 0.9)**

Abbreviations: CI = confidence interval; EAPC = estimated annual percent change; HIV = human immunodeficiency virus.
* Data include persons with a diagnosis of HIV infection regardless of stage of disease at diagnosis.
† Rates are per 100,000 population.
§ Trends were measured with EAPC in HIV diagnoses rates using Poisson regression.
¶ p<0.05.

Among persons aged 13–29 years with infection diagnosed during 2010–2014, blacks/African Americans accounted for the highest number and rate of HIV diagnoses (40,755 [52.0%]; 390.6 per 100,000 population), followed by Hispanics/Latinos (17,386 [22.2%]; 113.1) (Table 2). Among 66,471 males with diagnosed HIV infection, 59,634 (89.7%)

TABLE 2. Diagnoses of HIV infection* among persons aged 13–29 years, by age group at diagnosis and selected characteristics — National HIV Surveillance System, United States, 2010–2014

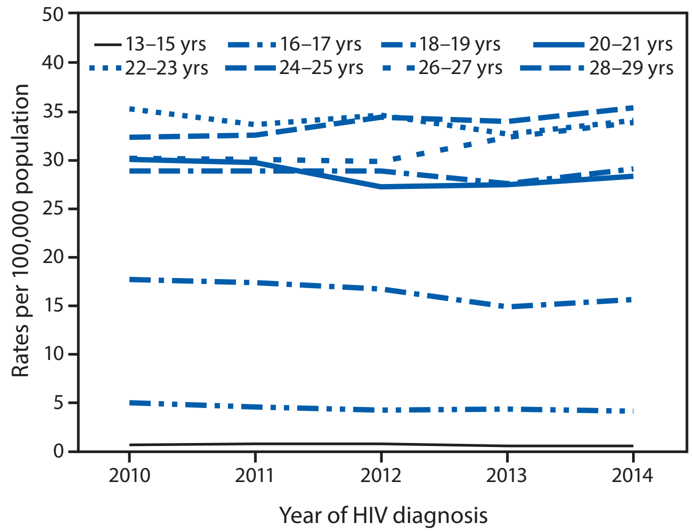
	Age group (yrs)																	
	Total		13–15		16–17		18–19		20–21		22–23		24–25		26–27		28–29	
Characteristic	No.† (%)	Rate§	No.† (%)	Rate§	No.† (%)	Rate§	No.† (%)	Rate§	No.† (%)	Rate§	No.† (%)	Rate§	No.† (%)	Rate§	No.† (%)	Rate§	No.† (%)	Rate§
Sex																		
Male	**66,471 (84.9)**	**176.8**	226 (0.3)	3.5	1,393 (2.1)	32.0	6,017 (9.1)	133.1	11,264 (16.9)	242.7	13,392 (20.1)	291.7	12,765 (19.2)	286.7	11,306 (17.0)	260.0	10,108 (15.2)	234.3
Female	**11,866 (15.1)**	**32.9**	212 (1.8)	3.5	513 (4.3)	12.4	1,241 (10.5)	29.0	1,679 (14.1)	38.0	1,913 (16.1)	43.5	2,005 (16.9)	46.7	2,138 (18.0)	50.5	2,165 (18.2)	51.0
Race/Ethnicity																		
American Indian/ Alaska Native	**323 (0.4)**	**51.5**	1 (0.3)	0.9	2 (0.6)	2.7	24 (7.4)	30.5	51 (15.8)	63.3	61 (18.9)	78.7	70 (21.7)	97.1	55 (17.0)	80.8	59 (18.3)	89.7
Asian	**1,333 (1.7)**	**34.7**	9 (0.7)	1.6	16 (1.2)	4.2	61 (4.6)	15.0	151 (11.3)	33.8	253 (19.0)	52.2	273 (20.5)	53.9	287 (21.5)	54.9	283 (21.2)	52.3
Black/African American	**40,755 (52.0)**	**390.6**	291 (0.7)	16.4	1,246 (3.1)	100.6	4,602 (11.3)	348.5	7,602 (18.7)	556.9	8,318 (20.4)	636.1	7,263 (17.8)	602.8	6,168 (15.1)	547.3	5,265 (12.9)	479.3
Hispanic/Latino¶	**17,386 (22.2)**	**113.1**	71 (0.4)	2.6	383 (2.2)	21.0	1,322 (7.6)	71.3	2,537 (14.6)	136.3	3,146 (18.1)	173.2	3,428 (19.7)	194.3	3,410 (19.6)	195.5	3,089 (17.8)	176.6
Native Hawaiian/ Other Pacific Islander	**92 (0.1)**	**60.3**	0 (0.0)	0.0	2 (2.2)	12.5	6 (6.5)	35.1	14 (15.2)	74.8	20 (21.7)	101.7	19 (20.7)	96.2	18 (19.6)	93.9	13 (14.1)	68.6
White	**15,419 (19.7)**	**37.2**	52 (0.3)	0.8	167 (1.1)	3.6	909 (5.9)	18.6	2,062 (13.4)	40.7	2,872 (18.6)	56.5	3,166 (20.5)	63.3	3,049 (19.8)	61.7	3,142 (20.4)	63.7
Multiple races	**3,029 (3.9)**	**166.6**	14 (0.5)	3.4	90 (3.0)	35.5	334 (11.0)	138.9	526 (17.4)	236.0	635 (21.0)	317.5	551 (18.2)	310.4	457 (15.1)	281.6	422 (13.9)	275.0
Transmission category**																		
Male																		
Male-to-male sexual contact	**59,634 (76.1)**	—	166 (0.3)	—	1,274 (2.1)	—	5,597 (9.4)	—	10,348 (17.4)	—	12,275 (20.6)	—	11,434 (19.2)	—	9,921 (16.6)	—	8,617 (14.4)	—
Injection drug use	**1,166 (1.5)**	—	4 (0.3)	—	11 (0.9)	—	56 (4.8)	—	141 (12.1)	—	183 (15.7)	—	226 (19.4)	—	273 (23.4)	—	273 (23.4)	—
Male-to-male sexual contact and injection drug use	**2,597 (3.3)**	—	8 (0.3)	—	40 (1.5)	—	171 (6.6)	—	389 (15.0)	—	453 (17.4)	—	542 (20.9)	—	481 (18.5)	—	513 (19.8)	—
Heterosexual contact††	**2,955 (3.8)**	—	13 (0.4)	—	55 (1.9)	—	177 (6.0)	—	373 (12.6)	—	468 (15.8)	—	550 (18.6)	—	622 (21.0)	—	698 (23.6)	—
Other§§	**120 (0.2)**	—	35 (29.2)	—	13 (10.8)	—	16 (13.3)	—	13 (10.8)	—	14 (11.7)	—	13 (10.8)	—	9 (7.5)	—	7 (5.8)	—
Female																		
Injection drug use	**1,262 (1.6)**	—	6 (0.5)	—	40 (3.2)	—	106 (8.4)	—	161 (12.8)	—	210 (16.6)	—	241 (19.1)	—	241 (19.1)	—	257 (20.4)	—
Heterosexual contact††	**10,462 (13.4)**	—	165 (1.6)	—	452 (4.3)	—	1,103 (10.5)	—	1,496 (14.3)	—	1,693 (16.2)	—	1,758 (16.8)	—	1,891 (18.1)	—	1,904 (18.2)	—
Other§§	**141 (0.2)**	—	40 (28.4)	—	21 (14.9)	—	32 (22.7)	—	22 (15.6)	—	10 (7.1)	—	6 (4.3)	—	6 (4.3)	—	4 (2.8)	—
Region of residence																		
Northeast	**12,812 (16.4)**	**99.9**	81 (0.6)	3.8	341 (2.7)	23.2	1,111 (8.7)	69.4	1,969 (15.4)	123.1	2,411 (18.8)	158.0	2,452 (19.1)	160.9	2,317 (18.1)	153.7	2,130 (16.6)	143.9
Midwest	**11,448 (14.6)**	**73.4**	55 (0.5)	2.0	311 (2.7)	16.8	1,262 (11.0)	66.1	2,069 (18.1)	105.5	2,303 (20.1)	122.7	2,053 (17.9)	115.6	1,821 (15.9)	104.0	1,574 (13.7)	89.2
South	**40,667 (51.9)**	**148.2**	240 (0.6)	5.1	1,061 (2.6)	33.9	3,958 (9.7)	122.2	6,975 (17.2)	207.5	8,129 (20.0)	240.7	7,570 (18.6)	231.2	6,645 (16.3)	208.0	6,089 (15.0)	191.1
West	**13,410 (17.1)**	**75.1**	62 (0.5)	2.1	193 (1.4)	9.5	927 (6.9)	45.1	1,930 (14.4)	90.4	2,462 (18.4)	111.5	2,695 (20.1)	124.1	2,661 (19.8)	125.0	2,480 (18.5)	116.4
Total	**78,337 (100.0)**	**106.3**	**438 (0.6)**	**3.5**	**1,906 (2.4)**	**22.5**	**7,258 (9.3)**	**82.4**	**12,943 (16.5)**	**142.9**	**15,305 (19.5)**	**170.2**	**14,770 (18.9)**	**168.9**	**13,444 (17.2)**	**156.7**	**12,273 (15.7)**	**143.4**

Abbreviation: HIV = human immunodeficiency virus.
* Data include persons with a diagnosis of HIV infection regardless of stage of disease at diagnosis.
† Numbers <12 should be interpreted with caution.
§ Rates are per 100,000 population. Rates are not calculated by transmission category because of the lack of denominator data.
¶ Hispanics or Latinos might be of any race.
** Data statistically adjusted using multiple imputation techniques to account for missing transmission categories.
†† Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.
§§ Includes persons with diagnosed infection attributed to hemophilia, blood transfusion, perinatal exposure, and risk factor not reported or not identified.

had infections attributable to male-to-male sexual contact, and among these, males aged 22–23 years accounted for the highest number of diagnoses (12,275 [20.6%]). Among 11,866 females with diagnosed HIV infection, 10,462 (88.2%) had infections attributable to heterosexual contact, and among these, females aged 26–27 and 28–29 years accounted for the highest numbers of diagnoses (1,891 [18.1%] and 1,904 [18.2%], respectively). By region, the South accounted for the highest number and rate of HIV diagnoses among persons aged 13–29 years (40,667 [51.9%]; 148.2 per 100,000 population).

During 2010–2014, the overall HIV diagnosis rate among persons aged 13–29 years remained stable (estimated annual percent change = 0.4, 95% CI = -0.1 to 0.9) (Table 1). However, by age group, rates per 100,000 population increased during 2010–2014 among persons aged 24–25 years (from 32.4 to 35.4) and 26–27 years (from 30.2 to 33.9) and decreased among persons aged 16–17 years (from 5.0 to 4.2), 18–19 years (from 17.7 to 15.6), and 20–21 years (from 30.1 to 28.3) (Table 1) (Figure). Rates remained stable among persons aged 13–15, 22–23, and 28–29 years.

FIGURE. Rates* of diagnoses of HIV infection† among persons aged 13–29 years, by year of diagnosis and age group — National HIV Surveillance System, United States, 2010–2014



Abbreviation: HIV = human immunodeficiency virus.
* Rates are per 100,000 population.
† Data include persons with a diagnosis of HIV infection regardless of stage of disease at diagnosis.

Discussion

This analysis revealed large differences in rates of diagnosis of HIV infection with increasing age among persons aged 13–15, 16–17, 18–19, and 20–21 years. This report also documents trends in diagnoses during 2010–2014 by narrow age groups, with increasing rates observed among persons aged 24–25 and 26–27 years and decreasing rates among persons aged 16–17, 18–19, and 20–21 years.

Studies focused on adolescents and young adults with HIV infection commonly incorporate broader age ranges (e.g., 13–29 years), obscuring important distinctions that can contribute to a better understanding of HIV infections among persons during adolescence and into young adulthood (*4*). Adolescence and young adulthood are periods of considerable biologic and physiologic change and represent developmental phases when engagement in high-risk sexual behaviors and alcohol and other drug use peak and the risk for acquiring HIV infection increases (*4*,*5*). However, few HIV-related studies have taken into account these developmental transitions, and studies rarely include persons aged <18 years (*5*). A recent longitudinal study in an urban area with high HIV prevalence among men aged 16–20 years who have sex with men found that HIV incidence was just as high among participants aged <18 years as among older participants (*5*), highlighting the importance of including adolescents aged <18 years in research and prevention efforts, particularly HIV testing. A previous study has also shown delays in diagnosis of HIV infection of an average of 2.7 years in persons aged 13–24 years (*2*), indicating that the period of risk for HIV acquisition begins before age 18 years.

To help address the impact of HIV infection among adolescents and young adults, especially sexual and racial/ethnic minority populations, two national goals focus on persons aged 13–24 years as a priority population at risk to monitor the percentage of young gay and bisexual men who have engaged in HIV acquisition risk behaviors and the percentage of adolescents and young adults with diagnosed HIV infection who are virally suppressed (<200 HIV RNA copies/mL) through use of antiretroviral therapy (*6*). Unfortunately, adolescents and young adults are least likely to be linked to and retained in HIV care or to achieve viral suppression (*7*,*8*). In 2014, among men who have sex with men, who account for the majority of persons with HIV infection among persons aged 13–24 years, 48% were aware of their infection; awareness of infection is crucial to health and prevention (*9*). Among persons aged 13–24 years with infection diagnosed in 2014, 68% were linked to HIV medical care within 1 month of diagnosis, and among those living with diagnosed HIV infection at the end of 2013, 55% were retained in care, and 44% were virally suppressed (*8*). All of these indicators are well below national targets (*9*). Additional studies are needed to identify barriers that affect testing, retention in care, and access to health services, including the use of preexposure prophylaxis, among adolescents and young adults, particularly persons aged <18 years (*6*,*7*).

Summary

What is already known about this topic?

In 2014, persons aged 13–29 years represented 23% of the U.S. population, yet accounted for 40% of diagnoses of human immunodeficiency virus (HIV) infection in the United States during the same year.

What is added by this report?

HIV diagnoses analyzed by age groups revealed striking differences in rates of diagnosis of HIV infection between ages 13–21 years. During 2010–2014, HIV infection diagnosis rates per 100,000 population varied substantially with increasing age among persons aged 13–15 years (0.7), 16–17 years (4.5), 18–19 years (16.5), and 20–21 years (28.6). HIV diagnosis rates were higher, but less variable, among persons aged 22–23 years (34.0), 24–25 years (33.8), 26–27 years (31.3), and 28–29 years (28.7).

What are the implications for public health practice?

The findings underscore the importance of using a multifaceted approach and targeting primary prevention efforts to persons aged <18 years and continuing through the period of elevated risk in their mid-twenties.

The findings in this report are subject to at least three limitations. First, the data presented reflect diagnoses of HIV infection, which are subject to diagnosis delay when compared with incidence, and are not necessarily representative of all persons with HIV infection. Whereas there are models available to estimate incidence, such approaches typically yield wide confidence intervals and unreliable estimates for narrow age groups. Second, trends in diagnoses of HIV infection might be attributed to changes in testing, transmission, or reporting. Finally, state laws affecting minors' consent to care and disparities in access might also affect testing behaviors.

These findings underscore the importance of targeting primary prevention efforts to persons aged <18 years, specifically those aged 16–17 years, and continuing through the period of elevated risk in the mid-twenties. Much remains to be understood about the factors that affect adolescents and young adults at high risk for acquiring or transmitting HIV infection. CDC supports school districts and state education agencies that promote environments where teens can gain fundamental health knowledge and skills, establish healthy behaviors for a lifetime, connect to health services, and avoid becoming pregnant or infected with HIV or other sexually transmitted diseases (*10*). When implementing effective HIV prevention strategies, a multifaceted approach that incorporates the educational, social, policy, and health care systems can help support youths as they transition from adolescence into young adulthood (*7*).

Conflict of Interest

No conflicts of interest were reported.

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Prevalence of Amyotrophic Lateral Sclerosis — United States, 2014

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Amyotrophic lateral sclerosis (ALS), commonly known as Lou Gehrig's disease, is a progressive and fatal neuromuscular disease; the majority of ALS patients die within 2–5 years of receiving a diagnosis (*1*). Familial ALS, a hereditary form of the disease, accounts for 5%–10% of cases, whereas the remaining sporadic cases have no clearly defined etiology (*1*). ALS affects persons of all races and ethnicities; however, whites, males, non-Hispanics, persons aged >60 years, and those with a family history of ALS are more likely to develop the disease (*1–3*). No cure for ALS has yet been identified, and the lack of proven and effective therapeutic interventions is an ongoing challenge. Current treatments available do not cure ALS but have been shown to slow disease progression. Until recently, only one drug (riluzole) was approved to treat ALS; however, in 2017, the Food and Drug Administration approved a second drug, edaravone (*4*).

This report presents National ALS Registry (Registry) findings regarding ALS prevalence for the period January 1–December 31, 2014, and, for the first time, includes Medicare hospice data and ALS prevalence rates by Census region. ALS prevalence did not change from 2013, remaining at 5.0 cases per 100,000 persons in 2014. Data collected by the Registry are being used to better describe the epidemiology of ALS in the United States and to facilitate research.

In 2008, the U.S. Congress passed the ALS Registry Act, which authorized the creation and maintenance of the Registry by CDC; CDC delegated this responsibility to the Agency for Toxic Substances and Disease Registry (ATSDR) (*5*). The main goals of the Registry are to better describe the incidence and prevalence of ALS, characterize the demographics of persons living with ALS in the United States, and examine potential risk factors such as environmental and occupational influences. Because ALS is not a notifiable disease in the United States, the Registry employs a novel case-finding approach that uses administrative and self-reported data to identify cases, whereas usual noncommunicable disease registries (e.g., cancer) typically rely on data reported from health care providers to identify cases.

ATSDR's Registry uses a two-pronged approach to identify ALS cases (*6*). The first component applies a pilot-tested algorithm that includes elements such as the *International Classification of Diseases* code for ALS, frequency of visits to a neurologist, and prescription drug use to three large national databases (Medicare, Veterans Health Administration, and Veterans Benefits Administration). The algorithm categorizes cases as "definite ALS," "possible ALS," and "not ALS"; only definite ALS cases are entered into the Registry. "Possible ALS" cases are evaluated for conversion to "definite ALS" in subsequent years. The second component comprises a secure web portal to allow persons with ALS to self-register to facilitate identification of cases not collected through the first component (*7*). Cases from both data sources are then merged and deduplicated. In addition, for this report, Medicare hospice data were included for the first time. Once an ALS case is identified, it remains a case until the person is confirmed as deceased by obtaining death data from the National Death Index. The prevalence of ALS was calculated from the Registry by using the deduplicated total number of persons with ALS identified through administrative data and those who self-identified through the portal as the numerator. The 2014 Census estimate was used for the denominator (*8*).

A total of 15,927 persons were identified as having definite ALS across the three national databases and through web portal registration for 2014 (Table). The estimated prevalence for 2014 was 5.0 per 100,000 population, representing no increase from 2013 (5.0 per 100,000). No significant increases were observed across age groups (Figure). The lowest prevalence (0.5 per 100,000 population) was among persons aged 18–39 years, and the highest (20.0) was among persons aged 70–79 years. As in 2013, the prevalence in males (6.3) was higher than that in females (3.6) (Table). The ratio of cases in males to those in females was 1.7:1. The prevalence in whites (5.4) was more than twice that in blacks (2.4).

Prevalence rates were also calculated for the four U.S. Census regions: Northeast, South, Midwest, and West. Rates were highest in the Midwest (5.7 per 100,000 population), followed by the Northeast (5.5), the South (4.7), and the West (4.3) (Table).

Discussion

Data sources for the Registry remain unchanged, but the national administrative data now include hospice data from Medicare. The Registry's novel approach of using national administrative databases is the cornerstone for identifying ALS cases because most of the definite ALS cases from 2010 to 2014 originate from this source.

Since publication of the first surveillance summary that reported analyzed data for 2010–2011 (*2*) and for subsequent

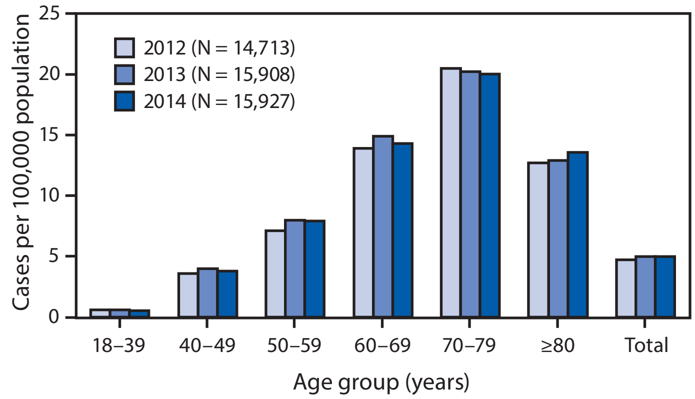
TABLE. Number and percentage of identified cases of amyotrophic lateral sclerosis (N = 15,927) and estimated prevalence, by age group, sex, race, and geographic region — National ALS Registry, United States, 2014

Characteristic	Population*	No. (%) ALS cases	Prevalence estimate (cases per 100,000 population), % (95% CI)
Age group (yrs)			
18–39	94,902,312	506 (3.2)	0.5 (0.5–0.6)
40–49	41,479,525	1,587 (10.0)	3.8 (3.5–4.2)
50–59	44,082,258	3,492 (21.9)	7.9 (7.4–8.4)
60–69	33,891,398	4,861 (30.5)	14.3 (13.7–15.0)
70–79	18,995,348	3,807 (23.9)	20.0 (19.2–20.9)
≥80	11,922,597	1,623 (10.2)	13.6 (13.1–14.2)
Unknown	—	51 (0.3)	—
Sex			
Males	156,936,487	9,821 (18.6)	6.3 (6.1–6.4)
Females	161,920,569	5,854 (36.8)	3.6 (3.5–3.7)
Unknown	—	252 (1.6)	—
Race			
White	233,963,128	12,660 (79.5)	5.4 (5.2–5.5)
Black	40,379,066	988 (6.2)	2.4 (2.3–2.6)
Other	—	863 (5.4)	—
Unknown	—	1,416 (8.9)	—
U.S. Census region†			
Midwest	67,745,108	3,832 (24.1)	5.7 (5.4–5.9)
Northeast	56,152,333	3,075 (19.3)	5.5 (5.2–5.8)
South	119,771,934	5,682 (35.7)	4.7 (4.6–4.9)
West	75,187,681	3,252 (20.4)	4.3 (4.1–4.5)
Unknown	—	86 (0.5)	—
Total	**318,857,056**	**15,927**	**5.0 (4.9–5.1)**

Abbreviations: ALS = amyotrophic lateral sclerosis; CI = confidence interval.
* From 2014 U.S. Census data.
† *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont; *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia; *Midwest:* Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin; *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

years (*3*), ALS has remained more prevalent in whites, males, and persons aged ≥60 years; current patterns are similar to those identified during 2010–2013. These patterns remain unchanged for 2014. It was hypothesized that the prevalence would increase in 2014 with the additional hospice data; however, this was not the case. Additional years of data are needed to determine whether ALS cases are increasing, decreasing, or remaining the same in the United States. The inclusion of Medicare hospice data for the first time in 2014 did not affect estimated ALS prevalence. Many patients identified through hospice data had been previously identified in either Medicare data, Veterans Health Administration data, Veterans Benefits Administration data, or the web portal. The Registry continues to evaluate additional data sources for case identification as well as ways to increase self-registration through the secure web portal to increase case ascertainment.

FIGURE. Prevalence of amyotrophic lateral sclerosis (ALS), by age group — National ALS Registry, United States, 2012–2014



Abbreviation: ALS = Amyotrophic lateral sclerosis.

Prevalence rates by U.S. Census regions are consistent with ALS demographics. Overall, whites have a higher prevalence of ALS than blacks. The higher ALS prevalence in the Midwest and Northeast likely reflects the higher proportion of whites, compared with the South and West (*8*). The lowest prevalence in the West Census region is most likely related to the population diversity in states such as California (*8*).

The Registry continues to expand ALS research nationally. In January 2017, the National ALS Biorepository (Biorepository), a component of the Registry, was launched. The Biorepository is novel in several ways. First, it obtains samples from Registry enrollees via in-home collection (e.g., blood, hair, or saliva) and postmortem collection (e.g., brain, bone, spinal cord, cerebrospinal fluid, muscle, and skin) at no charge to patients or their caregivers. Currently, the few existing ALS biorepositories largely have samples from specific clinics or medical practices, and the samples that are left over from previous clinical trials in the United States. Second, specimens from the National ALS Biorepository are collected from a geographically representative sample of Registry enrollees. The sample of persons recruited to participate in the Biorepository correlates with the population distribution of the United States and each year will include at least one person from each state. Third, these deidentified samples are paired with completed risk factor survey data (e.g., occupational and military history) from the Registry. Researchers are currently able to request samples alone or paired with risk factor data. The availability of additional specimens from a national sample of ALS patients further expands research potential on the genetics, potential biomarkers, environmental pollutants, and etiology for ALS. Additional information for requesting samples and/or risk factor data is available at https://wwwn.cdc.gov/als/ALSRegistryResearchApplicationInfo.aspx.

The findings in this report are subject to at least four limitations. First, ALS is not a notifiable disease, and ensuring that all newly diagnosed and prevalent ALS cases in the United States are collected in the Registry is challenging; therefore, the possibility of underascertainment exists. Second, although every attempt was made to deduplicate the files, differences in fields collected by the different sources, misspellings of names, and data entry errors could have prevented records from merging correctly. However, it is unlikely that this occurred in numbers sufficient to affect the overall conclusions. Third, the calculation of ALS incidence with Registry data is not possible at this time because the date of diagnosis is not collected through the large administrative database approach, and cases without a date of diagnosis account for more than two thirds (68%) of cases in the Registry. Finally, the Registry has been officially active since October 2009 and is still being enhanced. As more persons with ALS enroll and complete surveys, a better understanding of possible risk factors might emerge (*2*,*3*).

Establishment of the National ALS Registry, as well as the newly launched National ALS Biorepository, fills a critical scientific gap by providing estimates of prevalence of this disease and facilitates further study of risk factors and etiology. The National ALS Registry continues to be improved and enhanced, increasing its potential for ALS research and detection of more ALS cases. ATSDR is committed to advancing ALS research and monitoring trends of ALS prevalence in the United States.

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Summary

What is already known about this topic?

Amyotrophic lateral sclerosis (ALS), commonly known as Lou Gehrig's disease, is a progressive and fatal neuromuscular disease. Familial ALS, a hereditary form of the disease, accounts for 5%–10% of cases; the remaining sporadic cases have no clearly defined etiology.

What is added by this report?

A total of 15,927 persons were identified as having definite ALS across three national databases (Medicare, Veterans Health Administration, and Veterans Benefits Administration) and through web portal registration for 2014. The estimated ALS prevalence for 2014 was 5.0 cases per 100,000 population, the same as 2013 estimate.

What are the implications for public health practice?

Through ongoing enhancements and expanded outreach and promotion, the National ALS Registry has the potential to expand ALS research and detect more ALS cases in the United States.

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Prevalence of Self-Reported Hypertension and Antihypertensive Medication Use Among Adults Aged ≥18 Years — United States, 2011–2015

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Hypertension, which affects nearly one third of adults in the United States, is a major risk factor for heart disease and stroke (*1*), and only approximately half of those with hypertension have their hypertension under control (*2*). The prevalence of hypertension is highest among non-Hispanic blacks, whereas the prevalence of antihypertensive medication use is lowest among Hispanics (*1*). Geographic variations have also been identified: a recent report indicated that the Southern region of the United States had the highest prevalence of hypertension as well as the highest prevalence of medication use (*3*). Using data from the Behavioral Risk Factor Surveillance System (BRFSS), this study found minimal change in state-level prevalence of hypertension awareness and treatment among U.S. adults during the first half of the current decade. From 2011 to 2015, the age-standardized prevalence of self-reported hypertension decreased slightly, from 30.1% to 29.8% (p = 0.031); among those with hypertension, the age-standardized prevalence of medication use also decreased slightly, from 63.0% to 61.8% (p<0.001). Persistent differences were observed by age, sex, race/ethnicity, level of education, and state of residence. Increasing hypertension awareness, as well as increasing hypertension control through lifestyle changes and consistent antihypertensive medication use, requires diverse clinical and public health intervention.

BRFSS is a state-based telephone survey of noninstitutionalized adults aged ≥18 years.* Data for this study were taken from the fixed core questions asked every year and the rotating core questions asked every other year. Hypertension awareness questions, included in the rotating core, were asked in odd years. New survey methods were introduced to the BRFSS in 2011; thus, available data from 2011 to 2015 were used for trend analyses. The median state-specific response rates in 2011, 2013, and 2015 were 49.7% (range = 33.8%–64.1%), 45.9% (29.0%–59.2%), and 47.2% (33.9%–61.1%), respectively.†

Self-reported diagnosed hypertension was ascertained by an affirmative response to the question "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?" To determine whether persons with hypertension were being treated, respondents who answered "yes" were asked "Are you currently taking medicine for your high blood pressure?" Hypertension and treatment were assessed by age group (18–44 years, 45–64 years, and ≥65 years), sex, race/ethnicity (non-Hispanic whites [whites]; non-Hispanic blacks [blacks]; Hispanics; non-Hispanic Asians [Asians]; non-Hispanic Native Hawaiian/Pacific Islanders [NH/PIs]; non-Hispanic American Indian/Alaskan Natives [AI/ANs]); and non-Hispanic others [others]), highest level of education attained (less than high school graduate, high school graduate, some college, college graduate or higher), and state of residence. Estimates were directly age-standardized to the 2000 U.S. standard population. Changes over time were assessed using t-tests for the differences from 2011 to 2015. Because of a large difference in the age distribution between persons with hypertension and the general population, both age-standardized and crude estimates were calculated. All analyses were conducted using statistical software to account for the complex sampling design.

Overall, 497,967, 483,865, and 434,382 participants were interviewed in 2011, 2013, and 2015, respectively. After excluding participants who were pregnant (0.5%–0.6%), missing data for hypertension variables (0.3%–0.4%) and other covariates (2.0%–2.8%), the final analytic samples for 2011, 2013 and 2015 were 483,120 (97% of original sample), 465,739 (96%), and 418,317 (96%), respectively. From 2011 to 2015, the overall age-standardized prevalence of self-reported hypertension decreased from 30.1% to 29.8% (p = 0.031). Hypertension prevalence was higher in 2015 among adults aged ≥65 years (61.7%), men (32.5%), blacks (40.3%), and persons with less than high school education (35.1%) compared with younger adults, women (27.1%), Asians (24.6%), and persons with higher levels of education (Table 1). Statistically significant, but minimal, declines in the prevalence of hypertension from 2011 to 2015 were observed among women (28.1% to 27.1%), persons aged ≥65 years (62.2% to 61.7%), and persons with some college education (30.5% to 29.8%). In contrast, an increase in hypertension prevalence was observed among persons with less than high school education (34.1% to 35.1%).

By state, the age-standardized prevalence of self-reported hypertension ranged from 24.2% in Minnesota to 40.1% in Mississippi in 2015 (Table 1). From 2011 to 2015, significant increases in the prevalence of hypertension were observed in five states (Arkansas, Georgia, Hawaii, North Carolina, and West Virginia)

* https://www.cdc.gov/brfss.

† According to the guidelines for the American Association of Public Opinion Research.

TABLE 1. Age-standardized prevalence of self-reported hypertension among adults aged ≥18 years by sociodemographic characteristics and state* — Behavioral Risk Factor Surveillance System, United States 2011–2015

	% (95% CI)			Change 2011–2015	
Characteristic	2011	2013	2015	%	p-value†
Total	**30.1 (29.9–30.4)**	**30.6 (30.3–30.8)**	**29.8 (29.5–30.0)**	**-0.3**	**0.031**
Sex					
Male	32.1 (31.7–32.4)	32.8 (32.4–33.2)	32.5 (32.1–32.9)	0.4	0.096
Female	28.1 (27.8–28.4)	28.3 (28.0–28.6)	27.1 (26.8–27.4)	-1.0	<0.001
Age group (yrs)					
18–44	14.1 (13.8–14.5)	14.2 (13.8–14.5)	13.7 (13.4–14.1)	-0.4	0.210
45–64	40.2 (39.8–40.6)	41.1 (40.7–41.6)	40.2 (39.7–40.6)	-0.1	0.496
≥65	62.2 (61.7–62.7)	63.0 (62.5–63.5)	61.7 (61.1–62.2)	-0.5	0.039
Race/Ethnicity					
White, non-Hispanic	29.0 (28.7–29.3)	29.3 (29.0–29.5)	28.8 (28.5–29.0)	-0.2	0.102
Black, non-Hispanic	41.2 (40.4–42.0)	41.4 (40.6–42.2)	40.3 (39.5–41.1)	-0.9	0.094
Asian, non-Hispanic	25.4 (23.9–27.0)	27.0 (25.2–28.8)	24.6 (22.9–26.3)	-0.9	0.707
Native Hawaiian/Pacific Islander	34.6 (29.6–39.9)	28.8 (24.5–33.6)	32.8 (28.6–37.3)		0.523
American Indian/Alaska Native	36.2 (34.0–38.4)	34.2 (32.2–36.3)	35.0 (33.1–37.1)	-1.1	0.540
Hispanic	28.3 (27.5–29.2)	29.7 (28.7–30.6)	28.0 (27.1–28.9)	-0.3	0.789
Other§	27.7 (25.5–30.0)	29.2 (26.7–31.7)	28.0 (25.5–30.8)	0.3	0.562
Education					
Less than high school	34.1 (33.3–34.9)	36.2 (35.3–37.1)	35.1 (34.2–36.0)	1.0	0.019
High school graduate	32.2 (31.7–32.6)	32.0 (31.6–32.4)	31.9 (31.4–32.3)	-0.3	0.574
Some college	30.5 (30.1–30.9)	31.0 (30.5–31.4)	29.8 (29.3–30.2)	-0.7	0.012
College graduate or higher	25.2 (24.8–25.5)	25.4 (25.0–25.8)	24.9 (24.5–25.3)	-0.3	0.136

See table footnotes on next page.

and significant decreases were observed in six states (Michigan, Nevada, New Hampshire, New York, Texas, and Washington). In 2015, hypertension prevalence was, in general, higher in the Southern states and lower in the Western states (Figure).

Among participants with self-reported hypertension, the age-standardized prevalences of antihypertensive medication use in 2011, 2013, and 2015 were 63.0%, 62.0%, and 61.8%, respectively (p<0.001, Table 2). In 2015, the prevalence of medication use was higher among women (66.8%), adults aged ≥65 years (93.1%), and blacks (60.7%), and lower among men (58.5%), adults aged 18–44 years (41.2%), and Hispanics (55.4%). From 2011 to 2015, significant decreases in antihypertensive medication use among persons with self-reported hypertension were observed among both men and women, persons aged ≥65 years, whites, and high school graduates, as well as those with any college education. By state, a significant decrease in the prevalence of medication use was observed in Connecticut, Hawaii, North Carolina, South Carolina, Texas, Utah, and West Virginia. In 2015, the prevalence of medication use among persons with self-reported hypertension was highest in Louisiana (73.8%) and lowest in Idaho (51.1%). In general, the prevalence of medication use was higher in the Southern states and lower in the Western states (Figure).

Age-standardized estimates were lower than unadjusted estimates for self-reported hypertension (Supplementary Table 1; https://stacks.cdc.gov/view/cdc/50226) and substantially lower for antihypertension medication use (Supplementary Table 2; https://stacks.cdc.gov/view/cdc/50226). In addition, statistically significant increases were observed in the unadjusted prevalence of both hypertension (0.6%), and antihypertension medication use from 2011 to 2015; however, the increase in medication use was small in magnitude (0.1%).

Discussion

Among U.S. adults, the age-standardized prevalence of self-reported hypertension and antihypertension medication use changed little from 2011 to 2015. Differences were observed by age, sex, race/ethnicity, and state of residence.

A recent report using National Health and Nutrition Examination Survey data found no change in the prevalence of hypertension among U.S. adults, from 1999–2000 (28.4%) to 2011–2012 (28.7%) and 2015–2016 (29.0%) (*4*). Because of the large number of participants in BRFSS each year, the statistically significant decline in hypertension prevalence from 30.1% to 29.8% likely does not represent a meaningful change. However, at the state level, both the age-standardized and unadjusted prevalences of hypertension declined significantly in Alaska, Michigan, Nevada, New Hampshire, and Texas and increased in Arkansas, Georgia, Hawaii, and West Virginia, which suggests that there might be notable changes in hypertension prevalence in these states.

The finding that the age-standardized prevalence of antihypertensive medication use declined slightly from 2011 (63.1%) to 2015 (61.8%) was unexpected, although the trend in unadjusted prevalence had no meaningful change (from 77.5% to 77.6%).

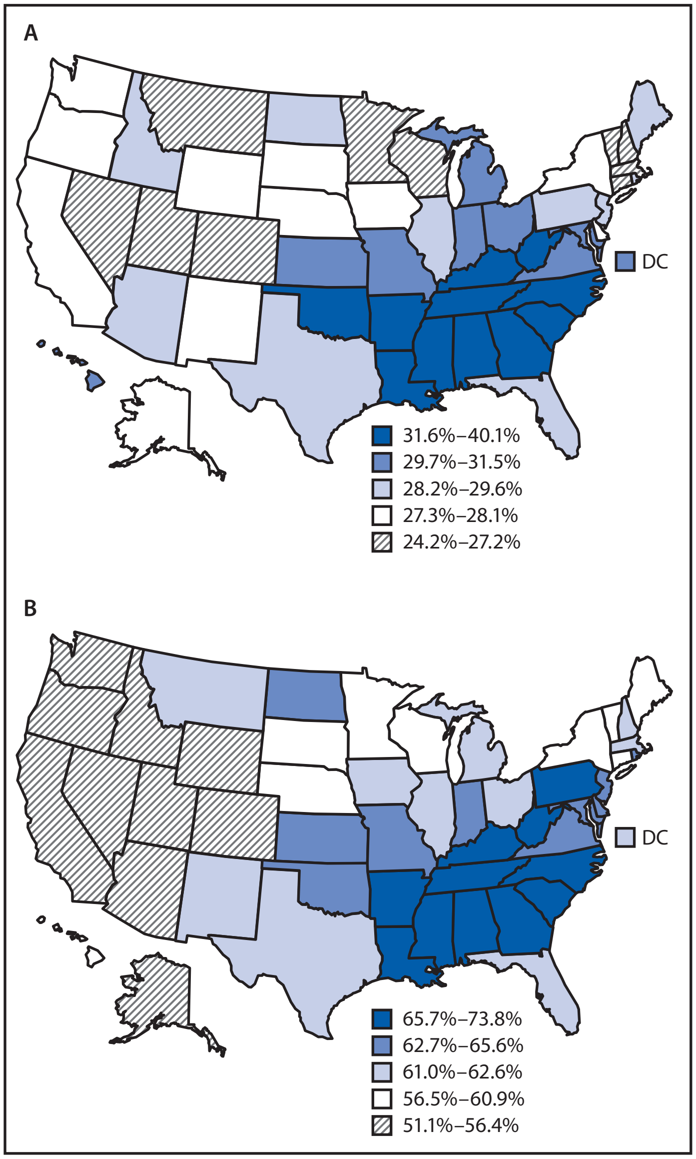
TABLE 1. (*Continued*) **Age-standardized prevalence of self-reported hypertension among adults aged ≥18 years by sociodemographic characteristics and state* — Behavioral Risk Factor Surveillance System, United States 2011–2015**

Characteristic	% (95% CI)			Change 2011–2015	
	2011	2013	2015	%	p-value†
State					
Alabama	37.9 (36.5–39.4)	37.6 (36.0–39.3)	37.6 (36.2–39.0)	-0.4	0.663
Alaska	30.8 (28.8–32.9)	30.2 (28.5–32.0)	27.9 (26.0–29.9)	-2.9	0.030
Arizona	26.3 (24.6–28.2)	29.5 (27.2–32.0)	28.5 (27.2–29.9)	2.2	0.053
Arkansas	33.7 (31.9–35.6)	36.4 (34.5–38.3)	36.7 (34.5–39.0)	3.1	0.033
California	27.8 (27.0–28.6)	28.2 (27.2–29.3)	27.7 (26.7–28.6)	-0.2	0.703
Colorado	24.8 (23.9–25.7)	25.8 (25.0–26.7)	24.6 (23.6–25.7)	-0.1	0.688
Connecticut	27.6 (26.3–29.0)	28.3 (27.0–29.6)	27.0 (26.0–28.1)	-0.6	0.518
Delaware	32.5 (30.8–34.3)	32.6 (31.0–34.2)	31.2 (29.4–33.2)	-1.3	0.262
District of Columbia	31.0 (29.3–32.8)	30.2 (28.6–32.0)	31.0 (28.7–33.4)	0.0	0.927
Florida	30.6 (29.4–31.8)	30.6 (29.6–31.7)	29.4 (28.1–30.7)	-1.3	0.081
Georgia	32.4 (31.2–33.7)	34.5 (33.2–35.8)	35.0 (33.4–36.6)	2.6	0.020
Hawaii	26.8 (25.5–28.2)	26.2 (24.9–27.5)	29.7 (28.3–31.2)	2.9	0.013
Idaho	28.9 (27.3–30.5)	27.7 (26.2–29.2)	29.6 (28.0–31.3)	0.8	0.528
Illinois	30.1 (28.5–31.7)	28.7 (27.2–30.3)	28.9 (27.6–30.2)	-1.1	0.333
Indiana	31.3 (30.1–32.5)	31.6 (30.5–32.7)	30.0 (28.5–31.6)	-1.3	0.228
Iowa	27.5 (26.3–28.6)	28.6 (27.4–29.8)	27.8 (26.5–29.1)	0.3	0.798
Kansas	29.4 (28.7–30.2)	29.4 (28.8–30.1)	29.6 (29.0–30.3)	0.2	0.742
Kentucky	36.1 (34.7–37.5)	36.6 (35.4–37.9)	36.3 (34.8–37.9)	0.2	0.726
Louisiana	37.3 (36.0–38.6)	38.0 (36.1–39.9)	37.5 (35.8–39.1)	0.2	0.881
Maine	28.6 (27.6–29.5)	29.2 (27.9–30.4)	29.0 (27.7–30.2)	0.4	0.431
Maryland	29.9 (28.7–31.2)	30.9 (29.8–32.0)	30.6 (29.1–32.1)	0.7	0.356
Massachusetts	27.6 (26.7–28.5)	27.1 (26.1–28.1)	27.2 (26.0–28.3)	-0.4	0.695
Michigan	32.1 (30.9–33.3)	31.8 (30.7–32.8)	30.0 (29.0–31.1)	-2.0	0.008
Minnesota	25.2 (24.3–26.1)	25.4 (24.2–26.6)	24.2 (23.5–25.0)	-1.0	0.115
Mississippi	37.8 (36.6–39.1)	38.3 (36.8–39.8)	40.1 (38.4–41.8)	2.2	0.063
Missouri	32.3 (30.8–33.8)	29.5 (27.9–31.1)	31.5 (30.1–33.0)	-0.7	0.356
Montana	27.5 (26.3–28.8)	26.3 (25.2–27.4)	25.9 (24.4–27.4)	-1.6	0.056
Nebraska	26.9 (26.3–27.6)	28.4 (27.5–29.5)	27.7 (26.8–28.7)	0.8	0.227
Nevada	30.6 (28.6–32.7)	29.4 (27.5–31.5)	26.7 (24.5–29.0)	-3.9	0.009
New Hampshire	28.7 (27.3–30.2)	27.1 (25.8–28.5)	25.8 (24.4–27.2)	-2.9	0.005
New Jersey	28.8 (27.8–29.8)	28.5 (27.5–29.5)	28.2 (27.1–29.4)	-0.6	0.551
New Mexico	27.0 (26.0–28.1)	27.4 (26.3–28.6)	28.0 (26.6–29.4)	0.9	0.341
New York	29.1 (27.9–30.5)	29.4 (28.2–30.6)	27.2 (26.2–28.2)	-1.9	0.018
North Carolina	30.9 (29.8–32.1)	33.4 (32.2–34.6)	32.8 (31.6–34.0)	1.9	0.028
North Dakota	27.4 (26.1–28.8)	27.6 (26.4–28.8)	28.9 (27.5–30.3)	1.5	0.100
Ohio	30.4 (29.2–31.6)	30.5 (29.4–31.6)	31.2 (29.9–32.5)	0.8	0.417
Oklahoma	33.9 (32.7–35.2)	35.6 (34.4–36.9)	33.9 (32.5–35.3)	-0.1	0.895
Oregon	27.8 (26.5–29.2)	29.5 (28.0–31.1)	27.5 (26.1–28.9)	-0.3	0.721
Pennsylvania	28.6 (27.5–29.8)	30.4 (29.3–31.5)	29.0 (27.6–30.5)	0.3	0.602
Rhode Island	30.6 (29.2–32.0)	31.0 (29.6–32.4)	29.2 (27.7–30.6)	-1.4	0.230
South Carolina	34.1 (32.9–35.3)	35.5 (34.3–36.7)	34.7 (33.6–35.9)	0.6	0.489
South Dakota	28.7 (27.0–30.4)	27.9 (26.4–29.4)	27.5 (25.9–29.1)	-1.2	0.244
Tennessee	37.0 (34.6–39.4)	36.2 (34.6–37.9)	35.3 (33.6–36.9)	-1.7	0.360
Texas	31.7 (30.5–32.9)	31.3 (30.1–32.6)	29.2 (28.0–30.4)	-2.5	0.004
Utah	25.0 (24.2–25.9)	25.7 (24.8–26.5)	25.0 (24.1–25.8)	-0.1	0.891
Vermont	26.7 (25.5–28.0)	27.7 (26.4–29.0)	25.7 (24.5–27.0)	-1.0	0.299
Virginia	30.0 (28.6–31.5)	30.9 (29.7–32.2)	31.5 (30.3–32.8)	1.5	0.193
Washington	29.4 (28.3–30.5)	28.9 (27.9–30.0)	28.1 (27.2–29.0)	-1.3	0.036
West Virginia	33.8 (32.4–35.3)	36.8 (35.4–38.3)	38.6 (37.1–40.0)	4.8	<0.001
Wisconsin	27.0 (25.3–28.7)	29.7 (28.1–31.4)	26.8 (25.4–28.3)	-0.2	0.918
Wyoming	27.6 (26.2–29.0)	27.0 (25.6–28.4)	27.7 (26.0–29.5)	0.2	0.887

Abbreviation: CI = confidence interval.
* Directly standardized to the 2000 U.S. standard population.
† Adjusted for sex, age group, and race/ethnicity.
§ Includes participants of multiple racial/ethnic groups.

A previous study found that hypertension medication prescriptions provided during U.S. physician office visits increased from 69.2% to 78.8% from 2003–2004 to 2009–2010 (*5*). U.S. prescription sales data also indicated that prescription fill counts for antihypertensive medication increased from 2009 to 2014 (*6*). Data from the National Health and Nutrition Examination

FIGURE. Age-standardized prevalence of self-reported hypertension among adults (A) and use of antihypertensive medication among adults with self-reported hypertension (B), by state — Behavioral Risk Factor Surveillance System, 50 states and the District of Columbia (DC), 2015



Survey indicated that antihypertensive medication use increased from 63.5% (2001–2002) to 77.3% (2009–2010) (*7*).

Reduction targets in the prevalence of hypertension and improvements in its management are included in many national initiatives. *Healthy People 2020* heart disease and stroke objectives include reducing the proportion of persons in the population with hypertension (target = 26.9%) and increasing the proportion of adults with hypertension who are taking the prescribed medications to lower their blood pressure (target = 69.5%).[§]

Summary

What is already known about this topic?

Hypertension is a major risk factor for heart disease and stroke. Hypertension prevalence and treatment among the U.S. population varies by demographic characteristics and by state.

What is added by this report?

During 2011–2015, overall, the age-standardized prevalence of hypertension (30.1% in 2011 to 29.8% in 2015), as well as the use of antihypertensive medication among persons with self-reported hypertension (63.0% in 2011 to 61.8% in 2015), decreased slightly among U.S. adults. However, it is unclear whether these small changes are clinically meaningful.

What are the implications for public health practice?

Aggressive public health actions to expand existing, effective interventions could enhance improvement in hypertension prevention and management in order to achieve *Healthy People 2020* goals.

Although improvements have been seen in hypertension management, *Healthy People 2020* hypertension targets have yet to be realized. Whereas *Healthy People 2020* objectives and targets are set for the United States, data from this report highlighting sociodemographic and geographic differences in the prevalence and treatment of hypertension can be used by state partners to target interventions to improve hypertension management within their populations and communities. Complementary to *Healthy People 2020* and other programs, the U.S. Department of Health and Human Services Million Hearts initiative[¶] seeks to improve hypertension control through diverse, multifaceted interventions (*8*). CDC has been working with state and local public health communities to improve hypertension awareness, treatment, and control through multiple strategies within the CDC State Heart Disease and Stroke Prevention programs (*9*). In addition to effective, replicable interventions available through these programs, data from this report could be used by public health practitioners to inform hypertension awareness initiatives and management strategies with clinical partners.

The findings in this report are subject to at least three limitations. First, BRFSS data are based on self-report; the lack of direct blood pressure measurement makes it impossible to fully assess hypertension prevalence or control according to current guidelines. Based on data from the National Health and Nutrition Examination Survey, the prevalence of awareness among adults with hypertension was 83.3% during 2011–2014 (*10*). Therefore, nearly 20% of adults with hypertension are unaware of their condition. Second, the representativeness of the BRFSS sample might be affected by median response rates of <50% across the states. Finally, because hypertension is related

[§] https://www.healthypeople.gov/2020/topics-objectives/topic/heart-disease-and-stroke.

[¶] https://millionhearts.hhs.gov/partners-progress/champions/index.html.

TABLE 2. Age-standardized prevalence of use of antihypertensive medication among adults aged ≥18 years with self-reported hypertension, by sociodemographic characteristics and state* — Behavioral Risk Factor Surveillance System, United States, 2011–2015

	% (95% CI)			Change 2011–2015	
Characteristic	**2011**	**2013**	**2015**	**%**	**p-value†**
Total	**63.0 (62.3–63.8)**	**62.0 (61.3–62.7)**	**61.8 (61.0–62.5)**	**-1.3**	**<0.001**
Sex					
Male	59.6 (58.7–60.6)	58.3 (57.4–59.2)	58.5 (57.6–59.4)	-1.1	0.029
Female	68.2 (67.1–69.2)	67.1 (66.0–68.2)	66.8 (65.7–67.9)	-1.3	0.007
Age group (yrs)					
18–44	42.9 (41.6–44.2)	41.4 (40.1–42.6)	41.2 (39.9–42.5)	-1.7	0.180
45–64	81.2 (80.6–81.8)	80.7 (80.1–81.3)	80.3 (79.7–80.9)	-0.9	0.048
≥65	93.9 (93.6–94.2)	93.1 (92.8–93.4)	93.1 (92.8–93.4)	-0.8	<0.001
Race/Ethnicity					
White, non-Hispanic	63.1 (62.3–64.0)	61.9 (61.1–62.7)	60.7 (59.8–61.5)	-2.5	<0.001
Black, non-Hispanic	69.7 (67.8–71.4)	68.7 (67.0–70.4)	70.7 (68.8–72.4)	1.0	0.146
Asian, non-Hispanic	59.9 (55.6–64.0)	58.2 (53.3–62.8)	62.7 (58.6–66.6)	2.8	0.491
Native Hawaiian/Pacific Islander	63.8 (53.4–73.0)	56.3 (47.3–65.0)	55.1 (46.4–63.5)	-8.7	0.148
American Indian/Alaska Native	61.8 (57.5–66.0)	62.0 (57.8–66.0)	61.2 (56.5–65.6)	-0.7	0.867
Hispanic	54.6 (52.5–56.8)	55.4 (53.3–57.5)	55.4 (53.3–57.5)	0.8	0.952
Other§	61.2 (54.2–67.7)	57.4 (50.6–64.0)	60.6 (53.1–67.7)	-0.5	0.771
Education					
Less than high school	60.0 (58.0–62.0)	59.8 (57.7–61.8)	60.3 (58.0–62.5)	0.3	0.845
High school graduate	64.3 (63.0–65.6)	62.7 (61.4–63.9)	61.8 (60.5–63.1)	-2.4	0.031
Some college	62.6 (61.4–63.9)	61.5 (60.2–62.7)	61.8 (60.5–63.0)	-0.8	0.128
College graduate or higher	64.1 (62.8–65.4)	63.4 (62.2–64.6)	62.5 (61.2–63.7)	-1.6	0.002

See table footnotes on next page.

to age, the slight decline in the age-standardized prevalence of medication use during the analysis period could be caused by the mathematical distortion of standardizing to a general population age distribution, or could reflect reporting bias.

This report provides the most current self-reported state-level hypertension surveillance data. Hypertension remains a significant public health problem. Public health and health system interventions might help to improve hypertension awareness and management. A substantial evidence base is available to inform programs at multiple levels and across diverse settings to support improvements in hypertension management.**,††

** https://www.thecommunityguide.org/topic/cardiovascular-disease.
†† https://millionhearts.hhs.gov/files/HTN_Change_Package.pdf.

Conflict of Interest

No conflicts of interest were reported.

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TABLE 2. (*Continued*) Age-standardized prevalence of use of antihypertensive medication among adults aged ≥18 years with self-reported hypertension, by sociodemographic characteristics and state* — Behavioral Risk Factor Surveillance System, United States, 2011–2015

Characteristic	% (95% CI)			Change 2011–2015	
	2011	2013	2015	%	p-value†
State					
Alabama	72.7 (69.3–75.9)	71.2 (67.0–75.0)	70.4 (66.9–73.6)	-2.4	0.392
Alaska	52.3 (47.8–56.7)	48.6 (44.5–52.7)	51.7 (46.3–57.1)	-0.5	0.455
Arizona	56.3 (50.6–61.8)	50.8 (45.6–55.9)	56.1 (52.2–60.0)	-0.1	0.701
Arkansas	67.6 (62.0–72.9)	66.5 (61.9–70.8)	66.5 (60.7–71.8)	-1.2	0.958
California	53.8 (51.5–56.2)	54.0 (51.1–56.8)	53.3 (50.8–55.8)	-0.5	0.286
Colorado	51.6 (48.6–54.5)	54.6 (51.9–57.4)	54.0 (50.6–57.4)	2.4	0.916
Connecticut	63.2 (58.9–67.3)	58.3 (54.1–62.3)	58.1 (54.2–61.9)	-5.1	0.001
Delaware	63.9 (59.2–68.3)	70.1 (65.2–74.6)	63.5 (57.6–69.0)	-0.4	0.717
District of Columbia	64.2 (58.5–69.5)	59.7 (54.7–64.4)	61.0 (54.4–67.2)	-3.2	0.588
Florida	61.9 (58.3–65.3)	60.8 (57.8–63.8)	62.6 (58.6–66.3)	0.7	0.665
Georgia	68.5 (64.8–72.0)	66.8 (63.5–70.0)	65.7 (61.3–69.9)	-2.8	0.890
Hawaii	65.6 (60.9–70.1)	62.8 (58.3–67.2)	58.9 (54.9–62.7)	-6.7	0.002
Idaho	52.6 (48.6–56.6)	54.6 (49.7–59.5)	51.1 (46.9–55.2)	-1.5	0.159
Illinois	62.5 (57.6–67.2)	60.7 (55.8–65.4)	62.0 (57.6–66.2)	-0.6	0.690
Indiana	65.4 (61.8–68.8)	64.9 (61.6–68.0)	63.1 (58.1–67.8)	-2.3	0.339
Iowa	58.7 (55.2–62.1)	61.2 (57.3–65.0)	61.4 (57.0–65.7)	2.7	0.395
Kansas	62.1 (59.9–64.2)	62.7 (60.6–64.7)	62.6 (60.6–64.6)	0.5	0.655
Kentucky	67.6 (64.2–70.8)	69.2 (66.1–72.2)	68.2 (64.2–71.9)	0.6	0.471
Louisiana	73.9 (70.7–76.9)	70.4 (65.8–74.7)	73.8 (69.7–77.6)	-0.1	0.828
Maine	61.1 (57.9–64.2)	64.7 (60.7–68.5)	57.1 (53.2–60.9)	-4.0	0.094
Maryland	68.8 (64.9–72.4)	66.0 (62.6–69.3)	63.4 (58.7–67.8)	-5.4	0.054
Massachusetts	61.1 (58.2–63.9)	56.5 (53.3–59.6)	62.1 (58.4–65.6)	0.9	0.784
Michigan	62.1 (58.8–65.3)	58.0 (55.0–60.9)	61.5 (58.3–64.5)	-0.7	0.908
Minnesota	60.9 (57.6–64.0)	59.9 (56.2–63.6)	60.7 (57.8–63.4)	-0.2	0.851
Mississippi	71.9 (68.9–74.7)	73.7 (70.1–77.1)	72.1 (68.0–75.9)	0.2	0.838
Missouri	64.8 (60.6–68.8)	72.7 (67.3–77.5)	65.6 (61.3–69.7)	0.8	0.607
Montana	55.2 (51.4–58.9)	56.3 (52.9–59.5)	61.8 (56.2–67.0)	6.6	0.118
Nebraska	60.7 (58.3–62.9)	64.0 (60.6–67.2)	60.2 (56.9–63.4)	-0.5	0.685
Nevada	54.8 (49.4–60.0)	59.9 (53.9–65.6)	52.1 (45.8–58.4)	-2.7	0.363
New Hampshire	56.6 (52.7–60.5)	56.7 (52.6–60.6)	60.2 (54.7–65.5)	3.6	0.398
New Jersey	60.1 (57.1–63.0)	59.3 (56.3–62.2)	64.0 (60.0–67.7)	3.9	0.506
New Mexico	60.9 (57.1–64.6)	57.3 (53.7–60.7)	61.6 (56.7–66.2)	0.7	0.315
New York	61.6 (57.4–65.7)	59.8 (56.2–63.3)	60.9 (57.3–64.3)	-0.7	0.080
North Carolina	74.0 (70.3–77.3)	63.1 (59.9–66.2)	68.2 (64.5–71.6)	-5.8	0.007
North Dakota	61.4 (56.9–65.8)	64.1 (59.9–68.1)	65.2 (60.3–69.8)	3.8	0.069
Ohio	65.9 (62.2–69.4)	64.5 (61.2–67.6)	62.4 (58.7–66.0)	-3.5	0.686
Oklahoma	68.6 (65.2–71.7)	68.9 (65.7–71.8)	64.8 (60.7–68.8)	-3.7	0.054
Oregon	54.9 (51.0–58.7)	56.1 (51.5–60.6)	54.1 (49.8–58.3)	-0.8	0.545
Pennsylvania	62.9 (59.4–66.2)	64.2 (61.2–67.2)	65.8 (61.2–70.2)	3.0	0.164
Rhode Island	62.1 (57.9–66.2)	64.4 (60.2–68.4)	63.3 (57.9–68.3)	1.2	0.642
South Carolina	72.3 (69.1–75.3)	68.8 (65.7–71.8)	67.5 (64.3–70.6)	-4.8	0.020
South Dakota	60.2 (54.9–65.3)	64.0 (59.1–68.6)	59.3 (54.5–64.0)	-0.9	0.740
Tennessee	66.7 (60.7–72.1)	73.6 (69.3–77.4)	67.6 (63.0–71.9)	0.9	0.745
Texas	65.5 (61.9–68.9)	63.8 (60.2–67.3)	61.7 (58.0–65.3)	-3.8	0.042
Utah	56.7 (53.8–59.5)	54.1 (51.6–56.5)	52.5 (49.9–55.1)	-4.2	0.039
Vermont	57.8 (53.5–62.0)	53.3 (49.2–57.4)	57.8 (53.4–62.2)	0.0	0.508
Virginia	67.5 (62.8–71.9)	65.7 (62.3–69.0)	62.9 (59.7–66.0)	-4.6	0.248
Washington	54.7 (51.4–57.9)	53.0 (50.1–55.9)	53.4 (50.6–56.1)	-1.3	0.219
West Virginia	73.8 (70.1–77.3)	68.1 (64.7–71.3)	67.2 (64.0–70.3)	-6.6	<0.001
Wisconsin	61.7 (55.7–67.3)	61.0 (55.8–66.0)	58.4 (53.4–63.2)	-3.3	0.070
Wyoming	57.3 (53.0–61.4)	57.8 (53.0–62.4)	56.4 (50.8–61.8)	-0.9	0.858

Abbreviation: CI = confidence interval.
* Directly standardized to the 2000 U.S. standard population.
† Adjusted for sex, age group, and race/ethnicity.
§ Includes participants of multiple racial/ethnic groups.

Self-Reported Receipt of Advice and Action Taken To Reduce Dietary Sodium Among Adults With and Without Hypertension — Nine States and Puerto Rico, 2015

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Hypertension is a major cardiovascular disease risk factor (*1*,*2*). Advice given by health professionals can result in lower sodium intake and lower blood pressure (*3*).The 2017 Hypertension Guideline released by the American College of Cardiology and the American Heart Association emphasizes nonpharmacologic approaches, including sodium reduction, as important components of hypertension prevention and treatment (*4*). Data from 50,576 participants in the sodium module of the 2015 Behavioral Risk Factor Surveillance System (BRFSS) in nine states and Puerto Rico were analyzed to determine the prevalence of reported sodium reduction advice and action among participants with and without self-reported hypertension. Among participants with self-reported hypertension, adjusted prevalence of receiving sodium reduction advice from a health professional was 41.9%, compared with 12.8% among participants without hypertension. Among those with hypertension, adjusted prevalence of reported action to reduce sodium intake was 80.9% among participants who received advice and 55.7% among those who did not receive advice. Among participants without hypertension, adjusted prevalence of taking action to reduce sodium intake was 72.7% among those who received advice and 46.9% among those who did not receive advice. The provision of advice on sodium reduction by health professionals is associated with respondent action to watch or reduce sodium intake. Fewer than half of patients with hypertension received this advice from their health professionals, a circumstance that represents a substantial missed opportunity to promote hypertension prevention and treatment.

BRFSS is an annual state-based, cross-sectional telephone survey of noninstitutionalized adults aged ≥18 years. In 2015, nine states (Alabama, Indiana, Iowa, Kentucky, Maine, Nebraska, North Carolina, Oregon, and Tennessee) and Puerto Rico completed the optional sodium-related behavior module. Median survey response rate for all states and territories included in this analysis was 51.3% (range = 42.6%–59.0%) (*5*). Among 63,955 participants from jurisdictions that implemented the sodium-related behavior module, 55,857 participants completed it. After 5,281 participants with missing information on sex, age, race/ethnicity, education, smoking status, body mass index, and reported comorbidities were excluded, data from 50,576 respondents (90.5% of all participants) were analyzed. Prevalence of sodium reduction advice and action was estimated by self-reported hypertension status. Hypertension was defined as an affirmative response to the question "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?" Women who answered "yes" but "only during pregnancy," as well as those who were told that they were "borderline high or pre-hypertensive" were not included. Receiving health professional advice to reduce sodium intake was defined by an affirmative response to the question "Has a doctor or other health professional ever advised you to reduce sodium or salt intake?" Action to reduce sodium intake was defined by an affirmative response to the question "Are you currently watching or reducing your sodium or salt intake?"

Descriptive analyses were used to examine population characteristics by hypertension status. Multiple variable logistic regression was used to examine characteristics associated with advice and action and to estimate prevalence and 95% confidence intervals using predicted marginals adjusted for selected covariates (*6*). Covariates included sociodemographic characteristics (geographic location, sex, age/ethnicity, race, and education) and cardiovascular disease risk factors (smoking, obesity status, and reported associated comorbidities [diabetes, kidney disease, myocardial infarction, coronary heart disease, or stroke]). All estimates used sampling weights to account for the complex survey design and nonresponse. Chi-square tests were used to compare prevalence estimates. P-values <0.05 were considered statistically significant.

Participants with self-reported hypertension differed significantly from participants without hypertension for all characteristics examined (p<0.05 for all characteristics) (Table 1). Among participants with hypertension compared with those without hypertension, more participants were male (51.0% versus 48.6%), aged ≥65 years (37.0% versus 11.9%), non-Hispanic black (13.9% versus 9.6%), had less than a high school education (19.3% versus 11.6%), were current or former smokers (51.0% versus 41.0%), had obesity (45.1% versus 25.0%), or reported ≥1 comorbidity (39.8% versus 8.9%).

After adjusting for sociodemographic and cardiovascular risk factors, the prevalence of having received sodium reduction advice was 41.9% among participants with hypertension and 12.8% among those without hypertension (Table 2)

TABLE 1. Unadjusted prevalence* of selected characteristics of adults aged ≥18 years by hypertension† status — Behavioral Risk Factor Surveillance System, nine states and Puerto Rico, 2015

	Hypertension status % (95% CI)§	
Characteristic	Self-reported hypertension (n = 22,606)	No self-reported hypertension (n = 27,970)
Jurisdiction		
Alabama	11.9 (11.4–12.3)	10.0 (9.6–10.4)
Indiana	12.1 (11.5–12.8)	14.5 (13.9–15.1)
Iowa	5.5 (5.3–5.8)	7.2 (6.9–7.5)
Kentucky	10.2 (9.8–10.7)	9.1 (8.7–9.5)
Maine	3.1 (2.9–3.3)	3.4 (3.3–3.6)
Nebraska	3.5 (3.3–3.7)	4.6 (4.4–4.8)
North Carolina	21.3 (20.5–22.1)	20.9 (20.3–21.5)
Oregon	7.2 (6.6–7.8)	9.6 (9.1–10.1)
Tennessee	14.7 (14.0–15.4)	12.1 (11.6–12.7)
Puerto Rico	10.6 (10.1–11.0)	8.6 (8.2–8.9)
Sex		
Male	51.0 (49.9–52.0)	48.6 (47.6–49.5)
Female	49.0 (48.0–50.1)	51.5 (50.5–52.4)
Age group (yrs)		
18–64	63.0 (62.1–63.9)	88.1 (87.6–88.5)
≥65	37.0 (36.1–37.9)	11.9 (11.5–12.4)
Race/Ethnicity		
White, non-Hispanic	70.5 (69.6–71.5)	72.5 (71.7–73.3)
Black, non-Hispanic	13.9 (13.1–14.7)	9.6 (9.0–10.3)
Other, non-Hispanic	2.9 (2.5–3.4)	4.1 (3.7–4.5)
Hispanic	12.7 (12.1–13.3)	13.8 (13.2–14.4)
Education		
Less than high school	19.3 (18.3–20.2)	11.6 (10.9–12.4)
High school	32.2 (31.2–33.1)	29.1 (28.2–30.0)
Some college	29.7 (28.8–30.7)	33.1 (32.2–34.0)
College or more	18.9 (18.2–19.6)	26.2 (25.5–26.9)
Smoking status		
Current and former smoker	51.0 (50.0–52.0)	41.0 (40.1–41.9)
Never smoker	49.0 (48.0–50.0)	59.0 (58.1–59.9)
Obesity status¶		
No	55.0 (53.9–56.0)	75.0 (74.1–75.8)
Yes	45.1 (44.0–46.1)	25.0 (24.2–25.9)
Comorbidities**		
No	60.2 (59.1–61.2)	91.1 (90.6–91.5)
Yes	39.8 (38.8–40.9)	8.9 (8.5–9.4)

Abbreviation: CI = confidence interval.
* Unadjusted prevalence estimates weighted for survey design and nonresponse.
† Hypertension was defined as an affirmative response to the question "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?"
§ p-value <0.05 for differences (chi-square test) in percent distribution of covariates between participants with reported hypertension and without reported hypertension, accounting for complex survey design and weighted.
¶ Obesity defined as body mass index ≥30 kg/m^2.
** Includes self-reported diabetes, kidney disease, myocardial infarction, coronary heart disease, or stroke.

(p<0.05 for difference overall and in each subgroup). Among participants with hypertension, the adjusted prevalence of receiving advice varied significantly by geographic location, ranging from 32.3% (Oregon) to 56.7% (Puerto Rico), and by sex, race/ethnicity, obesity status, and reported presence of ≥1 comorbidity, but not by age, level of education, or smoking status. By covariate, receipt of advice was higher, for example, among participants who were female (43.0%) versus male (40.8%); non-Hispanic black (54.1%) and Hispanic (46.1%) versus non-Hispanic white (39.1%); who had obesity (46.6%) versus those who did not have obesity (40.2%); and who had ≥1 comorbidity (53.4%) versus no comorbidity (40.0%) (Table 2). Among participants without hypertension, the prevalence of receiving advice ranged from 9.4% (Oregon) to 22.0% (Puerto Rico). Prevalence of receiving advice varied significantly by selected covariate (p<0.05), except sex. By covariate, the adjusted prevalence of advice was higher among non-Hispanic black (16.9%) and Hispanic participants (16.8%) than among non-Hispanic white participants (10.8%), among participants with a high school diploma (14.0%) or less than a high school education (14.9%) than among those with college or more (10.5%), among current or former smokers (13.9%) than among never smokers (11.9%), among those who had obesity (17.4%) versus those who did not (10.6%), and among those who reported ≥1 comorbidity (26.6%) than among those who did not (10.0%) (Table 2).

Overall, participants with hypertension who received advice had the highest adjusted prevalence of taking action to reduce sodium intake (80.9%), followed by those without hypertension who received advice (72.7%), those with hypertension who did not receive advice (55.7%), and those without hypertension who did not receive advice (46.9%) (p<0.05 for overall comparison across the four groups) (Table 3).

Discussion

In 2015, fewer than half (42%) of BRFSS participants with self-reported hypertension from nine states and Puerto Rico (range = 32% [Oregon] to 57% [Puerto Rico]) reported receiving sodium reduction advice from a health professional independent of sociodemographic characteristics and cardiovascular disease risk factors. Among respondents without hypertension, 13% reported receiving advice to reduce sodium intake (range = 9% [Oregon] to 22% [Puerto Rico]). Yet, among participants with hypertension who received advice, 81% reported taking action to reduce sodium, compared with 56% of those with hypertension who did not receive advice. Similarly, among participants without hypertension 73% of those who received advice to reduce sodium intake reported taking action to reduce sodium, compared with 47% of those who did not receive advice. In this analysis, among participants with and without hypertension, receiving sodium reduction advice from a health professional was associated with reported respondent action to watch or reduce sodium intake.

This study provides the most recent multistate BRFSS data on sodium reduction advice and action. Comparing these results with previously published BRFSS and other data are

TABLE 2. Adjusted* percentage of adults aged ≥18 years who reported receiving advice to reduce their sodium intake, by hypertension† status — Behavioral Risk Factor Surveillance System, nine states and Puerto Rico, 2015

	Reported receiving advice					
	Self-reported hypertension§			No self-reported hypertension		
Characteristic	**No.**	**% (95% CI)**	**p-value¶**	**No.**	**% (95% CI)**	**p-value¶**
Total	**22,606**	**41.9 (40.8–43.0)**	—	**27,970**	**12.8 (12.1–13.4)**	—
Jurisdiction						
Alabama	3,048	39.8 (37.3–42.4)	<0.05	3,159	12.7 (11.2–14.4)	<0.05
Indiana	2,043	43.1 (39.9–46.3)		2,613	11.5 (9.8–13.5)	
Iowa	1,884	37.9 (35.1–40.9)		2,857	11.3 (9.7–13.1)	
Kentucky	3,372	40.3 (37.5–43.2)		3,473	11.2 (9.6–13.0)	
Maine	1,941	44.8 (41.8–47.8)		2,740	13.6 (11.8–15.7)	
Nebraska	2,758	33.3 (30.7–36.0)		4,376	9.6 (8.1–11.3)	
North Carolina	2,152	43.7 (41.1–46.4)		2,909	12.1 (10.7–13.7)	
Oregon	744	32.3 (28.2–36.7)		1,188	9.4 (7.0–12.6)	
Tennessee	2,210	40.3 (37.1–43.6)		2,154	11.7 (9.8–13.9)	
Puerto Rico	2,454	56.7 (51.2–62.1)		2,501	22.0 (18.5–26.0)	
Sex						
Male	9,548	40.8 (39.3–42.4)	<0.05	11,582	12.9 (11.9–13.8)	0.980
Female	13,058	43.0 (41.5–44.4)		16,388	12.7 (11.9–13.5)	
Age group (yrs)						
18–64	11,264	42.7 (41.3–44.1)	0.582	21,439	11.4 (10.7–12.1)	<0.05
≥65	11,342	42.6 (41.1–44.1)		6,531	20.2 (18.7–21.7)	
Race/Ethnicity						
White, non-Hispanic	16,928	39.1 (37.7–40.6)	<0.05	22,016	10.8 (10.1–11.6)	<0.05
Black, non-Hispanic	2,398	54.1 (50.6–57.6)		1,769	16.9 (14.4–19.6)	
Other, non-Hispanic	570	40.2 (33.9–46.9)		881	15.3 (10.8–21.3)	
Hispanic	2,710	46.1 (41.0–51.3)		3,304	16.8 (14.2–19.7)	
Education						
Less than high school	2,670	43.0 (40.0–46.0)	0.377	1,848	14.9 (13.0–17.0)	<0.05
High school	7,610	41.8 (40.1–43.6)		7,882	14.0 (12.9–15.3)	
Some college	6,128	41.3 (39.4–43.2)		7,966	12.2 (11.1–13.4)	
College or more	6,198	42.9 (41.0–44.8)		10,274	10.5 (9.6–11.4)	
Smoking status						
Current and former smoker	10,938	41.2 (39.7–42.8)	0.245	11,358	13.9 (13.0–15.0)	<0.05
Never smoker	11,668	42.7 (41.2–44.2)		16,612	11.9 (11.1–12.8)	
Obesity Status**						
No	12,966	40.2 (38.8–41.6)	<0.05	21,037	10.6 (10.0–11.3)	<0.05
Yes	9,640	46.6 (44.9–48.2)		6,933	17.4 (16.1–18.8)	
Comorbidities††						
No	13,231	40.0 (38.7–41.4)	<0.05	24,674	10.0 (9.4–10.6)	<0.05
Yes	9,375	53.4 (51.7–55.1)		3,296	26.6 (24.4–29.0)	

Abbreviation: CI = confidence interval.

* Adjusted prevalence estimates were estimated from marginal predictions of separate multiple logistic regression models for each covariate with a term for the interaction between the covariate (e.g., sex) and hypertension status adjusted for all the other covariates in the table, accounting for survey design and survey weights. Significant interactions occurred between hypertension status and age, race/ethnicity, education, smoking status, obesity status, and comorbidities.

† Hypertension was defined as an affirmative response to the question "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?"

§ Across all participating locations and selected covariates, a higher prevalence of advice was reported among participants with hypertension compared with those without hypertension (p–value <0.05).

¶ p-value obtained by Wald F test and p-value <0.05 were used to identify statistically significant differences in prevalence of advice among subgroups with hypertension and without hypertension.

** Obesity defined as body mass index ≥30 kg/m^2.

†† Includes self-reported diabetes, kidney disease, myocardial infarction, coronary heart disease, or stroke.

difficult, given differences in sample size, number of states, and analytic method. Despite these differences, results were generally consistent with previous studies that found respondents with hypertension were more likely to receive advice and take action (*7*) and that the prevalence of taking action was highest among those who received advice (*8*).

Fewer than half of adults with hypertension in most locations, and even fewer adults without hypertension, reported receiving sodium reduction advice. Geographic patterns of prevalence of receiving advice appears to correspond with the pattern of self-reported "high blood pressure" diagnosis. For example, Puerto Rico, which had a prevalence of self-reported hypertension (42.2%) substantially higher than the national

TABLE 3. Adjusted* percentage of adults aged ≥18 years who report taking action to reduce their sodium intake, by receipt of advice to reduce sodium intake and self-reported hypertension† status — Behavioral Risk Factor Surveillance System, nine states and Puerto Rico, 2015

	Took action to reduce sodium intake											
	Self-reported hypertension						No self-reported hypertension					
	Advice			No advice			Advice			No advice		
Characteristic	**No.**	**% (95% CI)**	**p-value§**	**No.**	**% (95% CI)**	**p-value§**	**No.**	**% (95% CI)**	**p-value§**	**No.**	**% (95% CI)**	**p-value§**
Total	**10,900**	**80.9 (79.5–82.2)**	**—**	**11,706**	**55.7 (54.2–57.2)**	**—**	**3,346**	**72.7 (70.1–75.2)**	**—**	**24,624**	**46.9 (45.9–47.9)**	**—**
Jurisdiction												
Alabama	1,481	80.5 (77.2–83.5)	<0.05	1,567	56.5 (53.0–59.9)	<0.05	424	75.3 (68.7–80.9)	0.330	2,735	45.2 (42.7–47.8)	<0.05
Indiana	956	82.8 (79.1–86.0)		1,087	51.4 (46.9–55.8)		302	71.3 (62.3–78.9)		2,311	47.9 (45.0–50.9)	
Iowa	763	82.4 (78.3–85.8)		1,121	52.3 (48.5–56.0)		278	69.7 (61.1–77.2)		2,579	42.1 (39.6–44.7)	
Kentucky	1,664	76.1 (71.9–79.9)		1,708	54.3 (50.4–58.3)		402	72.2 (65.2–78.3)		3,071	42.2 (39.4–45.1)	
Maine	908	85.0 (81.6–87.8)		1,033	57.9 (54.0–61.8)		306	74.9 (67.9–80.8)		2,434	46.0 (43.2–48.7)	
Nebraska	1,063	82.9 (79.3–85.9)		1,695	51.0 (47.1–54.8)		344	68.3 (58.4–76.7)		4,032	39.2 (36.9–41.6)	
North Carolina	1,095	83.9 (80.6–86.8)		1,057	59.2 (55.3–62.9)		321	71.4 (64.6–77.3)		2,588	49.5 (47.2–51.8)	
Oregon	268	83.8 (77.3–88.7)		476	49.7 (43.4–55.9)		82	71.6 (55.0–83.9)		1,106	37.2 (33.4–41.1)	
Tennessee	1,024	78.9 (74.4–82.7)		1,186	56.8 (52.5–61.1)		238	81.1 (72.4–87.6)		1,916	51.4 (48.0–54.7)	
Puerto Rico	1,678	81.3 (77.4–84.8)		776	62.2 (56.0–68.1)		649	74.7 (68.9–79.8)		1,852	56.7 (51.8–61.4)	
Sex												
Male	4,467	79.3 (77.3–81.2)	<0.05	5,081	51.0 (48.7–53.2)	<0.05	1,419	70.9 (66.9–74.7)	0.077	10,163	43.1 (41.6–44.6)	<0.05
Female	6,433	82.4 (80.6–84.0)		6,625	60.5 (58.6–62.4)		1,927	74.5 (71.2–77.7)		14,461	50.6 (49.2–51.9)	
Age group (yrs)												
18–64	5,519	79.5 (77.7–81.2)	<0.05	5,745	55.1 (53.1–57.1)	<0.05	2,230	69.8 (66.6–72.8)	<0.05	19,209	44.5 (43.3–45.6)	<0.05
≥65	5,381	85.9 (84.3–87.3)		5,961	61.2 (59.2–63.1)		1,116	84.1 (80.5–87.1)		5,415	56.6 (54.6–58.6)	
Race/Ethnicity												
White, non-Hispanic	7,381	80.3 (78.7–81.9)	<0.05	9,547	53.1 (51.3–54.9)	<0.05	2,177	73.3 (70.1–76.3)	0.281	19,839	43.5 (42.2–44.7)	<0.05
Black, non-Hispanic	1,449	87.7 (84.5–90.3)		949	71.6 (66.7–76.0)		312	77.4 (69.0–84.1)		1,457	61.3 (57.6–65.0)	
Other, non-Hispanic	270	81.2 (67.5–90.0)		300	49.5 (39.6–59.5)		97	84.0 (70.9–91.9)		784	46.3 (41.1–51.7)	
Hispanic	1,800	79.8 (75.8–83.3)		910	57.8 (51.2–64.2)		760	70.2 (64.1–75.7)		2,544	53.4 (49.1–57.7)	
Education												
Less than high school	1,527	77.0 (72.9–80.5)	0.079	1,143	55.3 (50.7–59.7)	0.347	380	66.5 (58.5–73.6)	0.269	1,468	46.6 (42.7–50.5)	0.641
High school	3,684	80.4 (78.1–82.5)		3,926	54.9 (52.4–57.5)		1,088	74.0 (69.3–78.1)		6,794	46.3 (44.5–48.2)	
Some college	2,885	83.7 (81.4–85.7)		3,243	57.6 (55.0–60.2)		916	72.0 (67.0–76.5)		7,050	47.5 (45.7–49.2)	
College or more	2,804	81.0 (78.5–83.2)		3,394	53.9 (51.3–56.4)		962	76.3 (72.1–80.0)		9,312	47.1 (45.6–48.7)	
Smoking status												
Current and former smoker	5,146	79.9 (77.9–81.8)	<0.05	5,792	55.0 (52.8–57.1)	0.514	1,454	72.0 (68.2–75.5)	0.210	9,904	46.0 (44.5–47.6)	0.172
Never smoker	5,754	81.8 (80.0–83.4)		5,914	56.3 (54.1–58.3)		1,892	73.4 (69.7–76.8)		14,720	47.6 (46.2–48.9)	
Obesity status¶												
No	5,843	82.5 (80.9–84.1)	<0.05	7,123	53.6 (51.7–55.6)	<0.05	2,160	73.0 (69.6–76.2)	0.971	18,877	45.8 (44.6–46.9)	<0.05
Yes	5,057	79.8 (77.7–81.7)		4,583	59.3 (56.9–61.6)		1,186	72.6 (68.4–76.3)		5,747	49.4 (47.4–51.4)	
Comorbidities**												
No	5,520	80.1 (78.3–81.8)	<0.05	7,711	55.2 (53.4–57.0)	<0.05	2,423	70.3 (67.2–73.2)	<0.05	22,251	45.1 (44.0–46.2)	<0.05
Yes	5,380	84.6 (82.8–86.2)		3,995	59.8 (57.2–62.3)		923	82.1 (77.8–85.8)		2,373	55.0 (51.9–58.1)	

Abbreviation: CI = confidence interval.

* Adjusted prevalence estimates were estimated from marginal predictions of separate multiple logistic regression models for each covariate with a term for the interaction between the covariate (e.g., sex) and hypertension status adjusted for all the other covariates in the table. Significant interactions occurred between the hypertension and advice with state, age, race/ethnicity, obesity status, and comorbidities.

† Hypertension was defined as an affirmative response to the question "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?"

§ p-value obtained by Wald F test and p<0.05 were used to identify statistically significant differences in prevalence of action among subgroups with hypertension and without hypertension by receipt of advice.

¶ Obesity defined as body mass index ≥30 kg/m^2.

** Includes self-reported diabetes, kidney disease, myocardial infarction, coronary heart disease, or stroke.

prevalence of 30.9% (*9*), had one of the highest prevalences of receiving advice and taking action. Similar to previous reports, in this study, the prevalence of receiving advice was significantly higher among persons with hypertension and obesity or other cardiovascular disease–associated comorbidity than among those with hypertension without these other risk factors. However, among adults with an elevated risk for cardiovascular disease, but without hypertension, reported advice to reduce sodium intake was <30%. Also consistent with earlier findings, more adults who received advice from a health professional to reduce sodium intake reported watching or reducing their sodium intake, irrespective of hypertension

Summary

What is already known about this topic?

Hypertension is a major cardiovascular disease risk factor for which sodium reduction can be beneficial. Provision of sodium reduction advice by health professionals to persons with hypertension reduces their reported sodium intake.

What is added by this report?

Among participants with self-reported hypertension, the prevalence of receiving advice to reduce sodium intake from a health professional was 42% compared with 13% among participants without hypertension. Among those with hypertension, 81% of those who received advice to reduce sodium intake reported taking action to reduce sodium intake, compared with 56% of those with hypertension who did not receive this advice.

What are the implications for public health practice?

Most patients do not receive clinical advice to reduce sodium intake. Increasing the percentage of patients who receive this advice from their health care provider might provide increased opportunities for hypertension prevention and treatment.

status or cardiovascular risk factors (*7*). Self-reported action to watch or reduce sodium intake might not result in achieving clinically meaningful sodium reduction (*10*); however, these findings suggest that a health professional's advice can significantly affect awareness.

The findings in this report are subject to at least three limitations. First, BRFSS data are self-reported and subject to recall and social desirability bias, which affects prevalence estimates. Second, questions from BRFSS do not provide the extent of health professional advice or verify or detail the types of actions taken by respondents who report actively watching or reducing their sodium intake. Therefore, these questions might serve as a proxy for awareness of the need for sodium reduction rather than a measure of behavior change. Finally, responses were limited to nine states and Puerto Rico that elected to apply the sodium module during the 2015 BRFSS, and where response rates were approximately 50%; therefore, these results might not be generalizable to all U.S. adults and could be subject to response bias. Despite limitations, this report estimates sodium reduction advice and action using the latest BRFSS data and might provide a baseline for current practice as well as demonstrate opportunities for increasing the advice provided.

The findings from this analysis indicate that a higher percentage of BRFSS participants who reported receiving sodium reduction advice from a health professional reported taking action, across hypertension status and cardiovascular risk groups, underscoring the importance of health professional advice on potentially influencing sodium reduction awareness and behavior. Yet, fewer than half of respondents with self-reported hypertension and fewer respondents without hypertension reported receiving advice. In accordance with the 2017 hypertension guidelines (*4*) encouraging lifestyle modification, health professionals can encourage healthy food choices and support consumer and population efforts to reduce sodium intake, highlighting a potential opportunity for hypertension prevention and treatment.

Conflict of Interest

No conflicts of interest were reported.

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Notes from the Field

Increase in Acute Hepatitis B Infections — Pasco County, Florida, 2011–2016

Maura Comer, MPH[1]; James Matthias, MPH[2]; Garik Nicholson, MPH[3]; Alice Asher, PhD[4]; Scott Holmberg, MD[4]; Craig Wilson[1]

In April 2016, CDC noted an increase in acute hepatitis B virus (HBV) infections in Pasco County, Florida, through the National Notifiable Disease Surveillance System. Hepatitis B is an infection of the liver caused by HBV, which is transmitted through blood, semen, or other body fluids and is usually an acute, self-limiting illness in adults; however, some infected adults develop chronic HBV infection. HBV infection is preventable by vaccination. The Florida Department of Health (DOH-Florida) confirmed the local surveillance data; although Pasco County has fewer than half a million residents, in 2016, it had the highest number (87) and rate (17.28 per 100,000 population) of acute HBV infections among all Florida counties. From 2011 to 2016, the number of acute HBV-infected persons in Pasco County who met the national case definition* increased from 1.5 to 17.28 per 100,000 residents ($p<0.001$).

In mid-July 2016, DOH-Florida and Pasco County Department of Health (DOH-Pasco) epidemiologists initiated weekly conference calls to discuss strategies for preventing further infections within the county. Epidemiologic case surveillance data were reviewed to determine which risk factors were driving the increases in acute HBV infections. As of February 2017, among 275 cases of acute HBV infection reported in Pasco County during 2011–2016, risk factor information was ascertained for 221 (80%) patients. Among these, more than half (N = 113; 51%) reported some type of drug use, including 86 (39%) who reported injection drug use in the 6 months preceding symptom onset (Table) and 42 (19%) who reported incarceration for ≥24 hours during that time. Overall, 55% of reported HBV infections occurred in men and 45% in women. The observed increase in acute HBV infection related to injection drug use in Pasco County was similar to that seen in other Southern urban counties (*1*) and paralleled national trends in opioid use and overdose deaths (*2*).

Since September 2016, DOH-Pasco epidemiology staff members have been collaborating with HIV and Sexually Transmitted Diseases program personnel and clinical staff to establish targeted outreach for testing and hepatitis B vaccination programs for persons at risk, including at a methadone clinic, at free health care clinics, and via a mobile medical unit operated by the Pasco County Public Defender's Office. Law enforcement personnel helped to identify areas where drug users congregate, and DOH-Pasco worked with local jails and hospitals to identify and test persons who are at the highest risk for acquiring HBV infection. These efforts have resulted in administration of >300 hepatitis B vaccine doses in communities with persons at high risk for infection. One local hospital is now sending specimens to CDC for molecular characterization of HBV to delineate transmission networks in the county, using CDC's Global Health, Outbreak, and Surveillance Technology (*3*). HBV surveillance data available for January–April 2017 indicated an 80% decrease in the number of acute cases of HBV infection compared with the same period in 2016. The decline likely represents a saturation of HBV among risk populations, the impact of hepatitis B vaccination and other interventions, or a combination of these factors. Pasco County is continuing enhanced HBV surveillance and prevention activities.

* https://wwwn.cdc.gov/nndss/conditions/hepatitis-b-acute/case-definition/2012/.

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Conflict of Interest

No conflicts of interest were reported.

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TABLE. Demographic characteristics of persons with acute hepatitis B virus infection (N = 275) and reported risk factors — Pasco County, Florida 2011–2016

Characteristic	No. (%)						
	2011 (n = 7)	2012 (n = 25)	2013 (n = 39)	2014 (n = 53)	2015 (n = 64)	2016 (n = 87)	Total (N = 275) (% of total)
Race/Ethnicity							
White, non-Hispanic	6 (86)	19 (76)	32 (82)	45 (85)	58 (91)	75 (86)	**235 (85)**
Black, non-Hispanic	0	1 (4)	0	0	0	1 (1)	**2 (1)**
Other, non-Hispanic	0	0	0	0	1 (2)	0	**1 (<1)**
Hispanic	1 (14)	0	1 (3)	0	2 (3)	3 (3)	**7 (3)**
Unknown	0	5 (20)	6 (15)	8 (15)	3 (4)	8 (9)	**30 (11)**
Gender							
Male	4 (57)	13 (52)	22 (56)	34 (64)	30 (47)	48 (55)	**151 (55)**
Female	3 (43)	12 (48)	17 (44)	19 (36)	34 (53)	39 (45)	**124 (45)**
Age group (yrs)							
19–29	1 (14)	1 (4)	2 (5)	2 (4)	2 (3)	8 (9)	**16 (6)**
30–39	2 (28.5)	10 (40)	18 (46)	19 (36)	24 (37.5)	26 (30)	**99 (36)**
40–49	2 (28.5)	7 (28)	12 (31)	15 (28)	18 (28)	29 (33)	**83 (30)**
50–59	2 (28.5)	5 (20)	4 (10)	11 (21)	14 (22)	12 (14)	**48 (17)**
60–69	0 (0)	2 (8)	3 (8)	4 (7.5)	5 (8)	9 (10)	**23 (8)**
≥70	0 (0)	0 (0)	0 (0))	2 (4)	1 (1.5)	3 (3)	**6 (2)**
Investigated*	6 (86)	23 (92)	35 (90)	44 (90)	49 (77)	64 (74)	**221 (80)**
Risks†							
Any drug use	3 (50)	7 (30)	19 (54)	23 (52)	25 (51)	36 (56)	**113 (51)**
IDU§	3 (50)	5 (22)	14 (40)	18 (41)	21 (43)	25 (39)	**86 (39)**
Non-IDU§	2 (33)	3 (13)	9 (26)	17 (39)	20 (17)	32 (50)	**83 (38)**
Incarcerated >24 hours in last 6 months	2 (33)	4 (17)	6 (17)	4 (9)	7 (14)	19 (30)	**42 (19)**
Incarcerated >6 months in lifetime	2 (33)	1 (4)	5 (14)	12 (27)	9 (18)	13 (20)	**42 (19)**
Ever treated for an STI	2 (33)	6 (26)	3 (9)	5 (11)	13 (27)	5 (8)	**34 (15)**

Abbreviations: IDU = injection drug use; STI = sexually transmitted infection.
* Five or more of eight major risk factor questions answered.
† Risk factor percentages calculated by dividing the number of persons with a given risk factor by the 221 investigated.
§ Might exceed total reporting any drug use because respondents might report both IDU and non-IDU history.

Erratum

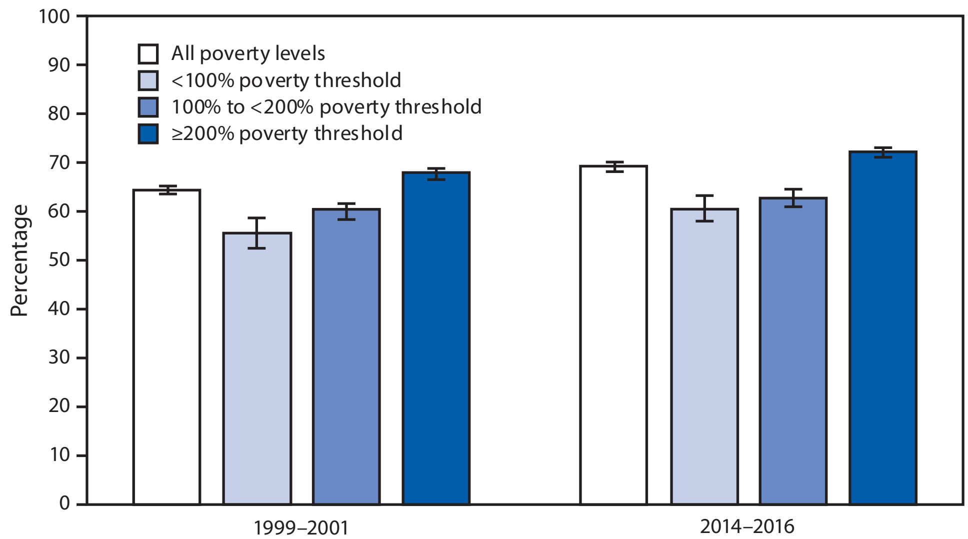
Vol. 67, No. 4

In the report "Outbreak of Seoul Virus Among Rats and Rat Owners — United States and Canada, 2017," on page 132, the second sentence of the first paragraph under "Public Health Response," should have read "On February **10, 2017,** the World Health Organization was notified of the U.S. and Canadian infections and investigations as required by International Health Regulations.[§]"

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Percentage*,† of Adults Aged ≥65 Years Who Had an Influenza Vaccine in the Past 12 Months,§ by Poverty Status¶ — National Health Interview Survey, United States, 1999–2001 and 2014–2016



* With 95% confidence intervals indicated by error bars.

† Estimates are based on household interviews of a sample of the noninstitutionalized U.S. civilian population and are derived from the National Health Interview Survey Sample adult component. Percentages were 3-year averages age-adjusted to the projected 2000 U.S. population as the standard population, using three age groups: 65–74, 75–84, and ≥85 years.

§ Based on the survey question, "During the past 12 months, have you had a flu vaccination?" Annual calendar-year estimates of immunizations differ from seasonal flu immunization totals, which reflect vaccinations obtained during the flu season.

¶ Poverty status is based on family income and family size using the U.S. Census Bureau poverty thresholds. Family income was imputed where missing.

During 2014–2016, 69.2% of all older adults, aged ≥65 years, had received an influenza vaccine in the past 12 months. The percentage of older adults with family income ≥200% poverty level who had received an influenza vaccine in the past 12 months significantly increased from 67.9% during 1999–2001 to 72.2% during 2014–2016. During the same period, the changes from 55.7% to 60.8% among those at the <100% poverty level and from 60.3% to 62.9% for those at the 100% to <200% poverty level were not statistically significant. During both periods, older adults with income ≥200% poverty level were significantly more likely to receive an influenza vaccine compared with those with lower family income.

Source: National Health Interview Survey, 1999–2016. https://www.cdc.gov/nchs/nhis.htm.

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