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Deaths from Alzheimer's Disease — United States, 1999–2014

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Alzheimer's disease (Alzheimer's), an ultimately fatal form of dementia, is the sixth leading cause of death in the United States, accounting for 3.6% of all deaths in 2014 (*1*,*2*). Alzheimer's deaths can be an indicator of paid and unpaid caregiver burden because nearly everyone in the final stages of Alzheimer's needs constant care, regardless of the setting, as the result of functional and cognitive declines (*2*). To examine deaths with Alzheimer's as the underlying cause, state-level and county-level death certificate data from the National Vital Statistics System for the period 1999–2014 were analyzed. A total of 93,541 Alzheimer's deaths occurred in the United States in 2014 at an age-adjusted (to the 2000 standard population) rate of 25.4 deaths per 100,000 population, a 54.5% increase compared with the 1999 rate of 16.5 deaths per 100,000. Most deaths occurred in a nursing home or long-term care facility. The percentage of Alzheimer's decedents who died in a medical facility (e.g., hospital) declined from 14.7% in 1999 to 6.6% in 2014, whereas the percentage who died at home increased from 13.9% in 1999 to 24.9% in 2014. Significant increases in Alzheimer's deaths coupled with an increase in the number of persons with Alzheimer's dying at home have likely added to the burden on family members or other unpaid caregivers. Caregivers might benefit from interventions such as education, respite care, and case management that can lessen the potential burden of caregiving and can improve the care received by persons with Alzheimer's.

Mortality data for 1999–2014 were analyzed using CDC WONDER (https://wonder.cdc.gov). The data were provided by the National Vital Statistics System and based on information from all resident death certificates filed in the 50 states and the District of Columbia (DC). The period analyzed represented all of the years with U.S. mortality data available at the time of analysis* using the International Classification of Disease, Tenth Revision (ICD-10) code set, which was implemented in 1999. CDC WONDER queries were used to generate the number of deaths with Alzheimer's reported as the underlying cause of death, along with unadjusted and age-adjusted death rates with 95% confidence intervals and standard errors for groups defined by characteristics including year, sex, age group (≤64, 65–74, 75–84, and ≥85 years), race/ethnicity (non-Hispanic white, non-Hispanic black, American Indian/Alaska Native, Asian/Pacific Islander, or Hispanic), urban-rural classification, state, and county.

The percentages of Alzheimer's deaths that occurred in medical facilities, the decedent's home, hospice facility, or nursing home/long-term care facilities also were obtained. County-level data were examined for the aggregated years of 2005–2014 because the geographic distribution for 1999–2004 data were

* Before the release of 2015 National Vital Statistics System data on December 9, 2016.

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inconsistent with more recent data and would have obscured any current geographic patterns. ICD-10 codes G30.0, G30.1, G30.8, and G30.9 were used to identify Alzheimer's as the underlying cause of death. These codes are used by CDC to describe Alzheimer's as a leading cause of death (*1*). Other forms of dementia were not examined in this analysis.

Mortality rates were calculated using population estimates produced by the U.S. Census Bureau in collaboration with CDC's National Center for Health Statistics. Age-adjusted mortality rates were calculated using the 2000 U.S. standard population. The z-statistic (assuming a normal approximation for the distribution of rates) was used to compare rates at a statistical significance level of $p<0.05$. No adjustment was made for multiple comparisons. Joinpoint regression was used to test the significance of trends in age-specific rates for the period 1999–2014.

From 1999 to 2014, age-specific rates of deaths attributed to Alzheimer's increased among adults aged 75–84 years from 129.5 to 185.6 per 100,000 population and among adults aged ≥85 years, from 601.3 to 1,006.8. The largest increase in the rates of Alzheimer's deaths among adults aged ≥85 years occurred from 1999 to 2005, compared with 2005–2014 ($p<0.001$) (Figure 1). Since 2005, although the mortality rate has continued to increase, the rate of increase was not as large as 1999–2005.

The age-adjusted Alzheimer's death rate per 100,000 population increased from 16.5 (44,536 deaths) in 1999 to 25.4 (93,541 deaths) in 2014, an increase of 54.5% (Table). In 2014, rates were higher compared with 1999 among all age groups; also in 2014 rates were higher among women compared with men and among non-Hispanic whites compared with other racial/ethnic populations (Table). In 2014, death rates for Alzheimer's were lower among residents of large central metropolitan areas and large fringe metropolitan areas compared with residents in other urban-rural classifications.

From 1999 to 2014, rates of Alzheimer's deaths significantly increased for 41 states and DC (Table). Only one state, Maine, had a significant decrease in age-adjusted Alzheimer's deaths. Age-adjusted rates for all 50 states and DC ranged from 7.0 to 29.8 per 100,000 in 1999 and from 10.7 to 43.6 per 100,000 in 2014.

Using average annual county-level data for the period 2005–2014, age-adjusted rates of Alzheimer's deaths ranged from 4.3 to 123.7 per 100,000 (Figure 2). Counties with the highest age-adjusted rates were primarily in the Southeast, plus some additional areas in the Midwest and West.

Most Alzheimer's decedents died in a nursing home or long-term care facility in 1999 (67.5%) and 2014 (54.1%). The percentage who died in a medical facility declined from 14.7% in 1999 to 6.6% in 2014. In contrast, the percentage who died at home increased from 13.9% in 1999 to 24.9% in 2014, with an additional 6.1% who died in a hospice facility in 2014.

Discussion

Symptoms of early stage Alzheimer's include memory loss that interferes with daily activities, difficulties with problem

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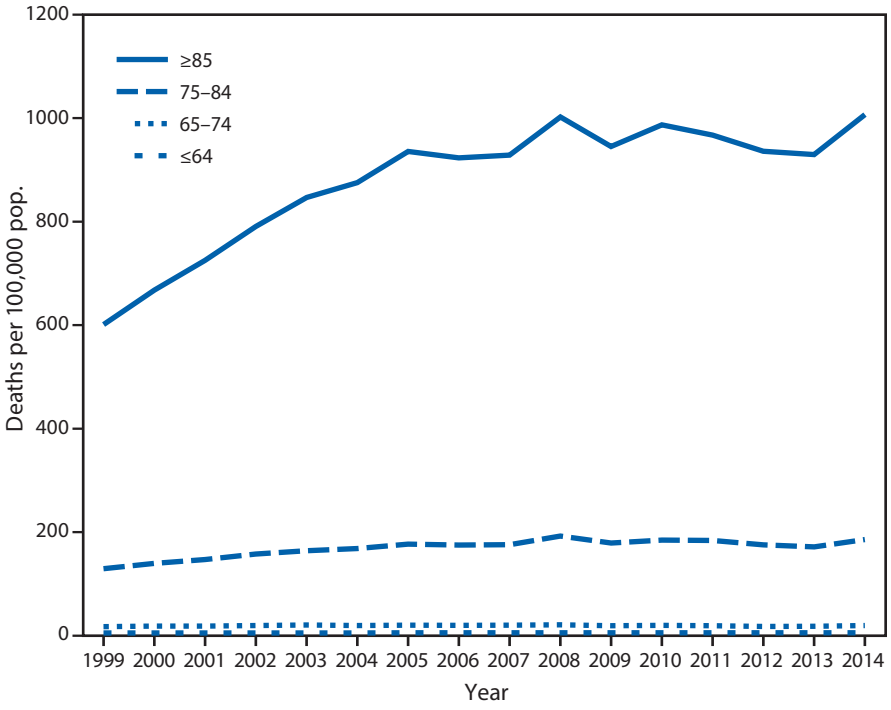
FIGURE 1. Death rates for Alzheimer's disease as the underlying cause of death, by age group (years) — United States, 1999–2014



solving, losing or misplacing objects, and changes in mood and personality. As Alzheimer's progresses, the brain's ability to control language and reasoning becomes impaired. Persons might have problems recognizing family and friends or performing multistep tasks such as getting dressed. In advanced stages, persons with Alzheimer's might be bedridden, have difficulty communicating, swallowing, or controlling bowel or bladder functions (*2*).

Adults aged ≥65 years are at greatest risk for developing Alzheimer's (*2*). The number of Alzheimer's deaths has increased, in part, because of a growing population of older adults. With the number of older adults increasing, the prevalence of Alzheimer's is projected to quadruple by 2050 (*3*). However, age-adjusted rates of Alzheimer's deaths have been increasing since 1979 (*4*). Although the actual number Alzheimer's deaths might be increasing, the increase in the rate of Alzheimer's deaths might also be attributed to increases in premorbid Alzheimer's diagnosis by patients seeking care for symptoms and increased reporting by physicians, coroners, and medical examiners who assign causes of death.

Studies have shown that non-Hispanic blacks and Hispanics are more likely to have Alzheimer's because of a wide variety of factors including increased cardiovascular disease risk factors (*5*). In contrast, this analysis showed that non-Hispanic whites have higher rates of Alzheimer's deaths. The causes of the racial differences in the increase in Alzheimer's death rates might be the result of competing causes of mortality; when compared with non-Hispanic whites, non-Hispanic blacks have higher rates for death from cardiovascular disease at younger ages (*6*).

It is important to note that the largest increase in the mortality rate occurred in older adults aged ≥85 years for the years 1999–2005. Since 2005, the mortality rate in this age group has continued to increase, but at a slower pace. This study did not directly examine factors that might have contributed to the sharp increase in reported deaths from 1999 to 2005 or the subsequent slowing of this increase. Increases in the mortality rate for Alzheimer's might be the result of corresponding decreases in mortality rates for competing causes of death, including cardiovascular disease and stroke (*2*,*6*).

The increasing rates of Alzheimer's deaths are not only problematic because of their obvious direct health effects on persons with Alzheimer's. The debilitating nature of Alzheimer's means that there are financial and societal costs borne by patients and their families, and by states and counties that operate publicly funded long-term care facilities. It is estimated that total health and long-term care costs for persons with Alzheimer's and other dementias in the United States will total $259 billion in 2017, more than two thirds of which is expected to be covered by public sources such as Medicare and Medicaid (*2*). Additionally, most care provided to older adults with Alzheimer's who do not live in long-term care facilities is provided by family members or other unpaid caregivers (*7*). In 2015, caregivers of persons with dementia, including Alzheimer's, provided 18.2 billion hours of unpaid assistance (*2*). These caregiving hours might correspond to increased financial costs for caregivers and decreased work productivity, as caregivers might take leave from work to ensure adequate care is provided. The societal costs are substantial when considered in the context of the estimated 5.5 million U.S. residents who live with Alzheimer's (*2*).

The findings in this report are subject to at least three limitations. First, several factors relating to the assigned cause of death might affect estimates of death involving Alzheimer's. Evidence suggests that Alzheimer's deaths reported on death certificates might be underestimates of the actual number of Alzheimer's deaths in the United States (*8*). Because cases were identified using the underlying cause of death, persons with Alzheimer's but a non-Alzheimer's underlying cause of death were not identified in this analysis. Second, complications from Alzheimer's, such as pneumonia, might be reported as the

TABLE. Number, unadjusted rates, and age-adjusted rates per 100,000 population for Alzheimer's disease deaths* as the underlying cause of death by age group, sex, race/ethnicity, urban-rural classification, and state — United States, 1999 and 2014

Characteristic	1999		2014		% change from 1999 to 2014
	No.	Rate (95% CI)	No.	Rate (95% CI)	
Total	**44,536**	**NA**	**93,541**	**NA**	**NA**
Unadjusted	NA	16.0 (15.8–16.1)	NA	29.3 (29.2–29.5)	83.8†
Age-adjusted§	NA	16.5 (16.3–16.6)	NA	25.4 (25.3–25.6)	54.5†
Age group (yrs)					
≤64	516	0.2 (0.2–0.2)	937	0.3 (0.3–0.4)	61.9†
65–74	3,204	17.4 (16.8–18.0)	5,170	19.6 (19.1–20.1)	12.5†
75–84	15,836	129.5 (127.5–131.6)	25,393	185.6 (183.3–187.9)	43.3†
≥85	24,980	601.3 (593.9–608.8)	62,041	1,006.8 (998.9–1,014.7)	67.4†
Sex§					
Male	13,391	14.4 (14.1–14.6)	28,362	20.6 (20.3–20.8)	43.1†
Female	31,145	17.4 (17.2–17.6)	65,179	28.3 (28.1–28.5)	62.7†
Race/Ethnicity§,¶					
White, non-Hispanic	40,835	17.4 (17.3–17.6)	80,014	26.8 (26.6–27.0)	53.6†
Black, non-Hispanic	2,325	11.4 (10.9–11.9)	6,493	22.7 (22.2–23.3)	99.4†
American Indian/Alaska Native	86	10.4 (8.3–12.9)	287	18.7 (16.5–20.9)	80.1†
Asian/Pacific Islander	225	4.8 (4.2–5.5)	1,660	12.2 (11.6–12.7)	151.4†
Hispanic	981	9.6 (6.0–10.2)	4,934	19.8 (19.3–20.4)	107.2†
Urban-rural classification§,**					
Large central metro	11,582	15.3 (15.0–15.6)	23,964	23.7 (23.4–24.0)	55.0†
Large fringe metro	9,570	16.2 (15.8–16.5)	19,998	22.6 (22.3–22.9)	39.6†
Medium metro	9,776	17.5 (17.2–17.9)	22,083	28.0 (27.6–28.3)	59.6†
Small metro	4,816	18.1 (17.6–18.7)	10,160	27.9 (27.3–28.4)	53.7†
Micropolitan (nonmetro)	5,019	17.4 (16.9–17.9)	9,826	27.7 (27.2–28.3)	59.2†
Non-core (nonmetro rural)	3,773	15.5 (15.0–16.0)	7,510	27.1 (26.5–27.7)	74.9†
State of residence§,††					
Alabama	772	17.8 (16.5–19.1)	1,885	35.3 (33.7–36.9)	98.3†
Alaska	24	11.9 (7.6–17.9)	68	17.2 (13.4–21.9)	44.5
Arizona	963	20.8 (19.5–22.1)	2,485	31.6 (30.3–32.8)	51.7†
Arkansas	434	14.8 (13.4–16.2)	1,193	34.8 (32.8–36.8)	134.5†
California	4,532	16.6 (16.1–17.1)	12,644	30.9 (30.4–31.5)	86.5†
Colorado	756	24.5 (22.7–26.2)	1,364	27.4 (25.9–28.9)	11.9†
Connecticut	449	11.4 (10.3–12.5)	923	18.4 (17.2–19.6)	61.6†
Delaware	107	15.0 (12.2–17.9)	188	16.6 (14.2–19.0)	10.5
District of Columbia	53	9.5 (7.1–12.4)	119	18.3 (15.0–21.7)	93.5†
Florida	3,059	14.3 (13.7–14.8)	5,874	18.8 (18.3–19.3)	31.8†
Georgia	1,080	18.8 (17.7–19.9)	2,670	31.7 (30.5–32.9)	68.9†
Hawaii	109	9.4 (7.7–11.2)	326	15.0 (13.4–16.7)	59.4†
Idaho	243	21.4 (18.7–24.1)	376	22.4 (20.1–24.7)	4.7
Illinois	1,908	15.9 (15.1–16.6)	3,266	21.9 (21.1–22.6)	38.0†
Indiana	1,106	18.9 (17.8–20.0)	2,204	29.4 (28.2–30.7)	55.7†
Iowa	706	18.2 (16.8–19.5)	1,313	29.6 (28.0–31.2)	62.8†
Kansas	511	16.6 (15.1–18.0)	790	21.9 (20.4–23.5)	32.3†
Kentucky	728	19.3 (17.9–20.7)	1,523	32.1 (30.4–33.7)	66.2†
Louisiana	683	17.9 (16.6–19.3)	1,670	36.0 (34.3–37.7)	101.1†
Maine	429	29.6 (26.8–32.4)	434	22.7 (20.5–24.8)	-23.5†
Maryland	681	15.4 (14.3–16.6)	934	14.5 (13.5–15.4)	-6.1
Massachusetts	1,182	16.5 (15.6–17.5)	1,688	19.0 (18.1–20.0)	15.3†
Michigan	1,431	15.4 (14.6–16.2)	3,349	27.0 (26.1–27.9)	75.2†
Minnesota	1,083	21.1 (19.8–22.4)	1,628	24.2 (23.0–25.4)	14.5†
Mississippi	356	13.3 (11.9–14.7)	1,098	35.2 (33.1–37.3)	164.1†
Missouri	914	15.0 (14.0–16.0)	2,053	27.4 (26.2–28.6)	82.9†
Montana	205	21.3 (18.4–24.3)	253	19.2 (16.9–21.6)	-9.9
Nebraska	331	16.3 (14.6–18.1)	515	21.9 (19.9–23.8)	33.8†
Nevada	174	13.6 (11.5–15.7)	606	23.8 (21.9–25.8)	75.2†
New Hampshire	266	23.2 (20.4–26.0)	396	24.0 (21.6–26.4)	3.5
New Jersey	1,041	12.0 (11.3–12.7)	1,962	17.4 (16.6–18.1)	44.8†
New Mexico	248	16.4 (14.4–18.5)	442	18.9 (17.1–20.7)	15.1
New York	1,357	7.0 (6.6–7.4)	2,639	10.7 (10.3–11.1)	52.2†

See table footnotes on next page.

TABLE. (*Continued*) Number, unadjusted rates, and age-adjusted rates per 100,000 population for Alzheimer's disease deaths* as the underlying cause of death by age group, sex, race/ethnicity, urban-rural classification, and state — United States, 1999 and 2014

Characteristic	1999		2014		% change from 1999 to 2014
	No.	Rate (95% CI)	No.	Rate (95% CI)	
North Carolina	1,456	20.8 (19.7–21.9)	3,246	30.5 (29.5–31.6)	46.6†
North Dakota	155	18.1 (15.2–21.0)	364	36.2 (32.4–40.0)	99.7†
Ohio	2,099	18.2 (17.4–19.0)	4,083	27.7 (26.8–28.5)	51.8†
Oklahoma	553	15.4 (14.1–16.7)	1,227	28.9 (27.3–30.5)	87.5†
Oregon	866	24.1 (22.5–25.7)	1,411	28.5 (27.0–30.0)	17.9†
Pennsylvania	2,192	14.4 (13.8–15.0)	3,486	18.3 (17.7–18.9)	26.8†
Rhode Island	219	17.0 (14.7–19.2)	403	25.9 (23.3–28.6)	53.0†
South Carolina	690	20.5 (18.9–22.0)	1,938	37.4 (35.8–39.1)	83.0†
South Dakota	155	16.3 (13.7–18.9)	434	36.2 (32.7–39.6)	121.8†
Tennessee	944	17.9 (16.7–19.0)	2,672	38.1 (36.7–39.6)	113.1†
Texas	2,833	18.5 (17.8–19.2)	6,772	30.0 (29.3–30.7)	62.2†
Utah	245	17.3 (15.1–19.4)	584	26.7 (24.6–28.9)	54.8†
Vermont	127	20.5 (17.0–24.1)	266	31.9 (28.0–35.8)	55.2†
Virginia	917	15.9 (14.8–16.9)	1,775	20.8 (19.8–21.8)	31.2†
Washington	1,577	29.8 (28.3–31.2)	3,344	43.6 (42.1–45.1)	46.4†
West Virginia	314	15.0 (13.3–16.7)	620	25.5 (23.5–27.5)	69.7†
Wisconsin	1,170	19.9 (18.8–21.1)	1,876	25.0 (23.9–26.2)	25.5†
Wyoming	103	23.9 (19.3–28.5)	162	26.6 (22.5–30.8)	11.5

Abbreviations: CI = confidence interval; NA = not applicable.

* Alzheimer's disease deaths in the National Vital Statistics System mortality file were identified using underlying cause-of-death *International Classification of Disease, Tenth Revision* codes G30.0, G30.1, G30.8, and G30.9.

† Statistically significant difference ($p<0.05$) in rates for 1999 and 2014 using the z-statistic.

§ Age-adjusted death rates for all groups except age groups were standardized to the 2000 projected U.S. standard population.

¶ Records without a specified Hispanic origin were excluded from this section.

** The National Center for Health Statistics urban-rural classification scheme classifies all U.S. counties into six levels that include large central metro (counties in metropolitan statistical areas [MSA] of ≥1 million population that also contain the entire population of the principal city of the MSA, or have their entire population contained in the largest principal city of the MSA, or contain at least 250,000 inhabitants of any principal city of the MSA); large fringe metro (counties in MSAs of ≥1 million population that did not qualify as large central metro counties; medium metro (counties in MSAs with populations of 250,000–999,999); small metro (counties in MSAs with populations <250,000); micropolitan (counties in a micropolitan statistical area that includes one or more urban clusters of 2,500–49,999 inhabitants that form the core and might contain outlying counties that meet specified requirements of commuting to or from the central counties); and noncore or rural nonmetropolitan counties that did not qualify as micropolitan.

†† State estimates are based on values from the entire state and not just from those counties that had available county-level data.

cause of death although the actual underlying cause of death, Alzheimer's, was not reported on the death certificate. Finally, a person with Alzheimer's might have dementia assigned as the underlying cause of death rather than a more specific diagnosis of Alzheimer's.

Some modifiable risk factors for cardiovascular disease, such as obesity and fewer years of education, have been identified as factors associated with an increased risk for dementia (*9*,*10*). Although some treatments have been demonstrated to alleviate symptoms of Alzheimer's, there is no cure or definitive means of prevention (*2*). Until Alzheimer's can be prevented, slowed, or stopped, caregiving for persons with advanced Alzheimer's will remain a demanding task. An increasing number of Alzheimer's deaths coupled with an increasing number of patients dying at home suggests that there is an increasing number of caregivers of persons with Alzheimer's. It is likely that these caregivers might benefit from interventions such as education, respite care, and case management that can lessen the potential burden of caregiving.

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Summary

What is already known about this topic?

Alzheimer's disease (Alzheimer's) is the most common cause of dementia. It currently affects an estimated 5.5 million adults in the United States and is expected to affect 13.8 million U. S. adults aged ≥65 years by 2050.

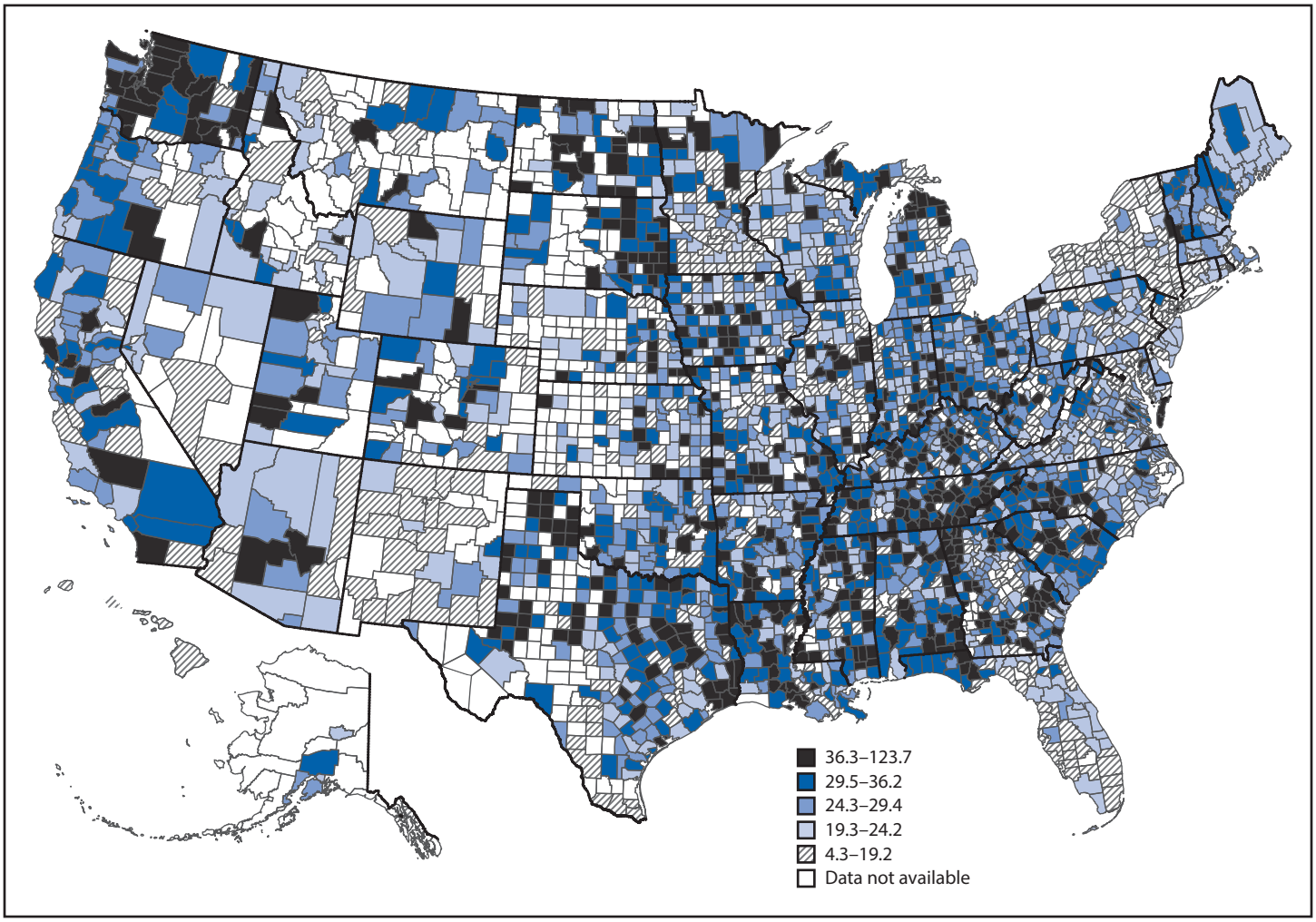
What is added by this report?

Age-adjusted rates of Alzheimer's mortality significantly increased in 41 states and the District of Columbia from 1999 to 2014. Counties with the highest age-adjusted rates were primarily in the Southeast, plus some additional areas in the Midwest and West. Significant increases in Alzheimer's deaths coupled with an increase in the number of persons with Alzheimer's dying at home suggest that the burden on caregivers has increased even more than the increase in the number of deaths.

What are the implications for public health practice?

Given the increasing number of Alzheimer's deaths and persons with Alzheimer's dying at home, there is a growing number of caregivers who likely can benefit from interventions like education, respite care, and home health assistance; such interventions can lessen the burden of caregiving and can improve the care received by persons with Alzheimer's.

FIGURE 2. Average annual age-adjusted death rates from Alzheimer's disease per 100,000 population, by county — United States, 2005–2014



References

1. Heron M. Deaths: leading causes for 2014. Natl Vital Stat Rep 2016;65:1–96.
2. Alzheimer's Association. 2017 Alzheimer's disease facts and figures. Alzheimers Dement 2017;13:325–73. https://doi.org/10.1016/j.jalz.2017.02.001
3. Brookmeyer R, Johnson E, Ziegler-Graham K, Arrighi HM. Forecasting the global burden of Alzheimer's disease. Alzheimers Dement 2007;3:186–91. https://doi.org/10.1016/j.jalz.2007.04.381
4. CDC. Mortality from Alzheimer disease—United States, 1979–1987. MMWR Morb Mortal Wkly Rep 1990;39:785–8.
5. National Research Council; Division of Behavioral and Social Sciences and Education; Committee on Population; Panel on Race, Ethnicity, and Health in Later Life. Critical perspectives on racial and ethnic differences in health in late life. Anderson NB, Bulatao RA, Cohen B, eds. Washington, DC: The National Academies Press; 2004.
6. National Center for Health Statistics. Health, United States, 2014: with special feature on adults aged 55–64. Hyattsville, MD: CDC, National Center for Health Statistics; 2015.
7. Kasper JD, Freedman VA, Spillman BC, Wolff JL. The disproportionate impact of dementia on family and unpaid caregiving to older adults. Health Aff (Millwood) 2015;34:1642–9. https://doi.org/10.1377/hlthaff.2015.0536
8. James BD, Leurgans SE, Hebert LE, Scherr PA, Yaffe K, Bennett DA. Contribution of Alzheimer disease to mortality in the United States. Neurology 2014;82:1045–50. https://doi.org/10.1212/WNL.0000000000000240
9. Anstey KJ, Cherbuin N, Budge M, Young J. Body mass index in midlife and late-life as a risk factor for dementia: a meta-analysis of prospective studies. Obes Rev 2011;12:e426–37. https://doi.org/10.1111/j.1467-789X.2010.00825.x
10. Fitzpatrick AL, Kuller LH, Ives DG, et al. Incidence and prevalence of dementia in the Cardiovascular Health Study. J Am Geriatr Soc 2004;52:195–204. https://doi.org/10.1111/j.1532-5415.2004.52058.x

Prevalence of Arthritis and Arthritis-Attributable Activity Limitation by Urban-Rural County Classification — United States, 2015

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Rural populations in the United States have well documented health disparities, including higher prevalences of chronic health conditions (*1*,*2*). Doctor-diagnosed arthritis is one of the most prevalent health conditions (22.7%) in the United States, affecting approximately 54.4 million adults (*3*). The impact of arthritis is considerable: an estimated 23.7 million adults have arthritis-attributable activity limitation (AAAL). The age-standardized prevalence of AAAL increased nearly 20% from 2002 to 2015 (*3*). Arthritis prevalence varies widely by state (range = 19%–36%) and county (range = 16%–39%) (*4*). Despite what is known about arthritis prevalence at the national, state, and county levels and the substantial impact of arthritis, little is known about the prevalence of arthritis and AAAL across urban-rural areas overall and among selected subgroups. To estimate the prevalence of arthritis and AAAL by urban-rural categories CDC analyzed data from the 2015 Behavioral Risk Factor Surveillance System (BRFSS). The unadjusted prevalence of arthritis in the most rural areas was 31.8% (95% confidence intervals [CI] = 31.0%–32.5%) and in the most urban, was 20.5% (95% CI = 20.1%–21.0%). The unadjusted AAAL prevalence among adults with arthritis was 55.3% in the most rural areas and 49.7% in the most urban. Approximately 1 in 3 adults in the most rural areas have arthritis and over half of these adults have AAAL. Wider use of evidence-based interventions including physical activity and self-management education in rural areas might help reduce the impact of arthritis and AAAL.

BRFSS is an ongoing, state-based, random-digit–dialed landline and cellphone survey of the noninstitutionalized adult population aged ≥18 years of the 50 states, the District of Columbia (DC), and the U.S. territories. BRFSS, designed to provide national and state-level estimates, collects data on health-related risk behaviors and chronic health conditions. Among the 2015 BRFSS respondents surveyed in the 50 states and DC, complete information on age, county, and arthritis diagnosis was available for 426,361 (98.2%). The median combined response rate for the 2015 BRFSS was 47.2% and ranged from 33.9% in California to 61.1% in Utah.* Respondents were classified as having arthritis if they answered "yes" to the question, "Have you ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?" Among adults with arthritis, AAAL was identified by a "yes" response to the question, "Are you now limited in any way in any of your usual activities because of arthritis or joint symptoms?"

Counties were classified into six urban-rural categories using the National Center for Health Statistics 2013 Urban-Rural Classification Scheme for Counties,† based on 2010 U.S. Census data and the 2013 Office of Management and Budget designations of metropolitan statistical areas, micropolitan statistical areas, and noncore areas. The county classification categories from most urban to most rural are 1) large central metropolitan (city); 2) large fringe metropolitan (suburb); 3) medium metropolitan; 4) small metropolitan; 5) micropolitan; and 6) noncore (rural).

Unadjusted overall, age-specific, and age-standardized prevalence with CIs were estimated for arthritis and AAAL by urban-rural categories. Age-standardized prevalence by urban-rural categories was further stratified by selected demographic (sex, race/ethnicity, highest education level, and employment status) and health (body mass index, leisure time physical activity, self-rated health, disability, and smoking status) characteristics. Estimates were age-standardized to the 2000 U.S. standard population aged ≥18 years using three age groups (18–44 years, 45–64 years, and ≥65 years).§ All analyses accounted for the complex sampling design of the survey, with sampling weights created using raking methodology. This methodology allows incorporation of many demographic variables into the weighting process, including telephone source, which makes the sample more representative of the population and reduces the potential for bias. Statistical significance was determined using t-tests at $\alpha = 0.05$ with the most rural (noncore) category as the reference group.

In the most rural areas (noncore) nearly 1 in 3 adults (unadjusted prevalence 31.8%) reported having doctor-diagnosed arthritis (Table 1). Age-specific prevalence was higher in older age groups and in rural areas. In age-standardized analyses, the prevalence of arthritis was lower among adults living in the most urban areas (20.0%; 95% CI = 19.6%–20.5%), and higher among adults living in the most rural areas (26.9%; 95% CI = 26.2%–27.5%) (Table 1) (Figure). Age-standardized arthritis prevalence was higher

* https://www.cdc.gov/brfss/annual_data/2015/2015_responserates.html.

† https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf.

§ https://www.cdc.gov/nchs/data/statnt/statnt20.pdf.

TABLE 1. Prevalence of doctor-diagnosed arthritis (crude and age-standardized) among U.S. adults aged ≥18 years, by urban-rural status and selected characteristics — Behavioral Risk Factor Surveillance System, 2015*

Characteristics	Large metro center (city)	Large fringe metro (suburb)	Medium metro	Small metro	Micropolitan	Noncore (rural)
No. of respondents	69,362	81,703	92,484	57,348	65,004	60,460
No. with arthritis	20,333	26,651	31,069	20,000	23,703	22,931
Prevalence	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**
Unadjusted	20.5 (20.1–21.0)	24.3 (23.8–24.8)	25.9 (25.4–26.4)	27.2 (26.6–27.8)	29.6 (28.9–30.2)	31.8 (31.0–32.5)
Age-standardized†	20.0 (19.6–20.5)	22.0 (21.6–22.5)	23.7 (23.3–24.2)	24.6 (24.1–25.2)	26.1 (25.5–26.7)	26.9 (26.2–27.5)
Age group (yrs)						
18–44	6.0 (5.6–6.5)	7.7 (7.2–8.2)	9.0 (8.5–9.6)	9.1 (8.4–9.9)	11.1 (10.3–12.0)	11.0 (10.2–11.9)
45–64	28.0 (27.0–28.9)	30.8 (30.0–31.7)	33.8 (33.0–34.7)	36.3 (35.1–37.4)	37.0 (35.9–38.1)	39.2 (38.0–40.4)
≥65	49.7 (48.3–51.0)	51.2 (50.1–52.2)	51.9 (50.9–52.8)	52.7 (51.5–54.0)	53.8 (52.6–55.0)	54.7 (53.4–55.9)
Sex†						
Male	16.8 (16.1–17.4)	18.9 (18.3–19.4)	20.7 (20.1–21.3)	21.7 (20.9–22.5)	23.0 (22.2–23.9)	23.8 (23.0–24.7)
Female	22.9 (22.3–23.5)	24.9 (24.3–25.5)	26.6 (26.0–27.2)	27.5 (26.7–28.3)	29.2 (28.3–30.0)	29.8 (28.9–30.7)
Race/Ethnicity†						
White, non-Hispanic	21.4 (20.8–22.0)	23.4 (22.9–23.9)	25.0 (24.5–25.6)	25.4 (24.7–26.1)	27.0 (26.3–27.8)	27.7 (27.0–28.4)
Black, non-Hispanic	22.9 (21.7–24.1)	22.6 (21.3–24.1)	24.5 (23.2–25.8)	26.0 (23.8–28.3)	24.9 (23.1–26.8)	25.8 (23.8–27.9)
Hispanic	18.1 (17.0–19.3)	16.8 (15.3–18.4)	18.2 (17.0–19.5)	17.7 (15.8–19.8)	17.3 (15.1–19.6)	16.6 (14.0–19.6)
American Indian/ Alaska Native	32.1 (25.3–39.8)	30.0 (24.1–36.7)	31.9 (27.8–36.2)	33.1 (28.2–38.3)	30.6 (26.7–34.8)	26.3 (23.2–29.7)
Asian	11.4 (9.4–13.6)	11.5 (9.2–14.2)	15.2 (12.0–19.1)	11.8 (8.8–15.6)	9.9 (7.2–13.3)	23.5 (16.6–32.3)
Native Hawaiian/ Pacific Islander	29.5 (21.8–38.7)	21.5 (13.8–31.8)	16.1 (10.2–24.6)	29.8 (18.3–44.6)	14.4 (8.3–23.8)	UR§
Multiracial, non-Hispanic	24.6 (21.2–28.3)	28.4 (24.9–32.1)	30.2 (27.4–33.1)	30.6 (26.1–35.5)	35.4 (31.4–39.5)	35.1 (29.8–40.7)
Others, non-Hispanic	15.2 (11.4–19.9)	20.8 (15.9–26.6)	31.3 (24.1–39.6)	28.8 (22.3–36.4)	23.0 (15.6–32.4)	29.6 (17.1–46.1)
Education†						
Less than HS	21.8 (20.4–23.2)	25.9 (24.2–27.6)	26.8 (25.4–28.3)	28.5 (26.5–30.5)	31.4 (29.2–33.6)	31.9 (29.9–33.9)
HS or equivalent	21.7 (20.8–22.6)	23.7 (22.9–24.5)	24.9 (24.1–25.7)	26.4 (25.4–27.5)	25.9 (25.0–26.9)	27.6 (26.6–28.5)
Some college	21.9 (21.1–22.8)	23.7 (22.9–24.5)	24.8 (24.1–25.6)	24.9 (23.9–25.9)	26.7 (25.7–27.7)	26.5 (25.4–27.6)
College and above	15.9 (15.3–16.5)	17.8 (17.2–18.3)	19.3 (18.7–19.9)	19.3 (18.5–20.1)	20.8 (19.9–21.7)	20.3 (19.2–21.4)
Employment†						
Employed/Self-employed	15.6 (15.0–16.3)	17.7 (17.1–18.3)	19.2 (18.5–19.8)	19.0 (18.2–19.8)	20.8 (20.0–21.6)	20.2 (19.3–21.0)
Unemployed	20.0 (18.0–22.1)	21.9 (19.8–24.0)	22.9 (20.7–25.3)	26.9 (23.9–30.1)	26.5 (23.3–30.0)	27.3 (24.1–30.8)
Retired	28.6 (23.0–35.0)	28.9 (23.5–34.9)	38.9 (29.7–48.9)	40.4 (30.1–51.7)	47.0 (31.9–62.7)	39.1 (25.0–55.3)
Unable to work because of disability	42.3 (39.6–45.2)	49.8 (46.6–53.0)	51.8 (49.1–54.4)	56.4 (52.6–60.1)	54.8 (51.3–58.3)	56.7 (53.2–60.2)
Other (student/ homemaker)	19.6 (18.0–21.3)	22.3 (20.9–23.8)	22.8 (21.5–24.1)	22.7 (20.9–24.7)	24.5 (22.4–26.8)	24.5 (22.6–26.5)

See table footnotes on next page.

in rural areas among most subgroups studied. Across all urban-rural categories, arthritis prevalence followed previously reported patterns for U.S. adults: higher prevalence among women, older adults, smokers, adults with less education, adults who are less physically active, or adults with higher body mass index. Arthritis prevalence was ≥50% among adults aged ≥65 years across all urban-rural categories (50%–55%), adults unable to work because of disability in all but the most urban categories (50%–57%), and adults reporting any functional disability in the most rural category (50%) (Table 1).

AAAL affected about half of adults with arthritis in all urban-rural categories; unadjusted overall prevalence ranged from 47.8% to 55.3% (Table 2). Age-specific prevalence of AAAL was higher in rural areas and among persons aged 45–64 years in all areas. In age-standardized analyses, the overall prevalence of AAAL was lower among adults in the most urban category (47.1%, 95% CI = 44.9%–49.3%), and higher in the most rural (56.9%, 95% CI = 54.6%–59.2%) (Table 2). Across the majority of health characteristic and demographic subgroups studied, higher prevalences of AAAL were found in the most rural (noncore) category (Table 2).

Discussion

In 2015, rural U.S. residents experienced a high prevalence and negative impact of arthritis. In the most rural areas, nearly 1 in 3 adults had arthritis and among adults with arthritis, approximately half reported being limited by arthritis. Prevalence of arthritis and AAAL was particularly high among rural residents with a functional or work disability. Rural populations might have higher prevalence of arthritis and AAAL because of recognized rural risk factors including older age, obesity, and lower socioeconomic status (*1*,*2*).

Several evidence-based physical activity and self-management education programs¶ can help decrease the impact of AAAL by reducing pain and improving function, mood, and quality of life (*5*). Many of these programs are offered in small groups, with limited availability in rural areas. For example, a national implementation of one self-management education program, the Chronic Disease Self-Management Program, reached less than 25% of all U.S. rural areas (*6*). However, engaging in

¶ https://www.cdc.gov/arthritis/interventions/index.htm.

TABLE 1. (*Continued*) Prevalence of doctor-diagnosed arthritis (crude and age-standardized) among U.S. adults aged ≥18 years, by urban-rural status and selected characteristics — Behavioral Risk Factor Surveillance System, 2015*

Characteristics	Large metro center (city)	Large fringe metro (suburb)	Medium metro	Small metro	Micropolitan	Noncore (rural)
Health characteristics						
Body mass index (kg/m^2)†						
<25.0 (under/normal weight)	16.4 (15.7–17.1)	17.7 (17.0–18.4)	19.1 (18.5–19.8)	20.3 (19.3–21.3)	21.3 (20.3–22.4)	22.3 (21.3–23.4)
25.0–29.9 (overweight)	18.7 (17.9–19.4)	20.6 (19.9–21.3)	22.2 (21.5–23.0)	22.8 (21.8–23.8)	23.4 (22.5–24.4)	24.6 (23.4–25.7)
≥30 (obese)	27.4 (26.5–28.4)	30.1 (29.1–31.1)	31.0 (30.1–32.0)	31.3 (30.2–32.4)	34.3 (33.1–35.6)	33.3 (32.2–34.5)
Smoking status†						
Current smoker	25.2 (23.8–26.6)	28.6 (27.3–30.1)	29.3 (28.2–30.5)	30.1 (28.6–31.7)	32.0 (30.4–33.6)	34.1 (32.5–35.7)
Former smoker	24.1 (23.1–25.2)	25.8 (24.8–26.7)	27.0 (25.9–28.0)	27.3 (26.0–28.6)	29.8 (28.4–31.3)	29.8 (28.4–31.3)
Never smoker	17.5 (16.9–18.0)	18.8 (18.3–19.3)	20.8 (20.3–21.3)	21.5 (20.9–22.2)	22.0 (21.3–22.8)	22.4 (21.7–23.2)
Physical activity (aerobic)†,¶						
Active	18.2 (17.6–18.9)	20.4 (19.8–20.9)	21.4 (20.8–22.0)	22.3 (21.5–23.1)	23.4 (22.5–24.2)	24.5 (23.6–25.5)
Insufficiently active	19.1 (18.1–20.2)	21.5 (20.5–22.5)	23.6 (22.6–24.6)	24.3 (22.9–25.7)	25.3 (24.0–26.6)	25.3 (23.8–26.7)
Inactive	24.8 (23.8–25.8)	26.8 (25.9–27.8)	29.2 (28.2–30.2)	29.6 (28.3–31.0)	32.2 (30.8–33.6)	31.3 (30.0–32.5)
Self-rated health†						
Excellent/Very good	13.8 (13.2–14.3)	15.5 (15.0–16.0)	16.3 (15.8–16.8)	16.3 (15.7–16.9)	17.1 (16.4–17.8)	16.6 (15.9–17.3)
Good	21.0 (20.2–21.9)	24.2 (23.4–25.0)	25.2 (24.4–26.0)	26.4 (25.4–27.5)	27.2 (26.1–28.3)	27.5 (26.3–28.6)
Fair/Poor	34.2 (32.8–35.7)	40.9 (39.2–42.7)	41.2 (39.8–42.6)	43.8 (41.8–45.9)	46.2 (44.1–48.4)	47.9 (45.8–50.1)
Functionally disabled†,**						
Yes	37.8 (36.5–39.1)	43.1 (41.6–44.5)	44.2 (42.9–45.5)	46.1 (44.3–47.9)	47.9 (46.1–49.7)	49.8 (47.9–51.8)
No	14.8 (14.3–15.2)	16.9 (16.5–17.3)	17.5 (17.1–17.9)	17.8 (17.3–18.4)	18.7 (18.1–19.3)	18.6 (18.0–19.2)

Abbreviations: CI = confidence interval; HS = high school; UR = unreliable.

* Estimates are weighted and account for the complex sampling design.

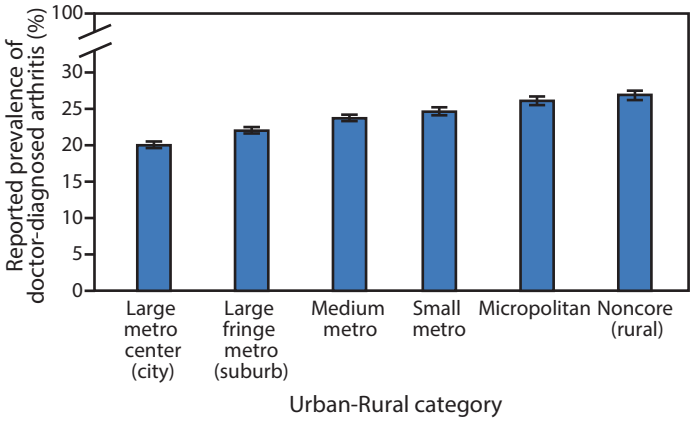
† Estimates age-standardized to the 2000 U.S standard population aged ≥18 years using three groups (18–44 years, 45–64 years, ≥65 years).

§ Estimates are unreliable and are suppressed (sample size <50 or relative standard error >30%).

¶ Respondents were classified as active if they reported ≥150 minutes of moderate intensity leisure time aerobic physical activity per week, insufficiently active if they reported 1–149 minutes, and inactive if they reported 0 minutes. Reported vigorous intensity physical activity minutes were counted double and added to moderate intensity physical activity minutes.

** Respondents were classified as functionally disabled if they answered yes to any of the following five questions: "Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?"; "Do you have serious difficulty walking or climbing stairs?"; "Are you blind or do you have serious difficulty seeing, even when wearing glasses?"; "Do you have difficulty dressing or bathing?"; "Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping?"

FIGURE. Age-standardized arthritis prevalence, by urban-rural categories — Behavioral Risk Factor Surveillance Survey, United States, 2015



proven self-directed versions of these programs (e.g., Walk with Ease, The Arthritis Toolkit) could represent inexpensive and accessible options. Community organizations already serving rural populations, including churches, county extension agents, veterans' service organizations, health care clinics, and

Summary

What is already known about this topic?

Arthritis is a highly prevalent health condition with an increasing negative impact. Nearly 1 in 4 adults in the United States (54.4 million persons) report having a diagnosis of arthritis, and the prevalence of arthritis-attributable activity limitation has increased 20% from 35.9% in 2002 to 42.8% in 2015.

What is added by this report?

In rural areas, arthritis affects nearly 1 in 3 adults. Rural residents with arthritis are likely to be limited by their arthritis, with approximately half reporting arthritis-attributable activity limitation. In rural areas, arthritis prevalence followed patterns previously reported for all adults with arthritis: higher prevalence among women, older adults, smokers, adults with less education, adults who are less physically active, or adults with higher body mass index.

What are the implications for public health practice?

Because of the high prevalence of arthritis in the rural adult population, rural residents should be targeted for interventions including physical activity and self-management education programs that help adults with arthritis manage their condition and reduce symptoms. Health care providers and community organizations can help residents participate in these helpful interventions.

TABLE 2. Prevalence (crude and age-standardized) of arthritis-attributable activity limitation (AAAL) among adults aged ≥18 years with doctor-diagnosed arthritis, by urban-rural status and selected characteristics — Behavioral Risk Factor Surveillance System, 2015*

Characteristics	Large metro center (city)	Large fringe metro (suburb)	Medium metro	Small metro	Micropolitan	Noncore (rural)
No. with arthritis†	18,228	24,213	28,377	18,353	21,803	21,092
No. with AAAL	9,005	11,550	14,026	9,130	11,037	10,905
Prevalence	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**
Unadjusted	49.7 (48.3–51.1)	47.8 (46.7–48.9)	50.2 (49.2–51.3)	50.9 (49.6–52.2)	51.7 (50.4–52.9)	55.3 (54.0–56.6)
Age-standardized§	47.1 (44.9–49.3)	48.6 (46.6–50.6)	49.7 (47.8–51.5)	50.6 (48.0–53.1)	52.4 (50.1–54.7)	56.9 (54.6–59.2)
Age group (yrs)						
18–44	42.9 (39.0–46.9)	49.0 (45.4–52.6)	47.9 (44.6–51.3)	48.8 (44.2–53.4)	52.3 (48.1–56.5)	57.4 (53.1–61.5)
45–64	54.6 (52.5–56.6)	50.2 (48.5–51.9)	54.8 (53.2–56.4)	56.2 (54.2–58.2)	55.4 (53.5–57.3)	60.4 (58.5–62.3)
≥65	47.0 (45.0–49.0)	44.8 (43.3–46.4)	46.1 (44.7–47.5)	46.1 (44.4–47.9)	47.6 (45.9–49.4)	49.3 (47.5–51.1)
Sex†						
Male	41.3 (37.6–45.0)	45.9 (42.6–49.2)	45.3 (42.5–48.3)	46.0 (42.3–49.8)	48.6 (45.0–52.2)	53.5 (49.7–57.4)
Female	51.1 (48.4–53.8)	50.5 (47.9–53.0)	52.9 (50.5–55.2)	54.3 (50.9–57.7)	55.2 (52.2–58.2)	59.3 (56.4–62.1)
Race/Ethnicity§						
White, non-Hispanic	48.3 (45.2–51.3)	48.6 (46.4–50.8)	47.4 (45.2–49.6)	49.6 (46.8–52.4)	51.5 (48.9–54.1)	56.5 (53.9–59.1)
Black, non-Hispanic	46.2 (41.6–50.8)	48.2 (42.1–54.2)	55.0 (49.1–60.8)	52.6 (43.1–62.0)	56.6 (48.6–64.2)	57.9 (49.2–66.1)
Hispanic	43.2 (38.3–48.1)	52.1 (44.4–59.7)	58.8 (53.2–64.3)	50.7 (40.4–60.8)	49.7 (40.4–59.1)	58.2 (44.3–71.0)
American Indian/ Alaska Native	64.4 (49.7–76.8)	63.3 (47.0–77.0)	57.9 (46.0–69.0)	64.1 (46.2–78.8)	68.2 (54.1–79.5)	59.4 (49.7–68.4)
Asian	40.6 (28.4–54.1)	38.1 (25.2–53.0)	45.1 (25.7–66.0)	UR¶	49.6 (29.6–69.8)	UR¶
Native Hawaiian/ Pacific Islander	UR¶	UR¶	UR¶	UR¶	UR¶	UR¶
Multiracial, non-Hispanic	59.4 (48.5–69.5)	59.7 (45.4–72.5)	54.9 (46.8–62.6)	68.0 (54.2–79.2)	67.1 (54.3–77.8)	59.2 (44.6–72.4)
Others, non-Hispanic	63.5 (37.4–83.4)	55.0 (35.6–73.0)	76.4 (63.9–85.5)	UR¶	27.6 (20.6–35.9)	74.5 (61.9–84.0)
Education§						
Less than HS	54.6 (47.5–61.4)	54.8 (47.8–61.7)	65.6 (60.0–70.8)	62.9 (55.0–70.2)	62.3 (55.0–69.2)	69.5 (63.7–74.7)
HS or equivalent	50.8 (46.1–55.4)	48.9 (44.9–53.0)	48.4 (44.7–52.1)	50.0 (45.6–54.3)	51.3 (47.4–55.1)	55.1 (51.1–58.9)
Some college	45.8 (42.2–49.4)	52.1 (48.7–55.4)	49.8 (46.8–52.9)	50.9 (46.7–55.1)	52.3 (48.6–55.9)	54.3 (50.5–58.1)
College graduate	40.4 (36.9–43.9)	40.5 (37.3–43.9)	39.6 (36.7–42.5)	40.1 (36.0–44.3)	41.9 (37.3–46.6)	48.2 (42.8–53.6)
Employment§						
Employed/Self-employed	36.1 (33.3–39.1)	39.5 (37.0–42.2)	38.1 (35.7–40.5)	37.0 (33.9–40.2)	37.9 (34.9–40.9)	42.2 (38.9–45.5)
Unemployed	51.9 (43.8–59.8)	56.9 (49.3–64.2)	64.3 (58.2–70.0)	53.2 (44.7–61.5)	64.8 (57.0–71.9)	60.9 (52.2–69.0)
Retired	51.8 (28.2–74.7)	57.5 (38.9–74.1)	61.6 (44.6–76.2)	65.6 (48.4–79.6)	74.9 (72.1–77.5)	UR¶
Unable to work because of disability	83.7 (79.2–87.4)	81.0 (76.1–85.1)	77.6 (72.8–81.7)	81.7 (74.9–87.0)	83.2 (78.7–86.9)	84.3 (80.9–87.2)
Other (student/ homemaker)	47.7 (41.7–53.7)	47.0 (41.2–53.0)	47.0 (41.7–52.4)	49.1 (41.2–57.1)	48.6 (41.6–55.7)	51.6 (44.7–58.4)

See table footnotes on next page.

community centers might be able to collaborate to make the small-group versions of these low-cost programs more available.

Physical activity is a proven intervention for managing arthritis and reducing the impact of arthritis-attributable activity limitations (*7*). Walking is a low impact, accessible activity proven to reduce pain and improve quality of life for adults with arthritis (*8*). In micropolitan areas, an important environmental barrier to walking is limited pedestrian infrastructure including long distances between destinations and lack of sidewalks (*9*). Changes in land use (e.g., parks and trails), destination locations (e.g., coffee shops, post offices) and transportation infrastructure (e.g., presence of sidewalks and crosswalks, light signals) have been associated with environments that facilitate increased walking in many geographic areas and some of these components might also apply in smaller rural areas (*9*). These changes could provide an environment that facilitates walking among rural residents.

Health care providers can help their patients manage their arthritis by recommending physical activity and self-management education programs. Adults with arthritis are more likely to attend a self-management education program when it is recommended by a health care provider.**

The prevalence of arthritis and AAAL among adults with work and functional disabilities were substantial; at least four of five rural residents with a functional or work disability had AAAL. Persons of all ages with work disabilities could benefit from Job Accommodation Network (JAN) services.†† JAN is a free federal resource that provides job accommodation information, links persons needing accommodation and employers to legal advice, and facilitates contact with additional state-specific and other employment resources, including state-based vocational rehabilitation and job retraining resources.

The findings in this study are subject to at least four limitations. First, arthritis is self-reported and the diagnosis was not confirmed by a health care professional; however, this case definition has been validated for public health surveillance (*10*). Second, the health-related behaviors are self-reported and therefore subject to social desirability bias. Third, findings are

** https://acr.confex.com/acr/2007/webprogram/Paper7677.html.
†† http://askjan.org.

TABLE 2. (*Continued*) Prevalence (crude and age-standardized) of arthritis-attributable activity limitation (AAAL) among adults aged ≥18 years with doctor-diagnosed arthritis, by urban-rural status and selected characteristics — Behavioral Risk Factor Surveillance System, 2015*

Characteristics	Large metro center (city)	Large fringe metro (suburb)	Medium metro	Small metro	Micropolitan	Noncore (rural)
Health characteristics						
Body mass index (kg/m^2)§						
<25.0 (under/normal weight)	44.4 (40.5–48.4)	45.6 (41.8–49.4)	46.7 (43.0–50.4)	50.4 (45.4–55.5)	51.5 (46.5–56.3)	56.2 (51.7–60.5)
25.0–29.9 (overweight)	42.2 (37.9–46.6)	47.2 (43.5–51.0)	42.9 (39.6–46.4)	48.2 (43.3–53.1)	45.9 (41.6–50.1)	55.4 (50.4–60.3)
≥30.0 (obese)	52.6 (49.0–56.2)	51.7 (48.4–55.0)	56.9 (54.0–59.7)	52.2 (48.5–55.8)	57.4 (53.9–60.8)	58.9 (55.4–62.3)
Smoking status§						
Current smoker	58.6 (54.0–63.1)	58.3 (54.5–62.0)	56.4 (53.1–59.6)	61.8 (57.5–66.0)	60.6 (56.9–64.2)	62.7 (58.9–66.4)
Former smoker	44.9 (40.3–49.5)	48.1 (44.1–52.2)	50.4 (46.3–54.5)	47.6 (42.7–52.6)	51.5 (46.6–56.3)	57.5 (52.6–62.2)
Never smoker	42.8 (39.9–45.7)	43.4 (40.6–46.3)	45.3 (42.5–48.1)	43.2 (39.4–47.1)	46.3 (42.5–50.1)	51.2 (47.4–55.0)
Physical activity (aerobic)§,**						
Active	41.7 (38.7–44.9)	43.4 (40.4–46.4)	42.8 (40.1–45.5)	44.9 (41.2–48.7)	45.0 (41.5–48.6)	52.0 (48.3–55.8)
Insufficiently active	44.6 (39.9–49.3)	49.6 (45.4–53.7)	50.8 (46.9–54.7)	49.2 (43.6–54.8)	51.3 (46.3–56.2)	53.9 (48.5–59.3)
Inactive	55.3 (51.0–59.5)	54.5 (50.7–58.3)	58.9 (55.4–62.3)	58.7 (54.2–63.0)	61.2 (57.4–64.8)	64.3 (60.7–67.8)
Self-rated health§						
Excellent/Very good	30.4 (27.1–33.8)	32.4 (29.3–35.7)	30.5 (27.6–33.6)	30.0 (26.5–33.8)	31.8 (28.1–35.9)	34.9 (30.8–39.2)
Good	42.5 (38.8–46.3)	48.4 (44.8–51.9)	49.1 (45.8–52.4)	46.8 (42.4–51.3)	46.9 (43.1–50.8)	51.9 (47.7–56.0)
Fair/Poor	68.4 (63.9–72.6)	67.6 (63.9–71.1)	69.7 (66.5–72.6)	71.8 (67.7–75.6)	73.4 (69.9–76.6)	75.1 (71.8–78.2)
Functionally disabled§,††						
Yes	70.3 (66.7–73.7)	74.9 (72.1–77.6)	73.8 (71.1–76.3)	72.9 (69.0–76.5)	75.6 (72.8–78.1)	79.1 (76.4–81.5)
No	28.7 (26.0–31.5)	30.1 (27.7–32.5)	28.9 (26.6–31.3)	28.5 (25.5–31.7)	28.9 (26.3–31.6)	32.1 (28.9–35.4)

Abbreviations: CI = confidence interval; HS = high school; UR = unreliable.

* Estimates are weighted and account for the complex sampling design.

† Analysis for AAAL prevalence excluded respondents where AAAL could not be ascertained (Don't know/Not sure, Refused, or missing).

§ Estimates are age-standardized to the 2000 U.S standard population aged ≥18 years using three groups (18–44 years, 45–64 years, ≥65 years).

¶ Estimates are unreliable and are suppressed (sample size <50 or relative standard error >30%).

** Respondents were classified as active if they reported ≥150 minutes of moderate intensity leisure time aerobic physical activity per week, insufficiently active if they reported 1–149 minutes, and inactive if they reported 0 minutes. Reported vigorous intensity physical activity minutes were counted double and added to moderate intensity physical activity minutes.

†† Respondents were classified as functionally disabled if they answered yes to any of the following five questions: "Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?"; "Do you have serious difficulty walking or climbing stairs?"; "Are you blind or do you have serious difficulty seeing, even when wearing glasses?"; "Do you have difficulty dressing or bathing?"; "Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping?"

generalizable only to the civilian, non-institutional population, as the survey does not include adults who live in long-term care facilities, prisons, and other institutions. Finally, low response rates can result in nonresponse bias and response rates by urban-rural classifications are not reported. However, the use of raking weighting methodology adjusts for nonresponse bias.§§

Despite these limitations, this study has multiple strengths. BRFSS collects information on a wide range of demographics, chronic conditions and health behaviors. Additionally, the large sample size allowed calculation of statistically precise estimates across all six urban-rural classifications overall and by subgroups.

The higher prevalence of arthritis and AAAL among rural U.S. residents highlights the need for evidence-based intervention approaches such as physical activity, self-management education, and vocational rehabilitation programs. Health care providers and community organizations that serve rural residents can help adults with arthritis in rural areas increase access to and participation in interventions that are proven to reduce pain, improve function and quality of life, and maintain workforce participation.

§§ https://www.cdc.gov/brfss/annual_data/2015/pdf/weighting_the-data_webpage_content.pdf.

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References

1. Meit M, Knudson A, Gilbert T, et al. The 2014 update of the rural-urban chartbook. Bethesda, MD: Rural Health Reform Policy Center; 2014. https://ruralhealth.und.edu/projects/health-reform-policy-research-center/pdf/2014-rural-urban-chartbook-update.pdf
2. Shaw KM, Theis KA, Self-Brown S, Roblin DW, Barker L. Chronic disease disparities by county economic status and metropolitan classification, Behavioral Risk Factor Surveillance System, 2013. Prev Chronic Dis 2016;13:E119. https://doi.org/10.5888/pcd13.160088
3. Barbour KE, Helmick CG, Boring M, Brady TJ. Vital signs: prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation—United States, 2013–2015. MMWR Morb Mortal Wkly Rep 2017;66:246–53. https://doi.org/10.15585/mmwr.mm6609e1
4. Barbour KE, Helmick CG, Boring M, Zhang X, Lu H, Holt JB. Prevalence of doctor-diagnosed arthritis at state and county levels—United States, 2014. MMWR Morb Mortal Wkly Rep 2016;65:489–94. https://doi.org/10.15585/mmwr.mm6519a2

5. Brady TJ, Murphy L, O'Colmain BJ, et al. A meta-analysis of health status, health behaviors, and healthcare utilization outcomes of the Chronic Disease Self-Management Program. Prev Chronic Dis 2013;10:120112. https://doi.org/10.5888/pcd10.120112
6. Towne SD, Smith ML, Ahn S, Ory MG. The reach of chronic-disease self-management education programs to rural populations. Front Public Health 2014;2:172.
7. Kelley GA, Kelley KS, Hootman JM, Jones DL. Effects of community-deliverable exercise on pain and physical function in adults with arthritis and other rheumatic diseases: a meta-analysis. Arthritis Care Res (Hoboken) 2011;63:79–93. https://doi.org/10.1002/acr.20347
8. Loew L, Brosseau L, Wells GA, et al.; Ottawa Panel. Ottawa panel evidence-based clinical practice guidelines for aerobic walking programs in the management of osteoarthritis. Arch Phys Med Rehabil 2012;93:1269–85. https://doi.org/10.1016/j.apmr.2012.01.024
9. Doescher MP, Lee C, Berke EM, et al. The built environment and utilitarian walking in small U.S. towns. Prev Med 2014;69:80–6. https://doi.org/10.1016/j.ypmed.2014.08.027
10. Sacks JJ, Harrold LR, Helmick CG, Gurwitz JH, Emani S, Yood RA. Validation of a surveillance case definition for arthritis. J Rheumatol 2005;32:340–7.

Current Tobacco Smoking and Desire to Quit Smoking Among Students Aged 13–15 Years — Global Youth Tobacco Survey, 61 Countries, 2012–2015

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Tobacco use is the world's leading cause of preventable morbidity and mortality, resulting in nearly 6 million deaths each year (*1*). Smoked tobacco products, such as cigarettes and cigars, are the most common form of tobacco consumed worldwide (*2*), and most tobacco smokers begin smoking during adolescence (*3*). The health benefits of quitting are greater for persons who stop smoking at earlier ages; however, quitting smoking at any age has health benefits (*4*). CDC used the Global Youth Tobacco Survey (GYTS) data from 61 countries across the six World Health Organization (WHO) regions from 2012 to 2015 to examine the prevalence of current tobacco smoking and desire to quit smoking among students aged 13–15 years. Across all 61 countries, the median current tobacco smoking prevalence among students aged 13–15 years was 10.7% (range = 1.7%, Sri Lanka to 35.0%, Timor-Leste). By sex, the median current tobacco smoking prevalence was 14.6% among males (range = 2.9%, Tajikistan to 61.4%, Timor-Leste) and 7.5% among females (range = 1.6%, Tajikistan to 29.0%, Bulgaria). In the majority of countries assessed, the proportion of current tobacco smokers who desired to quit smoking exceeded 50%. These findings could be used by country level tobacco control programs to inform strategies to prevent and reduce youth tobacco use (*1*,*4*).

GYTS is a nationally representative school-based, paper and pencil, cross-sectional survey of students in school grades associated with ages 13–15 years. GYTS uses a standardized methodology that allows for cross-country comparisons.* For this report, countries were selected if they met the following criteria: 1) nationally representative data (rather than subnational data) were available to allow for cross-country comparisons; and 2) data were collected during 2012–2015 to allow for estimation of recent prevalence estimates. Based on these criteria, 61 countries from all six WHO regions were selected for analyses.† The number of participating countries from each WHO region were African Region (AFR, 10 countries)§; Eastern Mediterranean Region (EMR, 10)¶; European Region (EUR, 18)**; Region of the Americas (AMR, 13)††; South East Asian Region (SEAR, 5)§§; and Western Pacific Region (WPR, 5).¶¶ Overall sample sizes ranged from 534 students in San Marino to 10,018 in Bosnia and Herzegovina (median = 2,428), and overall response rates ranged from 60.3% in Nicaragua to 99.2% in Sudan. Data were weighted for each country to yield nationally representatives estimates of youths attending school.

Students were asked about current (past 30-day) use of cigarettes*** and any form of smoked tobacco other than cigarettes.††† Current tobacco smoking was defined as smoking cigarettes or other smoked tobacco products on ≥1 day during the past 30 days. Students were classified as having a desire to quit smoking§§§ if they answered "yes" to the question, "Do you want to stop smoking now?"

Overall country-specific prevalence estimates with corresponding 95% confidence intervals were calculated for current tobacco smoking and desire to quit smoking. Estimates based on unweighted sample sizes <35 or relative standard error >0.3 are not reported. For countries where data are reported for both sexes, chi-squared tests were used to determine statistically significant differences ($p<0.05$) in current tobacco smoking between males and females.

* The Global Youth Tobacco Survey uses a two-stage sample design to select schools with a probability of selection proportional to enrollment size. The classes within selected schools are randomly selected and all students in selected classes are eligible to participate in the survey. More information is available from https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/Documentation.aspx?SUID=1&DOCT=1.

† Two countries (Finland and Bolivia) collected data in 2012 and did not use the updated GYTS methodology, and were excluded; two countries, (Bangladesh and Turkmenistan), did not meet the minimum established threshold for reporting results of sample size <35 or relative standard error >0.3, and were excluded; and one country (Russian Federation), collected subnational data and was excluded.

§ Algeria, Cameroon, Comoros, Gabon, Kenya, Mozambique, Senegal, Seychelles, Togo, and Zimbabwe.

¶ Bahrain, Djibouti, Egypt, Iraq, Jordan, Pakistan, Qatar, Sudan, United Arab Emirates, and Yemen.

** Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Greece, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Montenegro, Portugal, Romania, San Marino, Serbia, and Tajikistan.

†† Argentina, Bahamas, Barbados, Belize, Costa Rica, El Salvador, Guatemala, Guyana, Nicaragua, Panama, Paraguay, Peru, and Uruguay.

§§ Bhutan, Indonesia, Sri Lanka, Thailand, and Timor-Leste.

¶¶ Brunei, South Korea, Mongolia, Philippines, and Vietnam.

*** Past 30-day use of cigarettes was assessed with the following question, "During the past 30 days, on how many days did you smoke cigarettes?" and response option were: "a) 0 days," "b) 1 or 2 days," "c) 3 to 5 days," "d) 6 to 9 days," "e) 10 to 19 days," "f) 20 to 29 days," and "g) All 30 days."

††† Past 30-day use of any form of smoked tobacco other than cigarettes was assessed with the following question, "During the past 30 days, did you use any form of smoked tobacco products other than cigarettes (such as [country fills appropriate example])?" and response options were: "a) Yes" and "b) No."

§§§ Desire to quit smoking was assessed with the following question, "Do you want to stop smoking now?" and response options were: "a) I have never smoked," "b) I don't smoke now," "c) Yes," and "d) No."

Across all countries, the median current tobacco smoking prevalence among students aged 13–15 years was 10.7% (range = 1.7%, Sri Lanka to 35.0%, Timor-Leste). By WHO region, current tobacco smoking prevalence in AFR ranged from: 6.1% (Mozambique) to 20.2% (Seychelles); in EMR, from 7.2% (Pakistan) to 23.3% (Jordan); in EUR, from 2.4% (Tajikistan) to 27.4% (Bulgaria); in AMR, from 5.8% (Paraguay) to 22.0% (Argentina); in SEAR, from 1.7% (Sri Lanka) to 35.0% (Timor-Leste); and in WPR, from 3.5% (Vietnam) to 14.5% (Philippines) (Table).

By sex, the median current tobacco smoking prevalence was 14.6% among males (range = 2.9%, Tajikistan to 61.4%, Timor-Leste) and 7.5% among females (range = 1.6%, Tajikistan to 29.0%, Bulgaria). Among males, the prevalence of current tobacco smoking by WHO region ranged from 5.5% (Mozambique) to 25.6% (Seychelles) in AFR; 9.2% (Pakistan) to 32.8% (Jordan) in EMR; 2.9% (Tajikistan) to 28.6% (Lithuania) in EUR; 5.9% (Paraguay) to 20.2% (Argentina) in AMR; 20.7% (Thailand) to 61.4% (Timor-Leste) in SEAR; and 6.3% (Vietnam) to 20.5% (Philippines) in WPR (Table). Among females, the prevalence of current tobacco smoking by WHO region ranged from 1.8% (Algeria) to 15.2% (Seychelles) in AFR; 4.1% (Pakistan) to 13.4% (Jordan) in EMR; 1.6% (Tajikistan) to 29.0% (Bulgaria) in EUR; 5.7% (Paraguay) to 23.7% (Argentina) in AMR; 3.4% (Indonesia) to 15.4% (Timor-Leste) in SEAR; and 3.0% (Mongolia) to

TABLE. Prevalence of current tobacco smoking,* overall and by sex, among students aged 13–15 years — 61 countries, Global Youth Tobacco Survey, 2012–2015

World Health Organization region/country	Survey year	Overall unweighted sample size	Prevalence of current tobacco smoking		
			Overall % (95% CI)	Males % (95% CI)	Females % (95% CI)
African Region					
Algeria	2013	4,023	7.4 (6.3–8.7)	14.9 (12.3–17.9)	1.8 (1.3–2.7)†
Cameroon	2014	1,873	7.4 (4.8–11.5)	10.3 (6.8–15.4)	4.0 (2.4–6.6)†
Comoros	2015	1,551	9.1 (6.3–13.0)	13.2 (8.8–19.4)	5.6 (3.3–9.4)†
Gabon	2014	788	7.6 (6.1–9.5)	7.9 (6.3–9.8)	7.0 (5.1–9.5)
Kenya	2013	1,326	7.0 (4.9–9.8)	9.6 (6.6–13.8)	4.0 (2.2–7.2)†
Mozambique	2013	3,062	6.1 (4.7–7.9)	5.5 (4.0–7.5)	6.2 (4.4–8.7)
Senegal	2013	796	7.8 (5.0–12.1)	9.7 (5.9–15.7)	—§
Seychelles	2015	1,525	20.2 (17.2–23.7)	25.6 (21.7–30.0)	15.2 (11.9–19.2)†
Togo	2013	2,801	6.9 (5.3–8.9)	9.8 (7.3–13.0)	2.7 (1.8–4.2)†
Zimbabwe	2014	5,114	16.2 (10.6–24.1)	17.3 (11.4–25.5)	12.8 (7.9–19.9)†
Eastern Mediterranean Region					
Bahrain	2015	2,465	15.7 (11.1–21.8)	22.7 (17.4–28.9)	8.5 (6.5–11.0)†
Djibouti	2013	1,361	11.6 (8.8–15.2)	13.0 (9.1–18.1)	9.1 (5.9–13.6)
Egypt	2014	2,141	10.1 (6.7–15.0)	16.3 (10.0–25.6)	—
Iraq	2014	1,266	11.1 (7.2–16.8)	16.2 (10.3–24.7)	6.0 (4.2–8.4)†
Jordan	2014	1,899	23.3 (17.7–29.9)	32.8 (27.6–38.4)	13.4 (9.1–19.4)†
Pakistan	2013	5,832	7.2 (5.8–9.0)	9.2 (7.1–11.7)	4.1 (2.8–5.9)†
Qatar	2013	1,716	12.3 (8.8–17.0)	18.4 (14.1–23.7)	6.2 (4.4–8.8)†
Sudan	2014	1,450	8.3 (6.3–11.0)	10.6 (7.7–14.4)	5.0 (3.0–8.2)†
United Arab Emirates	2013	3,376	10.5 (7.9–13.9)	14.6 (10.7–19.5)	6.4 (4.3–9.5)†
Yemen	2014	1,634	15.1 (10.9–20.5)	19.4 (14.5–25.5)	7.9 (4.5–13.7)†
European Region					
Albania	2015	3,482	9.4 (7.9–11.1)	12.9 (10.7–15.6)	5.6 (4.2–7.5)†
Belarus	2015	2,428	9.4 (7.5–11.7)	8.9 (6.1–12.8)	9.9 (7.8–12.6)
Bosnia and Herzegovina	2013	10,018	15.1 (12.9–17.7)	17.8 (15.2–20.7)	12.2 (9.7–15.3)†
Bulgaria	2015	3,532	27.4 (22.8–32.5)	25.7 (19.5–33.1)	29.0 (24.7–33.8)
Georgia	2014	962	10.0 (7.0–14.1)	13.9 (9.9–19.2)	—
Greece	2013	4,096	13.3 (11.4–15.4)	14.9 (12.9–17.1)	11.6 (9.5–14.1)†
Italy	2014	1,428	23.4 (20.8–26.4)	20.6 (16.6–25.3)	26.3 (22.3–30.1)
Kazakhstan	2014	1,715	2.8 (2.0–3.9)	3.5 (2.2–5.3)	1.9 (1.2–3.2)
Kyrgyzstan	2014	3,468	3.7 (2.7–5.0)	5.5 (3.9–7.9)	2.0 (1.2–3.1)†
Latvia	2014	4,025	23.3 (21.6–25.0)	23.7 (21.6–26.0)	22.7 (20.4–25.1)
Lithuania	2014	3,113	26.4 (22.9–30.1)	28.6 (24.5–33.2)	24.1 (20.6–27.9)†
Moldova	2013	3,548	8.3 (6.3–10.9)	12.7 (9.3–17.0)	3.8 (2.6–5.7)†
Montenegro	2014	3,692	8.4 (4.7–14.7)	—	4.2 (2.7–6.4)
Portugal	2013	7,600	13.9 (12.5–15.4)	12.8 (11.3–14.5)	15.1 (13.2–17.1)†
Romania	2013	3,328	11.2 (9.3–13.4)	12.2 (9.9–14.8)	10.1 (7.9–12.8)
San Marino	2014	534	14.6 (11.2–19.0)	14.4 (10.1–20.0)	15.0 (10.2–21.4)
Serbia	2013	3,076	15.0 (12.4–18.0)	15.3 (12.9–18.0)	14.6 (11.1–18.9)
Tajikistan	2014	2,411	2.4 (1.7–3.5)	2.9 (1.9–4.5)	1.6 (1.0–2.6)

See table footnotes on next page.

TABLE. (*Continued*) Prevalence of current tobacco smoking,* overall and by sex, among students aged 13–15 years — 61 countries, Global Youth Tobacco Survey, 2012–2015

World Health Organization region/country	Survey year	Overall unweighted sample size	Prevalence of current tobacco smoking		
			Overall % (95% CI)	Males % (95% CI)	Females % (95% CI)
Region of the Americas					
Argentina	2012	2,069	22.0 (18.5–26.0)	20.2 (17.6–23.0)	23.7 (18.5–29.7)
Bahamas	2013	1,033	10.7 (7.4–15.4)	13.8 (8.4–21.8)	6.9 (4.4–10.7)†
Barbados	2013	1,306	12.6 (10.4–15.3)	15.7 (12.2–19.9)	9.3 (7.1–12.0)†
Belize	2014	1,273	11.5 (9.5–13.9)	15.7 (12.2–20.0)	7.5 (5.4–10.4)†
Costa Rica	2013	2,158	8.3 (6.6–10.4)	9.0 (6.9–11.6)	7.6 (5.6–10.3)
El Salvador	2015	2,567	12.2 (10.0–14.7)	14.7 (11.7–18.3)	9.4 (7.3–12.1)†
Guatemala	2015	3,351	15.7 (13.6–18.2)	18.0 (15.1–21.4)	13.2 (10.6–16.3)†
Guyana	2015	1,000	11.7 (8.6–15.7)	16.1 (10.8–23.2)	7.5 (4.5–12.5)†
Nicaragua	2014	3,006	14.6 (12.8–16.7)	16.8 (14.0–20.0)	12.3 (10.2–14.8)†
Panama	2012	4,077	8.1 (7.3–9.1)	10.3 (9.1–11.6)	6.2 (5.1–7.4)†
Paraguay	2014	5,153	5.8 (4.8–6.9)	5.9 (4.7–7.4)	5.7 (4.5–7.1)
Peru	2014	2,299	9.0 (6.4–12.5)	10.5 (7.2–15.2)	7.4 (5.2–10.5)†
Uruguay	2014	3,256	9.9 (8.3–11.8)	9.6 (7.6–12.1)	9.8 (8.0–11.9)
South East Asian Region					
Bhutan	2013	1,378	16.6 (13.9–19.4)	26.3 (21.6–31.6)	8.6 (7.0–10.6)†
Indonesia	2014	4,317	19.4 (15.0–24.8)	35.3 (27.4–44.0)	3.4 (2.2–5.3)†
Sri Lanka	2015	1,416	1.7 (0.9–3.2)	—	—
Thailand	2015	1,721	14.0 (10.4–18.6)	20.7 (16.0–26.3)	7.1 (4.4–11.2)†
Timor-Leste	2013	1,908	35.0 (28.9–41.6)	61.4 (48.1–73.2)	15.4 (12.0–19.5)†
Western Pacific Region					
Brunei	2013	917	10.2 (6.3–16.0)	15.0 (8.5–25.1)	5.1 (2.7–9.7)†
Mongolia	2014	6,178	5.6 (4.7–6.7)	8.2 (6.7–9.9)	3.0 (2.1–4.1)†
Philippines	2015	5,885	14.5 (11.6–18.0)	20.5 (16.3–25.4)	9.1 (6.2–13.3)†
South Korea	2013	3,437	5.9 (4.7–7.3)	8.4 (6.6–10.7)	3.1 (2.1–4.4)†
Vietnam	2014	3,430	3.5 (2.6–4.7)	6.3 (4.6–8.4)	—

Abbreviation: CI = confidence interval.
* Current tobacco smoking was defined as answering ≥1 day to the question "During the past 30 days, on how many days did you smoke cigarettes?" and/or "Yes" to "During the past 30 days, did you use any form of smoked tobacco products other than cigarettes (such as [country fills appropriate examples])?"
† Female prevalence significantly different from males at p<0.05.
§ Data not reported because unweighted sample size <35 or relative standard error >0.3.

9.1% (Philippines) in WPR. Males had a higher prevalence of current tobacco smoking in 38 countries (p<0.05); females had a significantly higher prevalence of current tobacco smoking in one country (Portugal) (p<0.05).

Among the 51 countries in which the desire to quit was assessed among current tobacco smokers, the proportion of students who desired to quit ranged from 32.1% (Uruguay) to 90.2% (Philippines); the proportion of current tobacco smokers who reported a desire to quit exceeded 50% in 40 of those countries (Figure). By WHO region, the proportions ranged from 62.2% (Seychelles) to 86.3% (Kenya) in AFR; 49.1% (United Arab Emirates) to 75.8% (Yemen) in EMR; 43.5% (Italy) to 83.1% (Moldova) in EUR; 32.1% (Uruguay) to 70.1% (Guyana) in AMR; 67.8% (Timor-Leste) to 88.2% (Indonesia) in SEARO; and 66.9% (South Korea) to 90.2% (Philippines) in WPR.

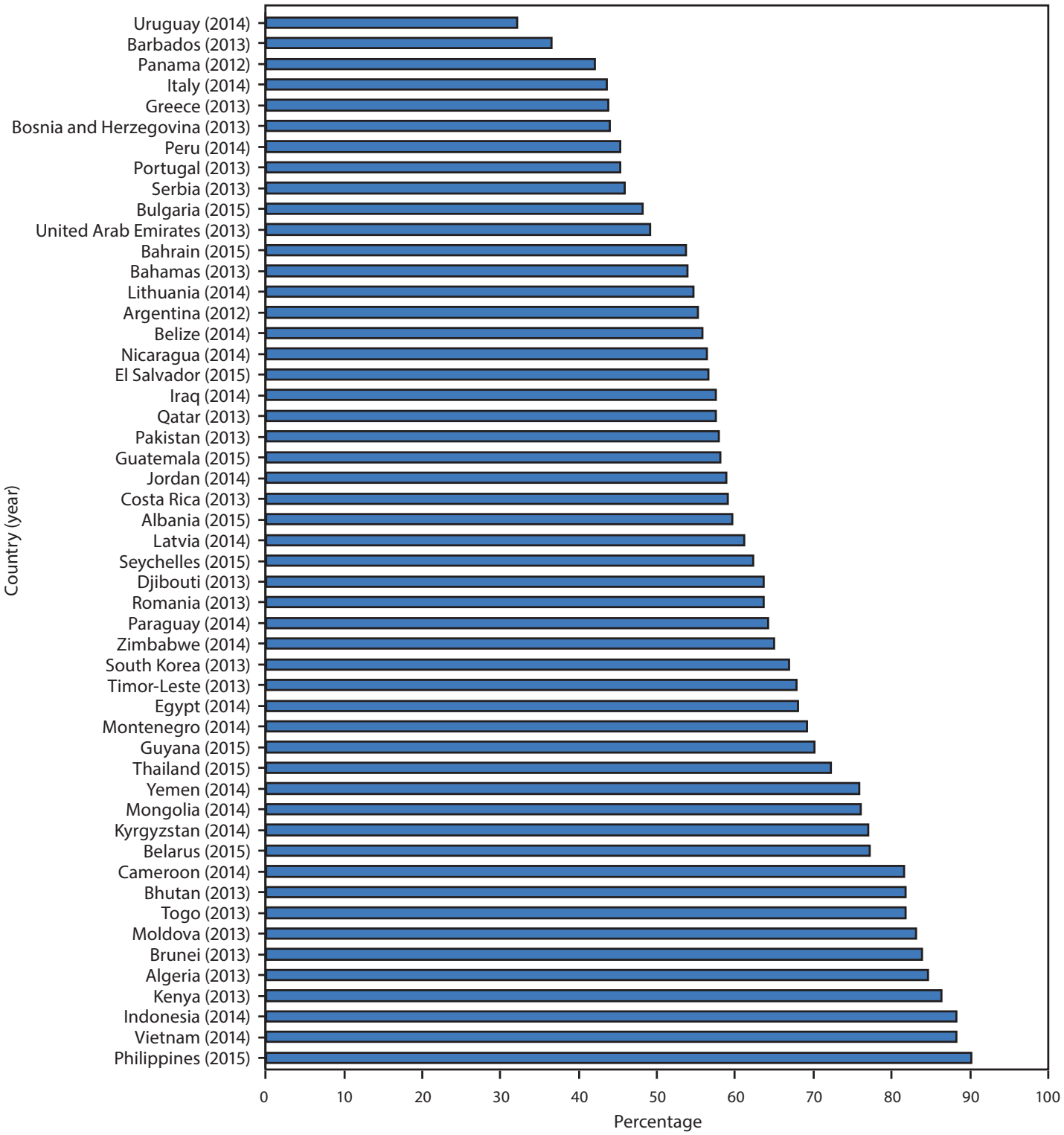
Discussion

The prevalence of current tobacco smoking among students aged 13–15 years in 61 countries ranged from 1.7% (Sri Lanka) to 35.0% (Timor-Leste). In 38 countries, tobacco smoking prevalence was significantly higher among males than females. In 40 of 51 countries that collected data about the desire to quit, the proportion of students who reported current tobacco smoking and desired to quit exceeded 50%.

WHO's Framework Convention on Tobacco Control (FCTC), the first international treaty negotiated under the auspices of WHO and developed in response to the global tobacco epidemic, includes evidence-based measures that have the potential to reduce youth tobacco use (*5*). These measures include increasing the price of tobacco (Article 6), bans on tobacco advertising, promotions, and sponsorship (Article 13), promoting tobacco cessation (Article 14), addressing illicit trade of tobacco products (Article 15), and prohibiting the sale of tobacco products to and by minors (Article 16). At the beginning of 2017, 59 of 61 countries in this report had ratified the FCTC. However, varying levels of tobacco control policy implementation and other country-specific factors might influence access to tobacco and tobacco smoking prevalence (*6*).

To assist with implementation of FCTC, countries can implement WHO's MPOWER package (*7*). MPOWER is a set of evidence-based interventions intended to reduce tobacco

FIGURE. Proportion of current tobacco smokers* who desire to quit,† among students aged 13–15 years — 51§ countries, Global Youth Tobacco Survey, 2012–2015



* Current tobacco smoking was defined as answering ≥1 day to the question "During the past 30 days, on how many days did you smoke cigarettes?" and/or "Yes" to "During the past 30 days, did you use any form of smoked tobacco products other than cigarettes (such as [country fills appropriate examples])?"

† Desire to quit was defined as answering "Yes" to the question "Do you want to stop smoking now?" among current tobacco smokers.

§ Data not reported for desire to quit in Comoros (2015), Gabon (2014), Mozambique (2013), Senegal (2013), Sudan (2014), Georgia (2014), Kazakhstan (2014), San Marino (2014), Tajikistan (2014), and Sri Lanka (2015) because unweighted sample size <35 or relative standard error >0.3.

use, including 1) monitoring tobacco use and prevention policies; 2) protecting persons from tobacco smoke; 3) offering help to quit tobacco use; 4) warning about the dangers of tobacco use; 5) enforcing bans on tobacco sponsorship, promotion, and advertising; and 6) raising taxes on tobacco. When implemented as part of a comprehensive approach, these strategies can help reduce youth tobacco use (*3*,*4*,*8*).

This report is subject to at least four limitations. First, data were self-reported by students, which might result in misreporting of smoking behavior. Second, the data presented represent only youths who are enrolled in school, which might limit generalizability to all youths in these countries. Third, low response rates in some countries might have resulted in nonresponse bias. Finally, only a limited number of countries were assessed from each WHO region; thus, the findings in this report are not necessarily generalizable to all countries in the respective WHO regions.

The prevalence of tobacco smoking is high among youths in many countries. However, many students who currently smoke report that they desire to quit. Implementing the evidence-based measures outlined in WHO's MPOWER package can help reduce tobacco use among youths, as well as the estimated 1 billion tobacco-related deaths projected to occur during the 21st century if current trends persist (*1*).

Summary

What is already known about this topic?

Smoked tobacco products, such as cigarettes and cigars, are the most common form of tobacco consumed worldwide and most tobacco smokers begin smoking during adolescence.

What is added by this report?

Global Youth Tobacco Survey data from 61 countries from 2012 to 2015 revealed that the median current tobacco smoking prevalence among students aged 13–15 years was 10.7%. Tobacco smoking prevalence differed by gender and varied across countries. In the majority of countries, over 50% of youth tobacco smokers desired to quit.

What are the implications for public health practice?

Implementing the evidence-based measures outlined in the World Health Organization's MPOWER package can help reduce tobacco use among youths, as well as the estimated 1 billion tobacco-related deaths projected to occur during the 21st century if current trends persist.

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References

1. World Health Organization. WHO global report: mortality attributable to tobacco. Geneva, Switzerland: World Health Organization; 2012. http://apps.who.int/iris/bitstream/10665/44815/1/9789241564434_eng.pdf
2. CDC Foundation. Global Adult Tobacco Survey atlas. Atlanta, GA: CDC Foundation; 2015. http://gatsatlas.org/
3. US Department of Health and Human Services. Preventing tobacco use among youth and young adults: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, CDC, National Center for Chronic Disease Prevention and Health Promotion; 2012. https://www.surgeongeneral.gov/library/reports/preventing-youth-tobacco-use/full-report.pdf
4. US Department of Health and Human Services. The health consequences of smoking—50 years of progress: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, CDC, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking Health; 2014. https://www.surgeongeneral.gov/library/reports/50-years-of-progress/full-report.pdf
5. World Health Organization. WHO Framework Convention on Tobacco Control. Geneva, Switzerland: World Health Organization; 2005. http://www.who.int/tobacco/framework/WHO_FCTC_english.pdf
6. Nagler RH, Viswanath K. Implementation and research priorities for FCTC Articles 13 and 16: tobacco advertising, promotion, and sponsorship and sales to and by minors. Nicotine Tob Res 2013;15:832–46. https://doi.org/10.1093/ntr/nts331
7. World Health Organization. WHO Report on the global tobacco epidemic, 2008: the MPOWER package. Geneva, World Health Organization, 2008. http://www.who.int/tobacco/mpower/mpower_report_full_2008.pdf
8. DiFranza JR. Which interventions against the sale of tobacco to minors can be expected to reduce smoking? Tob Control 2012;21:436–42. https://doi.org/10.1136/tobaccocontrol-2011-050145

Virologic Monitoring of Poliovirus Type 2 after Oral Poliovirus Vaccine Type 2 Withdrawal in April 2016 — Worldwide, 2016–2017

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The Global Polio Eradication Initiative (GPEI) has made substantial progress since its launch in 1988; only 37 wild poliovirus type 1 (WPV1) cases were detected in 2016, the lowest annual count ever. Wild poliovirus type 3 has not been detected since November 2012, and wild poliovirus type 2 was officially declared eradicated in September 2015. This success is attributable to the wide use of live oral poliovirus vaccines (OPVs). Since 2001, numerous outbreaks were caused by the emergence of genetically divergent vaccine-derived polioviruses (VDPVs) whose genetic drift from the parental OPV strains indicates prolonged replication or circulation (*1*). In 2015, circulating VDPV type 2 (cVDPV2) outbreaks were detected in five countries worldwide (Nigeria, Pakistan, Guinea, Burma, and South Sudan), and VDPV2 single events were reported in 22 countries. These events prompted the GPEI to withdraw the type 2 component (Sabin2) of trivalent OPV (tOPV) in a globally coordinated, synchronized manner in April 2016 (*2*,*3*), at which time all OPV-using countries switched to using bivalent OPV (bOPV), containing Sabin types 1 and 3. This report details for the first time the virologic tracking of elimination of a live vaccine that has been withdrawn from routine and mass immunization systems worldwide (*3*). To secure elimination, further monitoring is warranted to detect any use of tOPV or monovalent OPV type 2 (mOPV2).

The Global Polio Laboratory Network

The Global Polio Laboratory Network (GPLN) comprises 146 World Health Organization (WHO)–accredited poliovirus laboratories in 92 countries located in the six WHO regions (*4*). GPLN member laboratories follow standardized protocols to isolate poliovirus using sensitive and specific cell lines, conduct intratypic differentiation to identify WPVs, Sabin (vaccine) polioviruses, or screen for VDPVs, and conduct genomic sequencing. Sequencing results help monitor pathways of poliovirus transmission by comparing the nucleotide sequences of the capsid protein VP1-coding regions of poliovirus isolates. The GPLN processes approximately 200,000 specimens from cases of acute flaccid paralysis (AFP) each year and provides timely results to direct GPEI actions. The accuracy and quality of testing at GPLN member laboratories is monitored through an annual accreditation program that includes on-site reviews of work practices, performance, and proficiency testing (*5*).

Surveillance Systems

GPLN laboratories provide support to different polio surveillance systems, including AFP surveillance, environmental surveillance (testing of sewage samples), and enterovirus surveillance (testing of patients with specific clinical illness caused by enteroviruses). These surveillance systems ensure sensitive and timely detection of circulating polioviruses worldwide. Whereas AFP surveillance has been the standard surveillance system for poliovirus since the beginning of the GPEI, recently, existing environmental surveillance for poliovirus has been expanded (*6*) in countries with endemic poliovirus transmission and in countries designated as countries at high risk for WPV importation and circulation and/or VDPV emergence. During the last 5 years, 11 laboratories dedicated to environmental surveillance were established in Bangladesh, Cameroon, Côte d'Ivoire, Senegal, South Africa, Indonesia, Jordan, Kenya, Madagascar, Niger, and the Philippines; equipment and supplies were procured by WHO and field and laboratory personnel were trained by GPLN (*7*). This infrastructure, combined with the existing environmental surveillance system and AFP surveillance, has been used to monitor Sabin type 2 virus circulation after worldwide OPV2 withdrawal in April 2016.

Detection of Type 2 Polioviruses

Before OPV2 withdrawal, mass immunization campaigns using tOPV were conducted in OPV-using countries, to ensure that sufficiently high levels of immunity against poliovirus type 2 (PV2) were achieved in all countries. From January to April 2016 (before the global switch from tOPV to bOPV), 46 countries were reporting PV2 detected by GPLN laboratories from specimens from persons with AFP or their contacts and sewage samples (Table). From May to August 2016 (during the early switch period), the number of countries reporting PV2 declined to 22; from September to December 2016, eight countries reported isolation of PV2, and from January to March 2017, seven countries (Afghanistan, Cameroon, Chad, Mozambique, Niger, Nigeria, and Pakistan) reported PV2 detection.

Field investigations in response to detection of PV2 after the switch found breaches in OPV2 withdrawal with evidence of continued inadvertent use of tOPV in India (*8*), Pakistan, Afghanistan, Russia, Iraq, Nigeria, and Cameroon. Response

TABLE. Countries that have reported isolating poliovirus type 2 (PV2) from persons with acute flaccid paralysis or their contacts and from sewage samples, January 2016–March 2017

	Human specimens				Sewage samples			
	2016			2017	2016			2017
Countries	Jan–Apr (pre-switch	May–Aug (early post-switch)	Sep–Dec (post-switch)	Jan–Mar	Jan–Apr (pre-switch)	May–Aug (early post-switch)	Sep–Dec (post-switch)	Jan–Mar
mOPV used post-switch (six countries)								
Cameroon	4	—	1	14	—	—	—	—
Chad	3	—	—	7	—	—	—	1
Mozambique	—	—	—	1	—	—	—	—
Niger	8	—	1	6	—	—	—	1
Nigeria	341	64	26	103	123	65	24	196
Pakistan	42	4	—	5	99	14	3	29
No. of countries/No. of isolates	**5/398**	**2/68**	**3/28**	**6/136**	**2/222**	**2/79**	**2/27**	**4/227**
mOPV not used post-switch (44 countries)								
Afghanistan	22	1	1	—	16	—	—	1
Algeria	1	—	—	—	—	—	—	—
Angola	1	—	—	—	—	—	—	—
Azerbaijan	1	—	—	—	—	—	—	—
Bahrain	1	—	—	—	—	—	—	—
Bangladesh	1	—	—	—	—	—	—	—
Benin	1	—	—	—	—	—	—	—
Bhutan	1	—	—	—	—	—	—	—
Bosnia and Herzegovina	1	3	—	—	—	—	—	—
Burkina Faso	15	—	—	—	—	—	—	—
Burma	2	—	—	—	—	—	—	—
Central African Republic	2	1	—	—	—	—	—	—
Republic of the Congo	1	1	—	—	—	—	—	—
Côte d'Ivoire	5	—	—	—	—	—	—	—
Democratic Republic of the Congo	54	—	—	—	—	—	—	—
Egypt	8	1	—	—	—	—	—	—
Ethiopia	15	2	—	—	—	—	—	—
Guinea	40	3	—	—	—	—	—	—
India	345	7	—	—	13	53	4	—
Indonesia	15	1	—	—	—	—	—	—
Iran	—	1	—	—	—	—	—	—
Iraq	20	—	2	—	—	—	—	—
Israel	—	—	—	—	1	—	—	—
Kazakhstan	—	—	—	—	2	—	—	—
Kenya	3	—	—	—	22	3	—	—
Madagascar	26	—	—	—	6	10	—	—
Moldova	—	—	—	—	1	3	—	—
Mali	11	—	—	—	—	—	—	—
Morocco	1	—	—	—	—	—	—	—
Nepal	2	—	—	—	—	—	—	—
Russia	7	4	2	—	3	5	1	—
Senegal	2	—	—	—	—	—	—	—
Sierra Leone	2	—	—	—	—	—	—	—
Somalia	7	2	—	—	—	—	—	—
South Sudan	10	5	—	—	—	—	—	—
Sudan	—	1	—	—	—	—	—	—
Syria	—	1	—	—	—	—	—	—
Thailand	1	—	—	—	—	—	—	—
Turkmenistan	2	—	—	—	—	—	—	—
Uganda	13	—	—	—	—	—	—	—
Ukraine	5	—	—	—	5	1	—	—
Tanzania	2	—	—	—	—	—	—	—
Yemen	5	2	—	—	—	—	—	—
Zimbabwe	1	—	—	—	—	—	—	—
No. of countries/No. of isolates	**38/652**	**16/36**	**3/5**	**0/0**	**9/69**	**6/75**	**2/5**	**1/1**
Total all countries/All isolates	**43/1,050**	**18/104**	**6/33**	**6/136**	**11/291**	**8/154**	**4/32**	**5/228**

Abbreviation: mOPV2 = monovalent oral poliovirus vaccine type 2.

to these breaches included development of guidelines for investigation and implementation of corrective actions to ensure the safe disposal of all tOPV vials. For example, in India, the National Polio Surveillance Program established a policy to replace any tOPV vial found in private clinics with two bOPV vials as an incentive for finding and reporting tOPV vials. All countries with PV2 detected in 2017 (except Afghanistan) conducted immunization campaigns using monovalent oral poliovirus vaccine type 2 (mOPV2) in response to cVDPV2 isolates detected in Pakistan and Nigeria. PV2 detected in Afghanistan was linked to the use of mOPV2 in a neighboring district of Pakistan.

During the pre-switch period (January–April 2016), PV2 was detected through both AFP and environmental surveillance; after the switch, PV2 was detected primarily through environmental surveillance (Figure 1) (Figure 2). In countries where mOPV2 was not used after the switch, few PV2 isolates were reported during September–December 2016, and 60% of the viruses detected were from sewage samples (Figure 1). Among 364 isolates detected in 2017, 228 (62.6%) were from sewage samples (Figure 1) (Figure 2).

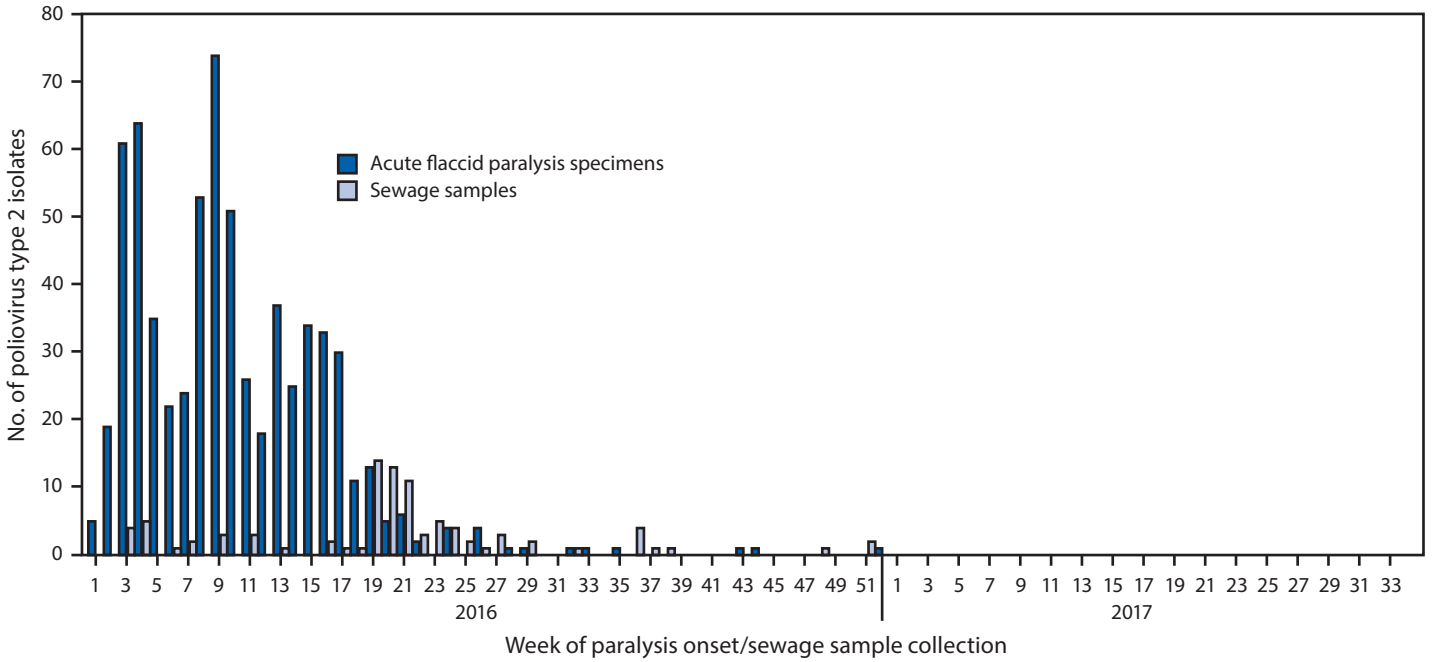
To provide evidence concerning the origin and significance of circulating PV2, on August 1, 2016, GPLN laboratories began to refer all PV2s detected from all sources for genetic sequencing. Isolation of Sabin-like poliovirus with zero or few nucleotide differences from Sabin2 by GPLN laboratories were instrumental in 1) identifying continued use of tOPV in some countries post-switch and in 2) confirmation of three post-switch cVDPV2 outbreaks caused by genetically related cVDPVs that began circulating before the switch.

Discussion

Virologic monitoring through AFP cases and sewage samples indicate that withdrawal of a live vaccine, OPV2, used in routine immunization programs and mass immunization campaigns, was successfully accomplished by the GPEI. Some evidence of limited use of tOPV after the global tOPV to bOPV switch was found; however, 1 year after OPV2 withdrawal, PV2 has been isolated only in the few areas where mOPV2 has been used in response to detection of cVDPV2 isolates. By expanding the preexisting surveillance network to include environmental surveillance for polioviruses during the last 5 years, GPLN successfully detected VDPV2 emergences and outbreaks to allow GPEI to respond in a timely manner. AFP and environmental surveillance with laboratory testing for poliovirus by GPLN will continue to play a long-term, critical role in ensuring polio eradication (*9*).

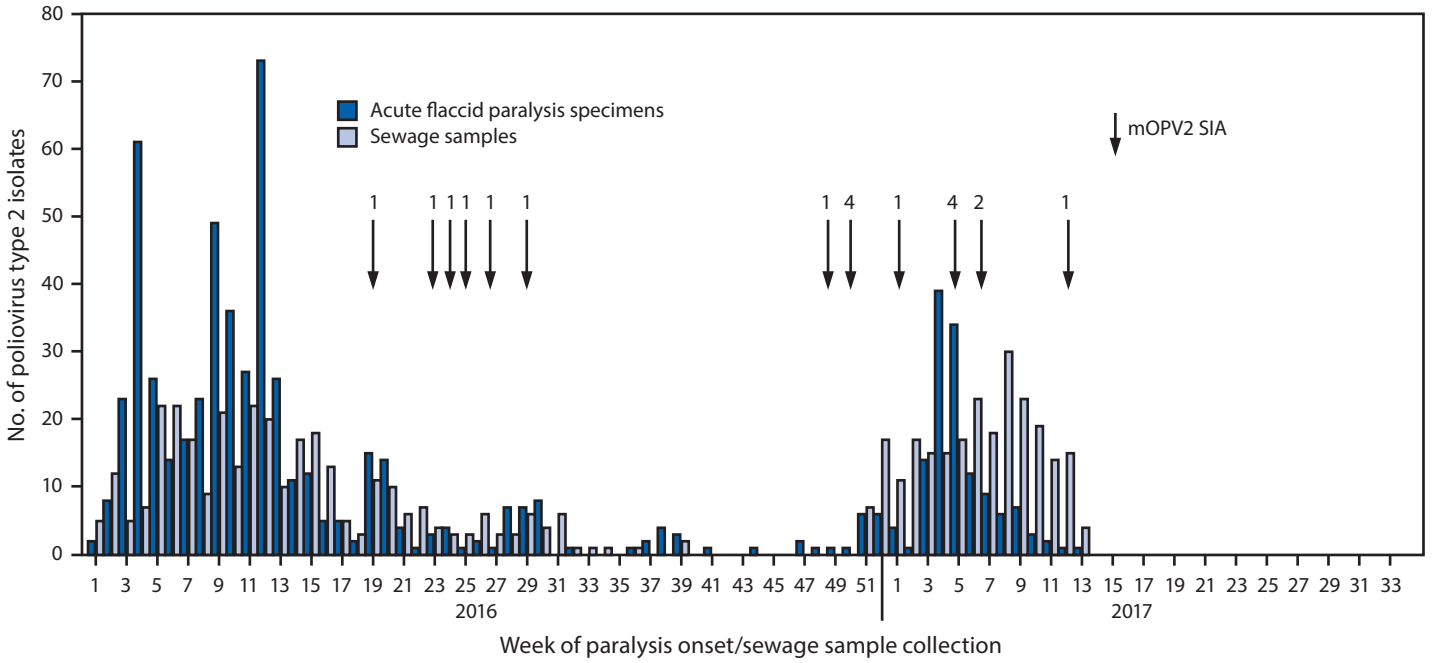
During the first year after the switch, although several emergences of VDPV2 occurred, including some in areas with low poliovirus immunity, such as Mozambique, only two new small-scale VDPV2 outbreaks were detected, in Sokoto, Nigeria, and Quetta, Pakistan, and mOPV2 was used to stop

FIGURE 1. Number of poliovirus type 2 isolates from persons with acute flaccid paralysis or their contacts and from sewage samples in countries where mOPV2 was not used after the global synchronized switch from tOPV to bOPV — January 2016–March 2017



Abbreviations: bOPV = bivalent oral poliovirus vaccine; mOPV2 = monovalent oral poliovirus vaccine type 2; tOPV = trivalent oral poliovirus vaccine.

FIGURE 2. Number of poliovirus type 2 isolates from persons with acute flaccid paralysis or their contacts and from sewage samples in countries where mOPV2 SIAs were conducted* after the global synchronized switch from tOPV to bOPV — January 2016–March 2017



Abbreviations: bOPV = bivalent oral poliovirus vaccine; mOPV2 = monovalent oral poliovirus vaccine; SIA = supplementary immunization activity; tOPV = trivalent oral poliovirus vaccine.
* Number of vaccination rounds shown for SIAs.

these outbreaks. However, it is noteworthy that ongoing persistent cVDPV2 transmission pre-switch was evidenced in Nigeria in April 2016 using environmental surveillance, and mOPV2 was used in Nigeria and in countries bordering Lake Chad (Cameroon, Chad, and Niger) to respond to this outbreak. Nigeria and Pakistan also have circulation of WPV1, and WPV1 circulation continues in Afghanistan.

Reintroduction of live PV2-containing vaccine through the use of 19 mOPV2 immunization campaigns to interrupt VDPV2 transmission in six countries (Cameroon, Chad, Mozambique, Niger, Nigeria, and Pakistan), from May 2016 to Mar 2017 has disrupted the goal of interrupting PV2 transmission globally after the switch. The GPEI has established a mOPV2 advisory group, which advises WHO about each use of mOPV2, after an in-depth review of risk assessments conducted after any VDPV2 event or outbreak detection. In countries where no type 2-containing vaccine has been used after the switch, only three countries (Russia, Iraq, and India) have reported VDPV2 detection since September 2016.

Environmental surveillance for polioviruses detected the majority of PV2 from September 2016 to March 2017. Detection and sequencing of polioviruses isolated from sewage samples is difficult because these isolates often represent complex mixtures of viruses. Despite these challenges, further expansion of environmental surveillance is needed to maintain the high level of vigilance required to detect and respond to any type 2 poliovirus from all sources in the future, including breaches in containment in facilities retaining or still working with PV2 materials, including WPV2.

PV2s were tracked in both human specimens and sewage samples using a newly designed molecular diagnostic assay and algorithm developed by CDC (real-time reverse-transcription–polymerase chain reaction assay for intratypic differentiation of polioviruses), which was rapidly and efficiently implemented in GPLN laboratories in 2016. PV2 detection and genetic sequencing has been essential for the following: 1) providing evidence of continued use of tOPV after the withdrawal of this vaccine in April 2016; 2) identifying and following up unusual patterns of PV2 detection or circulation that signal gaps in herd immunity against PV2; and 3) classifying VDPV2s as either circulating viruses (cVDPV2s) or originating from immunodeficient persons (iVDPV2s), or of ambiguous origin (aVDPV2s) (*10*). The lessons learned and the innovative mechanisms used to monitor and respond to any detection of PV2 from all sources will be leveraged to monitor type 1 and 3 polioviruses after WPV1 eradication and bOPV cessation.

Summary

What is already known about this topic?

The Global Polio Eradication Initiative (GPEI) has made substantial progress since 1988; in 2016, only 37 wild poliovirus (WPV) type 1 (WPV1) cases were detected, the lowest number ever recorded. WPV type 2 has been eradicated, and WPV type 3 has not been detected since 2012. To reduce the risk for paralysis from infection with vaccine-derived polioviruses (VDPVs), in April 2016, all 155 oral poliovirus vaccine (OPV)–using countries switched from trivalent OPV (tOPV) to bivalent OPV (bOPV), containing vaccine virus types 1 and 3.

What is added by this report?

After the withdrawal and destruction of tOPV, the GPEI devised mechanisms to monitor disappearance of type 2 polioviruses (PV2s) in human populations and the environment. Enhanced environmental surveillance and provision of clear guidance to the Global Polio Laboratory Network has allowed timely, accurate, and comprehensive detection of PV2 by examining approximately 208,000 stool specimens and sewage samples. Preceding the tOPV to bOPV switch (January–April 2016), 43 countries reported detection of PV2; during January–March 2017, the number of countries reporting PV2 had declined to seven.

What are the implications for public health practice?

To prevent paralysis caused by VDPVs, elimination of vaccine viruses from the environment will be critical. Lessons learned from surveillance for PV2 after the global synchronized withdrawal of the PV2 component from vaccines have resulted in development of standardized procedures for investigation of PV2 detection in humans and the environment, and handling PV2 in diagnostic laboratories. These lessons will guide the elimination of OPV1 and OPV3 once eradication of polio has been certified.

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References

1. Jorba J, Diop OM, Iber J, Sutter RW, Wassilak SG, Burns CC. Update on vaccine-derived polioviruses—worldwide, January 2015–May 2016. MMWR Morb Mortal Wkly Rep 2016;65:763–9. https://doi.org/10.15585/mmwr.mm6530a3
2. World Health Organization. Polio eradication and endgame strategic plan. Geneva, Switzerland: World Health Organization; 2013. http://polioeradication.org/wp-content/uploads/2016/07/PEESP_EN_A4.pdf
3. Hampton LM, Farrell M, Ramirez-Gonzalez A, et al.; Immunization Systems Management Group of the Global Polio Eradication Initiative. Cessation of trivalent oral poliovirus vaccine and introduction of inactivated poliovirus vaccine—worldwide, 2016. MMWR Morb Mortal Wkly Rep 2016;65:934–8. https://doi.org/10.15585/mmwr.mm6535a3
4. Maes EF, Diop OM, Jorba J, Chavan S, Tangermann RH, Wassilak SG. Surveillance systems to track progress toward polio eradication—worldwide, 2015–2016. MMWR Morb Mortal Wkly Rep 2017;66:359–65.PubMed https://doi.org/10.15585/mmwr.mm6613a3
5. Diop OM, Kew OM, de Gourville EM, Pallansch MA. The Global Polio Laboratory Network as a platform for the viral vaccine preventable and emerging diseases laboratory networks. J Infect Dis 2017;2017. In press.
6. World Health Organization. Polio environmental surveillance expansion plan. Geneva, Switzerland: World Health Organization; 2015. http://polioeradication.org/wp-content/uploads/2016/07/GPLN_ExpansionPlanES.pdf
7. Asghar H, Diop OM, Weldegebriel G, et al. Environmental surveillance for polioviruses in the Global Polio Eradication Initiative. J Infect Dis 2014;210(Suppl 1):S294–303. https://doi.org/10.1093/infdis/jiu384
8. Bahl S, Hampton LM, Bhatnagar P, et al. Notes from the field: detection of Sabin-like type 2 poliovirus from sewage after global cessation of trivalent oral poliovirus vaccine—Hyderabad and Ahmedabad, India, August–September 2016. MMWR Morb Mortal Wkly Rep 2017;65:1493–4. https://doi.org/10.15585/mmwr.mm6552a9
9. Adams A, Salisbury DM. Eradicating polio. Science 2015;350:609. https://doi.org/10.1126/science.aad7294
10. Global Polio Eradication Initiative. Classification and reporting of vaccine-derived polioviruses (VDPV). Geneva, Switzerland: Global Polio Eradication Initiative; 2016. http://polioeradication.org/wp-content/uploads/2016/09/Reporting-and-Classification-of-VDPVs_Aug2016_EN.pdf

Notes from the Field

Measles Outbreak at a United States Immigration and Customs Enforcement Facility — Arizona, May–June 2016

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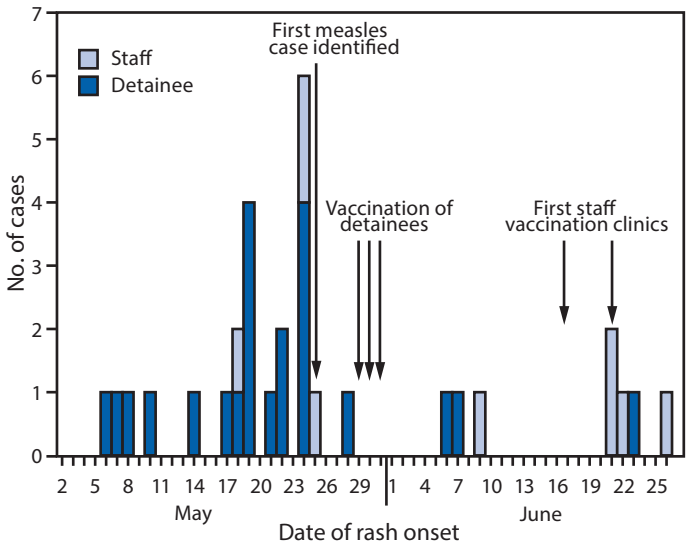
On May 25, 2016, a detainee at a U.S. Immigration and Customs Enforcement (ICE) detention center in Arizona who had been hospitalized with fever and a generalized maculopapular rash was confirmed to have measles by real-time polymerase chain reaction (rPCR). A second case of measles in a staff member was confirmed by rPCR the next day. The privately operated, city-contracted facility housed 1,425 detainees, and employed 510 staff members, including 95 federal ICE staff and 415 contract staff of four distinct employers. Outbreak control measures consisted of administration of measles-mumps-rubella (MMR) vaccine to 1,424 detainees housed at the facility during May 29–31 and isolation of the detainee patient and any additional detainee patients identified during their remaining infectious period (until 4 days after rash onset). Recommendations were made by federal, state, and local public health partners to exclude staff members with measles-compatible symptoms as well as exposed staff members without presumptive evidence of immunity to measles.*

Epidemiologic investigations by local and state health departments and CDC identified 31 total cases of measles in 22 detainees and nine staff members, with rash onsets occurring May 6–June 26 (Figure). Initial reports of rash illness among a few detainees were attributed to varicella (chickenpox) based on clinical presentation; some detainees also reported that they did not initially seek medical attention when they became ill, likely leading to the delay in diagnosing the first few cases of measles. The median detainee patient age was 34 years (range = 19–52 years), and the median staff patient age was 41 years (range = 22–49 years). Seven of the nine ill staff members reported receipt of at least 1 dose of MMR vaccine in the past, but no vaccination records were available at the time the outbreak was recognized. Three of the nine ill staff members received 1 dose of MMR vaccine 7–13 days before becoming ill, suggesting that exposure might have occurred before sufficient immunity developed from vaccination, because the incubation period for measles ranges from 7–21 days.† On June 17 and June 21, MMR staff member vaccination clinics were conducted on-site. Two additional clinics were conducted on July 15 and July 19. Staff members were encouraged to obtain their immunization records and to bring them to the facility to be recorded. Federal personnel policies and contractual agreements that do not require staff members to be vaccinated and the initial unavailability of staff member vaccination records might have contributed to low participation in the first two staff member vaccination clinics; only 120 MMR doses were administered, and 202 (40%) staff members were still considered to not have evidence of measles immunity.

FIGURE. Confirmed measles cases (N = 31) in an immigration and customs enforcement facility, by date of rash onset and staff member/detainee status — Arizona, May 6–June 26, 2016



Reports of illness from personnel who had developed measles might have prompted other staff members to get vaccinated; by August 4, a total of 445 (87%) staff members were considered to have evidence of immunity, including 119 (23%) with documentation of receipt of 2 MMR doses before the start of the outbreak, 307 (60%) who had received 1 previous MMR dose and received a second dose during the outbreak, and 19 (4%) with serologic evidence of immunity. Although recommendations to exclude infectious staff members and nonimmune staff members suspected to have been exposed were made as soon as the outbreak was recognized, slow compliance with

*Acceptable presumptive evidence of immunity against measles includes at least one of the following: 1) written documentation of adequate vaccination (≥1 dose of a measles-containing vaccine administered on or after the first birthday for preschool-age children and adults not at high risk; or 2 doses of measles-containing vaccine for school-age children and adults at high risk, including college students, health care personnel, and international travelers); 2) laboratory evidence of immunity; 3) laboratory confirmation of measles; or 4) birth before 1957.

† https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/meas.pdf.

vaccination recommendations and incomplete implementation of exclusion recommendations, and restrictions on enforcing them, might have prolonged this outbreak.

Outbreak response is expensive and resource-intensive (*1*); specific strategies for measles prevention and control can be in place in advance to expedite and optimize containment in the event of an outbreak. First, persons working in congregate settings with populations that include people who have traveled internationally from measles-endemic regions or others whose immunity levels are unknown or difficult to assess should have documented evidence of measles immunity (*2*). Second, a means to quickly verify presumptive measles immunity among staff members in the event of occurrence of a case of measles can facilitate containment (*2*,*3*). Finally, contingency plans that allow for the exclusion of infectious staff members and exposed nonimmune staff members can prevent spread of measles (*3*,*4*). Adherence to these recommendations in high-risk settings, such as health care facilities, has been shown to limit transmission, optimize resources, and reduce costs (*4*).

Recommendations for implementing measles control policies for detention and correctional facilities, similar to those recommended in health care facilities, could be considered. If permissible, contractual and interagency agreements could include similar provisions, such as requiring MMR vaccination for staff members who work in detention facilities and do not have documented evidence of immunity.

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References

1. Ortega-Sanchez IR, Vijayaraghavan M, Barskey AE, Wallace GS. The economic burden of sixteen measles outbreaks on United States public health departments in 2011. Vaccine 2014;32:1311–7. https://doi.org/10.1016/j.vaccine.2013.10.012
2. Kutty P, Rota J, Bellini W, et al. Manual for the surveillance of vaccine-preventable diseases. Chapter 7: measles. Atlanta, GA: US Department of Health and Human Services, CDC; 2013. https://www.cdc.gov/vaccines/pubs/surv-manual/chpt07-measles.html
3. McLean HQ, Fiebelkorn AP, Temte JL, Wallace GS. Prevention of measles, rubella, congenital rubella syndrome, and mumps, 2013: summary recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep 2013;62(No. RR-04).
4. Advisory Committee on Immunization Practices. Immunization of health-care personnel: recommendations of the Advisory Committee on Immunization Practices. MMWR Recomm Rep 2011;60(No. RR-07). https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6007a1.htm

Announcements

National Arthritis Awareness Month — May 2017

May is National Arthritis Awareness Month. In the United States, approximately 54 million (*1*) adults have some form of doctor-diagnosed arthritis; this number is projected to increase to 78 million by 2040 (*2*). In addition, arthritis-attributable activity limitation currently affects an estimated 24 million adults with arthritis (*1*), and this is expected to rise to 35 million by 2040 (*2*). Approximately one in three adults with arthritis have severe joint pain (*1*). Arthritis is a leading cause of disability and makes it harder to manage other co-occurring conditions, such as diabetes, heart disease, and obesity. A Vital Signs report on arthritis prevalence (*1*) was published in *MMWR* in March 2017 to increase awareness of arthritis, its impact in the United States, and what can be done by health care providers, adults with arthritis, and state and community leaders to address these issues.

CDC recommends physical activity and a variety of evidence-based physical activity and self-management education programs. Physical activity can reduce arthritis pain and improve function by about 40%, and self-management education workshops, such as the Chronic Disease Self-Management Program, have shown 10%–20% improvements in pain, fatigue, and depression in adults with arthritis (*3*). CDC funds 12 state health departments and several national organizations to disseminate these programs in local communities. Additional information is available at https://www.cdc.gov/arthritis/interventions/index.htm and https://www.cdc.gov/arthritis/partners/index.htm.

References

1. Barbour KE, Helmick CG, Boring M, Brady TJ. Vital signs: prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation—United States, 2013–2015. MMWR Morb Mortal Wkly Rep 2017;66:246–53. https://doi.org/10.15585/mmwr.mm6609e1
2. Hootman JM, Helmick CG, Barbour KE, Theis KA, Boring MA. Updated projected prevalence of self-reported doctor-diagnosed arthritis and arthritis-attributable activity limitation among US adults, 2015–2040. Arthritis Rheumatol 2016;68:1582–7. https://doi.org/10.1002/art.39692
3. Brady TJ, Murphy L, O'Colmain BJ, et al. A meta-analysis of health status, health behaviors, and healthcare utilization outcomes of the Chronic Disease Self-Management Program. Prev Chronic Dis 2013;10:120112. https://doi.org/10.5888/pcd10.120112

World No Tobacco Day — May 31, 2017

Each year, the global tobacco epidemic kills an estimated 6 million persons worldwide, including 600,000 who die from secondhand smoke exposure. If current trends continue, it is estimated that by 2030 tobacco use will result in approximately 8 million deaths worldwide annually; an estimated 80% of these preventable deaths will occur in low- and middle-income countries (*1*).

World No Tobacco Day, sponsored by the World Health Organization (WHO) and observed on May 31 each year, highlights the health risks associated with tobacco use and encourages effective actions to reduce tobacco consumption. This year, the theme for World No Tobacco Day is "Tobacco — a Threat to Development" (*2*).

To support this theme, WHO is calling for activities that include international collaboration highlighting the links between the use of tobacco products, tobacco control, and sustainable development. In addition, WHO is calling for activities that demonstrate ways that individuals can contribute to bringing about a sustainable, tobacco-free world, either by committing to never start using tobacco products or by quitting such use (*2*).

References

1. Eriksen M, Mackay J, Schluger N, Gomeshtapeh F, Drope J. The tobacco atlas. 5th ed. Brighton, United Kingdom: American Cancer Society; 2015. http://www.tobaccoatlas.org
2. World Health Organization. World No Tobacco Day: 31 May 2017. Geneva, Switzerland: World Health Organization; 2017. http://www.who.int/campaigns/no-tobacco-day/2017/en/

Erratum

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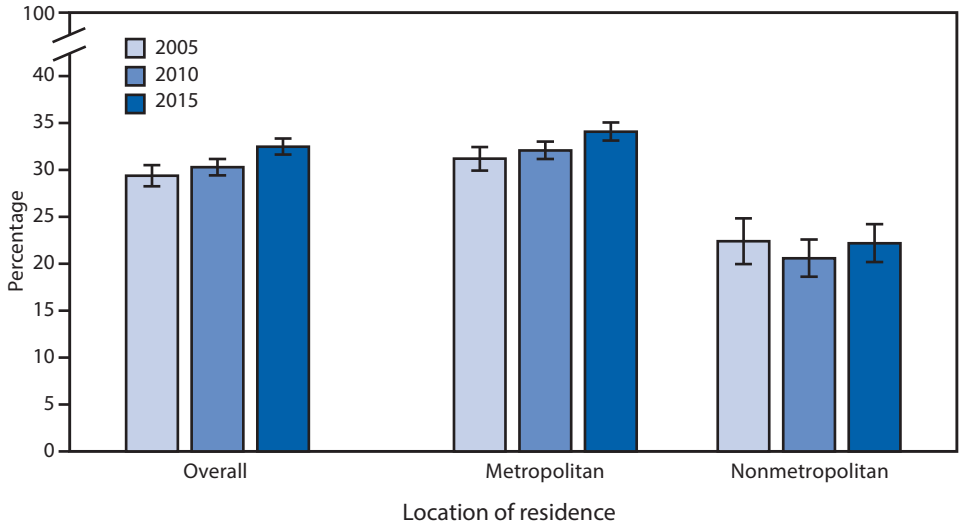
On page 392 in "QuickStats: Percentage Distribution of Gestational Age in Weeks for Infants Who Survived to Age 1 Year and Infants Who Died Before Age 1 Year — National Vital Statistics System, United States, 2014," the second and third sentences of the caption should have read as follows: "In 2014, 66% of infants who survived to age 1 year were delivered at full term or later (≥39 completed weeks) compared with **19%** of infants who died before reaching age 1 year. **Fifty-four** percent of infants who died before age 1 year were delivered at <32 weeks gestation compared with only 1% of infants who survived to age 1 year."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥18 Years Who Walked ≥10 Minutes as a Method of Transportation,† by Location of Residence§ — National Health Interview Survey, United States, 2005, 2010, and 2015¶



* Percentages shown with 95% confidence intervals.
† Based on the response of "yes" to the survey question, "During the past 7 days, did you walk to get some place that took you at least 10 minutes?" This was the first of a series of questions that asked about walking for transportation. Questions about walking for other reasons like relaxation or exercise were asked separately and were not included in these estimates.
§ Based on the household residence location. Metropolitan is located within a metropolitan statistical area, defined as a county or group of contiguous counties that contains at least one urbanized area of ≥50,000 population. Surrounding counties with strong economic ties to the urbanized area also are included. Nonmetropolitan areas do not include a large urbanized area and are typically thought of as more rural.
¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the National Health Interview Survey.

Overall, the percentage of adults aged ≥18 years that walked as a method of transportation increased from 29.4% in 2005 to 32.5% in 2015. A similar pattern was observed for adults residing in metropolitan locations (31.2% to 34.1%) but there was no change for those residing in nonmetropolitan locations (22.4% to 22.2%). Regardless of year, adults residing in metropolitan locations were more likely to have walked as a method of transportation than were adults residing in nonmetropolitan locations.

Source: National Health Interview Survey, 2005, 2010, 2015 data. https://www.cdc.gov/nchs/nhis.htm.

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