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Prevalence of Stroke — Behavioral Risk Factor Surveillance System, United States, 2011–2022

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Abstract

Stroke was the fifth leading cause of death in the United States in 2021, and cost U.S. residents approximately $56.2 billion during 2019–2020. During 2006–2010, self-reported stroke prevalence among noninstitutionalized adults had a relative decrease of 3.7%. Data from the Behavioral Risk Factor Surveillance System were used to analyze age-standardized stroke prevalence during 2011–2022 among adults aged ≥18 years. From 2011–2013 to 2020–2022, overall self-reported stroke prevalence increased by 7.8% nationwide. Increases occurred among adults aged 18–64 years; females and males; non-Hispanic Black or African American (Black), non-Hispanic White (White), and Hispanic or Latino (Hispanic) persons; and adults with less than a college degree. Stroke prevalence was higher among adults aged ≥65 years than among younger adults; among non-Hispanic American Indian or Alaska Native, non-Hispanic Native Hawaiian or Pacific Islander, and Black adults than among White adults; and among adults with less than a high school education than among those with higher levels of education. Stroke prevalence decreased in the District of Columbia and increased in 10 states. Initiatives to promote knowledge of the signs and symptoms of stroke, and the identification of disparities in stroke prevalence, might help to focus clinical and programmatic interventions, such as the Million Hearts 2027 initiative or the Paul Coverdell National Acute Stroke Program, to improve prevention and treatment of stroke.

Introduction

Stroke is a leading cause of morbidity in the United States and was the fifth leading cause of death in 2021.* The estimated direct and indirect cost of stroke in the United States was $56.2 billion during 2019–2020 (*1*). A report on stroke prevalence using Behavioral Risk Factor Surveillance System (BRFSS) data indicated that overall self-reported stroke prevalence among noninstitutionalized adults aged ≥18 years in all 50 states and the District of Columbia (DC) had a relative decrease of 3.7% during 2006–2010 (*2*). The current report used BRFSS data to assess stroke prevalence trends during 2011–2022 by sociodemographic characteristics and place of residence.

Methods

Data Source and Study Participants

BRFSS is a state-based surveillance system of noninstitutionalized U.S. civilian adults aged ≥18 years, administered in U.S. states and territories in coordination with CDC. Each year, health departments conduct a cross-sectional, random-digit–dialed landline and cellular telephone survey assessing

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* https://www.cdc.gov/nchs/products/databriefs/db456.htm

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health-related risk behaviors and preventive health practices among approximately 400,000 residents in all 50 states, DC, Guam, Puerto Rico, and U.S. Virgin Islands. The analysis includes 5,225,987 respondents from the 50 states and DC during 2011–2022. Respondents with missing demographic data were excluded, as were those who responded, "Don't know/Not sure" or "Refused" or who missed a response to the survey question, "Has a doctor or other health professional ever told you that you had a stroke?" Sample size ranged from 1,419,351 during 2011–2013 to 1,220,972 during 2020–2022. Median state and DC response rates ranged from 44.0% to 49.9%.[†]

Definitions and Statistical Analysis

All data were self-reported. Participants who responded "yes" to "Has a doctor or other health professional ever told you that you had a stroke?" were defined as having had a stroke. Sociodemographic data included the following categories: age group (18–44, 45–64, and ≥65 years), sex (female and male), race and ethnicity (non-Hispanic American Indian or Alaska Native [AI/AN], non-Hispanic Asian [Asian], non-Hispanic Black or African American [Black], non-Hispanic Native Hawaiian or Pacific Islander [NH/PI], non-Hispanic White [White], and Hispanic or Latino [Hispanic] adults), education level (less than high school graduate, high school graduate or general educational development certificate, some college, and college graduate), and jurisdiction of residence. Prevalence estimates were age-standardized to the 2000 U.S. Census Bureau standard population, and analyses accounted for BRFSS complex sampling design. To obtain statistically stable estimates, annual data were combined to create four consecutive 3-year periods (2011–2013, 2014–2016, 2017–2019, and 2020–2022). Wald chi-square tests were used to assess statistical significance of the adjusted associations between each sociodemographic characteristic and stroke prevalence during 2020–2022. P-values were obtained through survey weighted logistic regression that included age group, sex, race and ethnicity, and education level. Both absolute (percentage point) and relative (percent) changes from 2011–2013 to 2020–2022, with 95% CIs, were calculated for age-standardized stroke prevalence by sociodemographic characteristics and by jurisdiction. R statistical software (version 4.1.2; R Foundation) was used to calculate 95% CIs by sampling normal distributions 5,000 times based on the age-standardized stroke prevalence and their SEs, defining the 95% CI as the 2.5 and 97.5 percentiles of calculations on the basis of those samples. SAS-callable SUDAAN (version 9.4; RTI International) was used to account for complex sampling design. A two-sided p-value <0.05 was considered statistically significant. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.[§]

[†] https://www.cdc.gov/brfss/about/index.htm

[§] 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

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Results

The age-standardized prevalence of self-reported stroke increased from 2.7% during 2011–2013, to 2.9% during 2020–2022, a 7.8% increase (Table 1). During 2020–2022, stroke prevalence was highest among adults aged ≥65 years (7.7%) and lowest among those aged 18–44 years (0.9%). By race and ethnicity, stroke prevalence was highest among AI/AN (5.3%), NH/PI (4.4%), and Black (4.3%) adults, and lowest among Asian adults (1.6%). Stroke prevalence among adults with less than a high school diploma was approximately three times that of adults who had graduated college.

From 2011–2013 to 2020–2022, stroke prevalence increased 14.6% among adults aged 18–44 years, 15.7% among those aged 45–64 years, 9.3% among women, and 6.2% among men. Among Black, White, and Hispanic adults, stroke prevalence increased by 7.8%, 7.2%, and 16.1%, respectively. The largest percent increase (18.2%) occurred among adults with less than a high school education. DC had a statistically significant decrease in stroke prevalence (19.2%). A statistically significant increase occurred in 10 states (California, Colorado, Minnesota, Mississippi, North Carolina, North Dakota, Ohio, Oklahoma, Tennessee, and West Virginia); the largest increases were in Ohio (20.9%) and Tennessee (20.7%) (Table 2) (Figure). States with a stroke prevalence in the highest quantile during 2020–2022 were predominantly located in southern states. Analyses did not demonstrate significant changes in the prevalence of self-reported stroke during the COVID-19 pandemic compared with before the pandemic (CDC, unpublished data, 2023).

Discussion

This analysis found that age-standardized stroke prevalence increased by 7.8% from 2011–2013 to 2020–2022. This increase contrasts with the decrease of 3.7% reported during 2006–2010 (*2*). Significant increases in stroke prevalence were observed among several sociodemographic groups, including adults aged 18–44 and 45–64 years; females and males; Black, White, and Hispanic adults; and adults with less than a college degree. Stroke prevalence decreased in DC and had a statistically significant increase in 10 states.

Older age is a known risk factor for stroke (*1*). Stroke prevalence among adults aged ≥65 years was consistent across the

TABLE 1. Age-standardized prevalence* of stroke among noninstitutionalized adults aged ≥18 years,† by selected characteristics — Behavioral Risk Factor Surveillance System, United States, 2011–2022§

Characteristic	% (95% CI)				p-value of differences across sociodemographic categories for 2020–2022¶	Change from 2011–2013 to 2020–2022	
	2011–2013	2014–2016	2017–2019	2020–2022		Percentage point (95% CI)	% (95% CI)
Total	**2.7 (2.7 to 2.8)**	**2.8 (2.8 to 2.9)**	**3.0 (2.9 to 3.0)**	**2.9 (2.9 to 3.0)**	—	**0.2 (0.1 to 0.3)**	**7.8 (4.9 to 10.8)**
Age group, yrs							
18–44	0.8 (0.7 to 0.8)	0.8 (0.8 to 0.9)	0.9 (0.8 to 0.9)	0.9 (0.8 to 1.0)	<0.01	0.1 (0 to 0.2)	14.6 (3.7 to 25.9)
45–64	3.3 (3.2 to 3.4)	3.6 (3.5 to 3.7)	3.9 (3.8 to 4.0)	3.8 (3.6 to 3.9)		0.5 (0.4 to 0.7)	15.7 (10.6 to 20.8)
≥65	7.7 (7.5 to 7.9)	7.7 (7.5 to 7.8)	7.9 (7.7 to 8.0)	7.7 (7.5 to 7.9)		0 (−0.3 to 0.3)	0 (−3.3 to 3.3)
Sex							
Female	2.7 (2.6 to 2.7)	2.8 (2.7 to 2.9)	2.9 (2.8 to 3.0)	2.9 (2.8 to 3.0)	0.65	0.2 (0.1 to 0.4)	9.3 (5.0 to 13.4)
Male	2.8 (2.7 to 2.8)	2.9 (2.8 to 2.9)	3.1 (3.0 to 3.2)	2.9 (2.8 to 3.0)		0.2 (0.1 to 0.3)	6.2 (2.1 to 10.5)
Race and ethnicity**							
AI/AN	5.4 (4.8 to 6.0)	5.7 (5.1 to 6.2)	6.2 (5.6 to 6.8)	5.3 (4.7 to 5.9)	<0.01	−0.1 (−1.0 to 0.7)	−2.0 (−16.4 to 15.3)
Asian	1.8 (1.4 to 2.2)	1.6 (1.2 to 1.9)	1.7 (1.4 to 2.1)	1.6 (1.2 to 2.0)		−0.2 (−0.7 to 0.3)	−11.8 (−35.9 to 18.5)
Black or African American	4.0 (3.8 to 4.2)	4.3 (4.1 to 4.4)	4.6 (4.3 to 4.8)	4.3 (4.1 to 4.5)		0.3 (0 to 0.6)	7.8 (0.4 to 15.5)
NH/PI	2.9 (1.6 to 4.2)	3.6 (2.4 to 4.7)	3.9 (2.7 to 5.1)	4.4 (2.4 to 6.5)		1.5 (−0.9 to 3.9)	52.3 (−26.6 to 198.5)
White	2.5 (2.5 to 2.6)	2.6 (2.6 to 2.7)	2.8 (2.7 to 2.8)	2.7 (2.6 to 2.8)		0.2 (0.1 to 0.3)	7.2 (4.2 to 10.3)
Hispanic or Latino	2.4 (2.2 to 2.6)	2.4 (2.2 to 2.6)	2.6 (2.4 to 2.9)	2.8 (2.5 to 3.1)		0.4 (0.1 to 0.7)	16.1 (2.3 to 31.3)
Education							
Less than HS diploma	4.4 (4.2 to 4.5)	4.7 (4.5 to 4.9)	4.8 (4.6 to 5.0)	5.2 (4.8 to 5.4)	<0.01	0.8 (0.4 to 1.1)	18.2 (9.8 to 27.2)
HS diploma or GED	2.9 (2.8 to 3.0)	3.1 (3.0 to 3.2)	3.3 (3.2 to 3.4)	3.3 (3.2 to 3.4)		0.4 (0.2 to 0.5)	11.9 (6.7 to 17.4)
Some college	2.6 (2.5 to 2.7)	2.7 (2.6 to 2.8)	3.0 (2.8 to 3.1)	2.9 (2.8 to 3.0)		0.4 (0.2 to 0.5)	13.6 (8.3 to 19)
College degree or higher	1.6 (1.6 to 1.7)	1.6 (1.6 to 1.7)	1.7 (1.6 to 1.8)	1.7 (1.6 to 1.8)		0.1 (0 to 0.2)	5.4 (−0.4 to 11.3)

Abbreviations: AI/AN = American Indian or Alaska Native; GED = general educational development certificate; HS = high school; NH/PI = Native Hawaiian or Pacific Islander.
* Age-standardized to the 2000 U.S. Census Bureau standard population using age groups 18–44, 45–64, and ≥65 years.
† Respondents were asked, "Has a doctor, nurse, or other health professional ever told you that you had a stroke?" Refused, "don't know," and missing responses were excluded from analyses.
§ Sampling weights were adjusted to reflect 3-year increments (divided by 3).
¶ p-values calculated from Wald chi-square tests.
** Persons identified as Hispanic or Latino (Hispanic) might be of any race but are categorized as Hispanic. All racial groups are non-Hispanic.

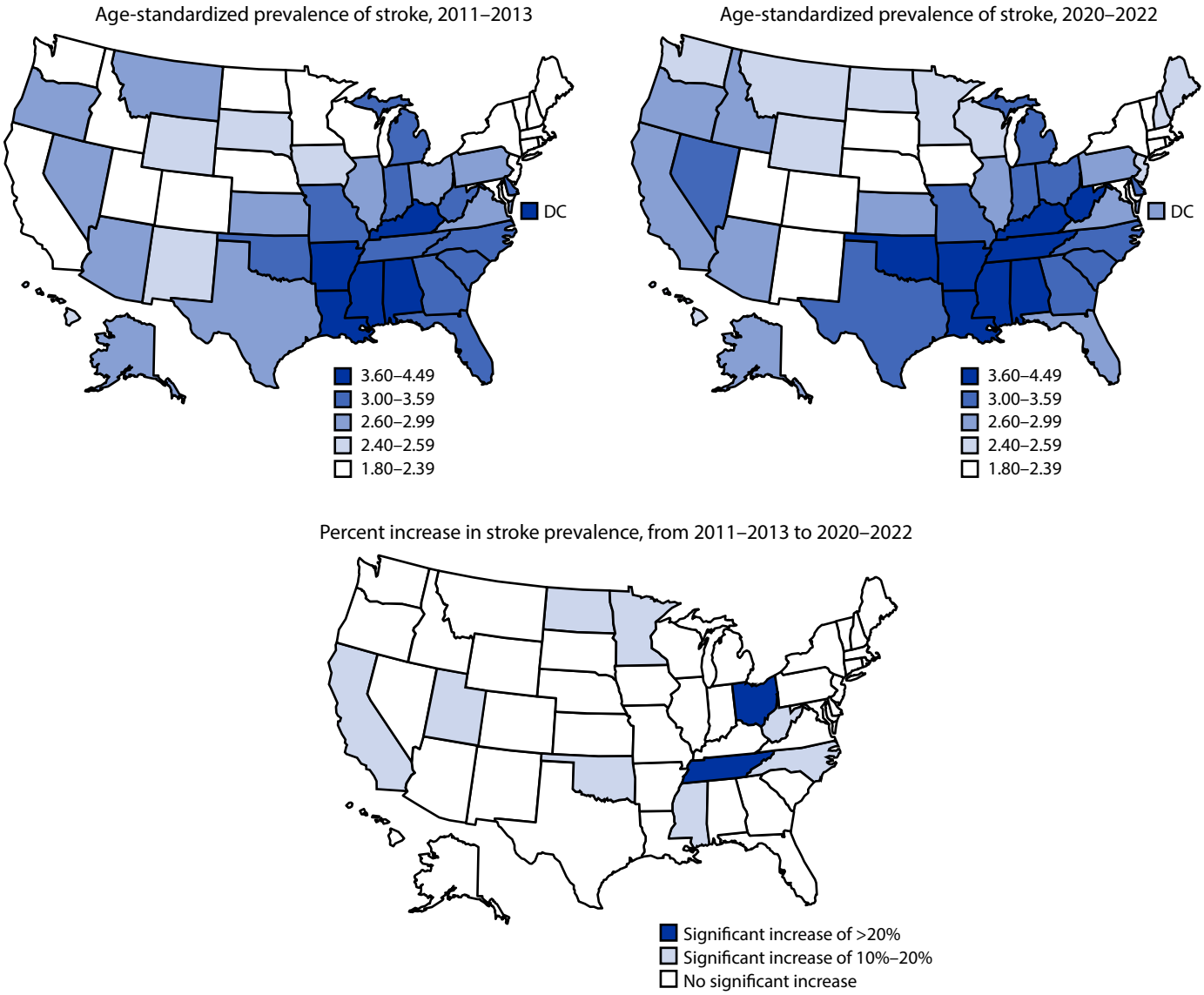
TABLE 2. Age-standardized prevalence* of stroke among noninstitutionalized adults aged ≥18 years,† by jurisdiction — Behavioral Risk Factor Surveillance System, United States, 2011–2022§

Jurisdiction	% (95% CI)				Change from 2011–2013 to 2020–2022	
	2011–2013	2014–2016	2017–2019	2020–2022	Percentage point (95% CI)	% (95% CI)
Alabama	4.3 (3.9 to 4.6)	4.2 (3.9 to 4.5)	4.5 (4.2 to 4.9)	4.1 (3.6 to 4.5)	−0.2 (−0.8 to 0.3)	−4.9 (−16.7 to 8.3)
Alaska	2.7 (2.4 to 3.1)	2.4 (2.0 to 2.7)	2.3 (2.0 to 2.7)	2.7 (2.3 to 3.1)	0 (−0.6 to 0.5)	−0.8 (−18.6 to 21.6)
Arizona	2.7 (2.4 to 3.1)	2.8 (2.5 to 3.0)	2.9 (2.6 to 3.2)	2.7 (2.5 to 3.0)	0 (−0.4 to 0.4)	0.6 (−13.4 to 17.8)
Arkansas	3.8 (3.4 to 4.2)	4.1 (3.6 to 4.5)	4.2 (3.8 to 4.6)	3.9 (3.5 to 4.2)	0 (−0.5 to 0.6)	0.9 (−11.7 to 16.2)
California¶	2.2 (2.1 to 2.4)	2.4 (2.2 to 2.6)	2.3 (2.1 to 2.5)	2.6 (2.3 to 2.9)	0.4 (0 to 0.7)	17.1 (1.2 to 34.8)
Colorado¶	1.9 (1.7 to 2.0)	2.1 (1.9 to 2.2)	2.0 (1.8 to 2.1)	2.2 (2.0 to 2.4)	0.3 (0.1 to 0.6)	16.2 (2.3 to 31.6)
Connecticut	2.0 (1.8 to 2.2)	2.3 (2.1 to 2.5)	2.2 (2.0 to 2.4)	2.2 (1.9 to 2.4)	0.1 (−0.2 to 0.5)	6.4 (−8.8 to 24.1)
Delaware	3.0 (2.7 to 3.4)	2.8 (2.5 to 3.1)	3.1 (2.8 to 3.4)	3.0 (2.6 to 3.4)	0 (−0.5 to 0.5)	−0.4 (−16.5 to 18.3)
District of Columbia¶	3.6 (3.1 to 4.0)	3.5 (3.0 to 3.9)	3.6 (3.2 to 4.0)	2.9 (2.5 to 3.3)	−0.7 (−1.3 to −0.1)	−19.2 (−32.1 to −3.8)
Florida	3.0 (2.8 to 3.3)	2.8 (2.6 to 3.0)	3.0 (2.8 to 3.3)	2.9 (2.6 to 3.2)	−0.1 (−0.5 to 0.3)	−3.7 (−16.6 to 10.2)
Georgia	3.2 (2.9 to 3.5)	3.5 (3.1 to 3.8)	3.4 (3.1 to 3.6)	3.4 (3.1 to 3.7)	0.2 (−0.2 to 0.6)	7.7 (−5.3 to 21.6)
Hawaii	2.5 (2.2 to 2.7)	2.6 (2.3 to 2.9)	2.5 (2.3 to 2.8)	2.4 (2.2 to 2.6)	−0.1 (−0.4 to 0.3)	−2.1 (−16.0 to 13.9)
Idaho	2.3 (2.1 to 2.6)	2.4 (2.1 to 2.7)	2.7 (2.3 to 3.1)	2.7 (2.4 to 3.0)	0.3 (−0.1 to 0.7)	14.0 (−2.8 to 35.6)
Illinois	2.7 (2.4 to 3.1)	2.8 (2.5 to 3.1)	2.7 (2.5 to 3.0)	2.9 (2.4 to 3.3)	0.1 (−0.4 to 0.7)	4.4 (−14.9 to 25.7)
Indiana	3.0 (2.8 to 3.2)	3.2 (2.9 to 3.4)	3.4 (3.2 to 3.7)	3.2 (3.0 to 3.5)	0.3 (−0.1 to 0.6)	8.3 (−2.0 to 19.8)
Iowa	2.4 (2.2 to 2.6)	2.3 (2.1 to 2.6)	2.5 (2.3 to 2.7)	2.3 (2.1 to 2.5)	−0.1 (−0.4 to 0.2)	−3.2 (−14.8 to 9.0)
Kansas	2.7 (2.5 to 2.8)	2.7 (2.6 to 2.9)	2.7 (2.6 to 2.9)	2.7 (2.5 to 2.9)	0 (−0.2 to 0.3)	1.4 (−8.1 to 11.9)
Kentucky	3.8 (3.5 to 4.1)	3.9 (3.6 to 4.2)	4.2 (3.8 to 4.6)	4.0 (3.6 to 4.4)	0.2 (−0.3 to 0.7)	5.9 (−6.5 to 19.9)
Louisiana	3.7 (3.4 to 4.1)	3.6 (3.3 to 4.0)	4.4 (4.0 to 4.8)	4.1 (3.7 to 4.4)	0.3 (−0.2 to 0.8)	8.2 (−4.9 to 24.0)
Maine	2.3 (2.1 to 2.5)	2.5 (2.3 to 2.7)	2.9 (2.6 to 3.2)	2.6 (2.4 to 2.8)	0.3 (0 to 0.6)	11.0 (−1.9 to 26.0)
Maryland	2.6 (2.3 to 2.8)	2.7 (2.4 to 2.9)	2.9 (2.7 to 3.1)	2.6 (2.5 to 2.8)	0.1 (−0.2 to 0.4)	3.3 (−7.7 to 15.6)
Massachusetts	2.1 (1.9 to 2.2)	2.4 (2.1 to 2.6)	2.2 (1.9 to 2.5)	2.2 (1.9 to 2.4)	0.1 (−0.2 to 0.4)	4.6 (−9.1 to 19.3)
Michigan	3.1 (2.9 to 3.3)	2.9 (2.7 to 3.1)	3.1 (2.9 to 3.3)	3.0 (2.8 to 3.3)	−0.1 (−0.4 to 0.3)	−1.9 (−12.1 to 9.6)
Minnesota¶	2.1 (1.9 to 2.3)	2.1 (1.9 to 2.2)	2.2 (2.0 to 2.3)	2.5 (2.3 to 2.7)	0.4 (0.1 to 0.7)	18.3 (5.2 to 33.9)
Mississippi¶	4.0 (3.7 to 4.3)	4.3 (3.9 to 4.7)	4.3 (3.9 to 4.7)	4.7 (4.2 to 5.1)	0.7 (−0.2 to 0.9)	16.8 (4.0 to 30.8)
Missouri	3.1 (2.8 to 3.4)	3.7 (3.4 to 4.0)	3.6 (3.3 to 3.9)	3.3 (3.0 to 3.5)	0.2 (−0.2 to 0.5)	4.9 (−6.9 to 18.1)
Montana	2.8 (2.5 to 3.0)	2.4 (2.2 to 2.7)	2.5 (2.3 to 2.8)	2.5 (2.2 to 2.7)	−0.3 (−0.7 to 0.0)	−11.7 (−23.4 to 1.4)
Nebraska	2.3 (2.2 to 2.5)	2.4 (2.2 to 2.6)	2.5 (2.3 to 2.7)	2.2 (2.0 to 2.4)	−0.1 (−0.4 to 0.1)	−5.6 (−15.8 to 4.7)
Nevada	2.9 (2.5 to 3.3)	2.6 (2.2 to 3.0)	2.9 (2.5 to 3.4)	3.0 (2.5 to 3.6)	0.1 (−0.6 to 0.8)	3.5 (−17.8 to 28.4)
New Hampshire	2.2 (2.0 to 2.4)	2.1 (1.9 to 2.4)	2.2 (1.9 to 2.5)	2.4 (2.1 to 2.7)	0.2 (−0.2 to 0.6)	8.9 (−8.1 to 29.4)
New Jersey	2.2 (2.0 to 2.4)	2.3 (2.1 to 2.6)	2.4 (2.0 to 2.8)	2.4 (2.2 to 2.7)	0.3 (−0.1 to 0.6)	12.1 (−2.7 to 28.3)
New Mexico	2.5 (2.3 to 2.7)	2.7 (2.5 to 3.0)	2.5 (2.2 to 2.7)	2.4 (2.1 to 2.6)	−0.1 (−0.5 to 0.3)	−4.1 (−17.2 to 10.6)
New York	2.2 (2.0 to 2.5)	2.3 (2.1 to 2.5)	2.3 (2.1 to 2.5)	2.2 (2.1 to 2.4)	0 (−0.3 to 0.3)	0.9 (−12.2 to 16.7)
North Carolina¶	3.1 (2.9 to 3.3)	3.4 (3.1 to 3.6)	3.5 (3.2 to 3.9)	3.6 (3.2 to 4.0)	0.5 (0 to 0.9)	15.4 (0.1 to 31.3)
North Dakota¶	2.2 (1.9 to 2.4)	2.4 (2.1 to 2.6)	2.3 (2.1 to 2.5)	2.6 (2.3 to 2.9)	0.4 (0 to 0.8)	18.5 (0.3 to 40.0)
Ohio¶	2.9 (2.7 to 3.1)	3.0 (2.8 to 3.3)	3.3 (3.0 to 3.5)	3.5 (3.3 to 3.8)	0.6 (0.3 to 0.9)	20.9 (9.7 to 33.3)
Oklahoma¶	3.2 (3.0 to 3.4)	3.5 (3.2 to 3.8)	4.0 (3.7 to 4.3)	3.8 (3.5 to 4.2)	0.6 (0.2 to 1.0)	18.5 (6.1 to 32.7)
Oregon	2.8 (2.5 to 3.1)	2.7 (2.4 to 2.9)	2.8 (2.6 to 3.1)	2.7 (2.4 to 3.0)	−0.1 (−0.5 to 0.3)	−3.8 (−16.5 to 10.9)
Pennsylvania	2.7 (2.5 to 2.9)	3.0 (2.7 to 3.2)	3.2 (2.9 to 3.5)	3.1 (2.8 to 3.5)	0.4 (0 to 0.9)	15.7 (−0.5 to 32.6)
Rhode Island	2.2 (2.0 to 2.5)	2.2 (1.9 to 2.5)	2.5 (2.3 to 2.8)	2.2 (1.9 to 2.4)	−0.1 (−0.4 to 0.3)	−2.9 (−17.0 to 14.0)
South Carolina	3.3 (3.0 to 3.5)	3.3 (3.1 to 3.6)	3.5 (3.3 to 3.8)	3.3 (2.9 to 3.6)	0 (−0.4 to 0.4)	−0.2 (−11.5 to 12.5)
South Dakota	2.4 (2.1 to 2.7)	2.2 (2.0 to 2.5)	2.3 (2.0 to 2.7)	2.3 (1.9 to 2.7)	−0.1 (−0.6 to 0.4)	−5.6 (−24.8 to 15.6)
Tennessee¶	3.5 (3.2 to 3.9)	4.0 (3.7 to 4.3)	4.2 (3.8 to 4.6)	4.2 (3.8 to 4.6)	0.7 (0.2 to 1.3)	20.7 (4.9 to 38.8)
Texas	2.7 (2.4 to 2.9)	2.8 (2.5 to 3.1)	3.4 (3.0 to 3.8)	3.0 (2.7 to 3.3)	0.3 (0 to 0.7)	12.8 (−1.5 to 28.4)
Utah	2.4 (2.2 to 2.5)	2.3 (2.1 to 2.5)	2.4 (2.2 to 2.6)	2.4 (2.2 to 2.6)	0 (−0.2 to 0.3)	0.7 (−9. to 12.4)
Vermont	2.2 (2.0 to 2.4)	2.1 (1.8 to 2.3)	2.2 (2.0 to 2.4)	2.2 (1.9 to 2.4)	0 (−0.4 to 0.3)	−0.7 (−15.3 to 16)
Virginia	2.8 (2.6 to 3.1)	2.7 (2.5 to 2.9)	2.8 (2.6 to 3.1)	2.9 (2.7 to 3.2)	0.1 (−0.2 to 0.4)	3.5 (−8.1 to 16.7)
Washington	2.3 (2.2 to 2.5)	2.6 (2.4 to 2.8)	2.6 (2.4 to 2.8)	2.5 (2.3 to 2.7)	0.2 (−0.1 to 0.4)	6.3 (−4.0 to 17.5)
West Virginia¶	3.5 (3.2 to 3.8)	3.9 (3.6 to 4.2)	4.0 (3.7 to 4.4)	3.9 (3.6 to 4.3)	0.5 (0.1 to 0.9)	14.1 (1.5 to 28.3)
Wisconsin	2.2 (1.9 to 2.5)	2.3 (2.0 to 2.6)	2.0 (1.8 to 2.3)	2.5 (2.2 to 2.9)	0.4 (−0.1 to 0.8)	17.3 (−2.7 to 40.9)
Wyoming	2.5 (2.2 to 2.7)	2.7 (2.3 to 3.0)	2.9 (2.5 to 3.2)	2.5 (2.2 to 2.8)	0 (−0.4 to 0.5)	1.4 (−14.6 to 19.7)

* Age-standardized to the 2000 U.S. Census Bureau standard population using age groups 18–44, 45–64, and ≥65 years.
† Respondents were asked, "Has a doctor, nurse, or other health professional ever told you that you had a stroke?" Refused, "don't know," and missing responses were excluded from analyses.
§ Sampling weights were adjusted to reflect 3-year increments (divided by 3).
¶ Statistically significant percentage change from 2011–2013 to 2020–2022.

study period; however, prevalence among adults aged <65 years increased by approximately 15%. This increase corresponds with a rise of cardiovascular risk factors among younger, working-age adults during recent decades. From 1999–2000 to 2017–2018, obesity prevalence among males increased from 27.5% to 43% and among females from 33.4% to 41.9%; prevalence during 2017–2018 was highest among those aged 40–59 years (44.8%) (*1*). Hypertension prevalence was highest among adults aged

FIGURE. Age-standardized prevalence* of stroke and percentage change among noninstitutionalized adults aged ≥18 years,† by jurisdiction — Behavioral Risk Factor Surveillance System, United States, 2011–2022



Abbreviation: DC = District of Columbia.

* Age-standardized to the 2000 U.S. Census Bureau standard population using age groups 18–44, 45–64, and ≥65 years.

† Respondents were asked, "Has a doctor, nurse, or other health professional ever told you that you had a stroke?" Refused, "don't know," and missing responses were excluded from analyses.

45–64 years, and increased from 40.3% during 1999–2000 to 46.8% during 2017–2018 (*1*). The opioid overdose epidemic¶ might also have contributed to increased stroke prevalence among younger adults. A rise in the rate of hospitalizations for stroke among adults aged <45 years during 2006–2015 was associated with opioid use and infective endocarditis and corresponded with the onset of the opioid epidemic (*3*). Among racial and ethnic groups, stroke prevalence was highest among AI/AN, NH/PI, and Black adults. Differences might exist because of a higher prevalence of risk factors among these populations, including comorbid conditions, lower income, and unequal access to health care (*1*,*4*,*5*). In this study, a review of overall and subgroup estimates demonstrated little difference in self-reported stroke prevalence before and during the COVID-19 pandemic (CDC, unpublished data, 2023). However, a previous

¶ https://aspe.hhs.gov/reports/non-fatal-opioid-overdose-associated-health-outcomes-final-summary-report-0

Summary

What is already known about this topic?

Stroke is the fifth leading cause of death in the United States and a leading cause of long-term disability. During 2006–2010, stroke prevalence decreased by 3.7%.

What is added by this report?

From 2011–2013 to 2020–2022, U.S. stroke prevalence increased by 7.8%. Increases occurred among adults aged 18–64 years; females and males; non-Hispanic Black or African American (Black), non-Hispanic White, and Hispanic or Latino (Hispanic) adults; and adults with less than a college degree. Stroke prevalence was higher among adults aged ≥65 years; non-Hispanic American Indian or Alaska Native, non-Hispanic Native Hawaiian or Pacific Islander, and Black adults; and adults with lower education. Stroke prevalence decreased in the District of Columbia and increased in 10 states.

What are the implications for public health practice?

Initiatives to promote knowledge of the signs and symptoms of stroke, and identification of disparities in stroke prevalence, might help effectively focus interventions to improve stroke prevention and treatment.

study demonstrated an increase in stroke mortality rates during the COVID-19 pandemic, with Black adults experiencing a disproportionate increase in excess stroke deaths compared with White adults (*6*). Racial and ethnic disparities, education level inequality, and socioeconomic status disparities within the context of larger structural factors, such as discrimination, might be important to consider when developing focused interventions addressing stroke prevalence (*5*,*7*). Consistent with previous analyses (*2*), states in the highest quantile of stroke prevalence included many in the southeastern United States (a region known as the stroke belt). Increased stroke survival could also contribute to increased stroke prevalence; the rate of thrombolytic therapy for acute ischemic stroke among all racial and ethnic groups increased from 10%–15% during 2003–2009, to 43%–46% in 2021 (*8*). However, disparities persisted, with Asian, Black, and Hispanic patients having lower odds than did White patients of getting to the hospital within 4.5 hours of ischemic stroke onset and of receiving thrombolysis (*8*).

Limitations

The findings in this report are subject to at least three limitations. First, BRFSS data are self-reported and could be subject to social desirability and recall biases. Second, bias might exist because BRFSS response rates were <50%; however, response rates have been relatively stable during the study period. Finally, as the percentage of acute stroke patients who receive timely thrombolytic treatment increases, an increasing percentage of these patients will likely achieve full recovery.

Implications for Public Health Practice

Identifying and understanding demographic factors associated with stroke, and disparities in stroke prevalence, might help focus programmatic and clinical interventions to improve the prevention and treatment of stroke at state and national levels. Effective national programs, such as the Million Hearts 2027 initiative,** maintain a repository of sustainable interventions focused on stroke risk factor prevention and improvement in clinical management that can be replicated across diverse communities. For example, the CDC Paul Coverdell National Acute Stroke Program,†† a stroke quality-of-care initiative, has demonstrated improvements across the continuum of stroke care among varied geographic and socioeconomic communities. Programmatic and clinical interventions might improve stroke prevention and outcomes, and changes in social determinants of health might also be needed to reduce inequities in stroke prevalence and care (*9*). Such initiatives can include those that promote knowledge of the signs and symptoms of stroke, particularly those which emphasize Act F.A.S.T questions: "Face: Does one side of the face droop when smiling? Arms: Does one arm drift downward when both arms are raised? Speech: Is speech slurred or strange when repeating a simple phrase? Time: If you see any of these signs, call 9-1-1 right away."§§ Acting F.A.S.T is key to stroke survival. Awareness and knowledge of stroke signs and symptoms have increased among US adults, although there is room for improvement (*10*). Better recognition of stroke signs and symptoms might have potentially contributed to increased stroke prevalence, because earlier stroke treatment contributes to improved outcomes (*8*). Advancing focused evidence-based practices and programs for stroke awareness, prevention, and treatment is essential for improving the cerebrovascular health of the nation.

** https://millionhearts.hhs.gov/about-million-hearts/index.html
†† https://www.cdc.gov/coverdell/php/about/index.html
§§ https://www.cdc.gov/stroke/signs-symptoms/index.html

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Outbreak of Human Trichinellosis — Arizona, Minnesota, and South Dakota, 2022

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Abstract

Trichinellosis is a parasitic zoonotic disease transmitted through the consumption of meat from animals infected with *Trichinella* spp. nematodes. In North America, human trichinellosis is rare and is most commonly acquired through consumption of wild game meat. In July 2022, a hospitalized patient with suspected trichinellosis was reported to the Minnesota Department of Health. One week before symptom onset, the patient and eight other persons shared a meal that included bear meat that had been frozen for 45 days before being grilled and served rare with vegetables that had been cooked with the meat. Investigation identified six trichinellosis cases, including two in persons who consumed only the vegetables. Motile *Trichinella* larvae were found in remaining bear meat that had been frozen for >15 weeks. Molecular testing identified larvae from the bear meat as *Trichinella nativa*, a freeze-resistant species. Persons who consume meat from wild game animals should be aware that that adequate cooking is the only reliable way to kill *Trichinella* parasites and that infected meat can cross-contaminate other foods.

Investigation and Results

Index Patient Notification

In July 2022, the Minnesota Department of Health was notified of a man aged 29 years who was hospitalized with fever, severe myalgias, periorbital edema, eosinophilia, and other laboratory abnormalities (Table); health care providers suspected trichinellosis. The patient had sought care for his symptoms, which commenced in early July, four times and had been hospitalized twice over a 17-day period. During his second hospitalization, providers obtained a history of bear meat consumption, and empiric albendazole treatment

TABLE. Demographic characteristics, clinical data, and laboratory test results from persons who consumed a meal that included bear meat infected with *Trichinella nativa* — Arizona, Minnesota, and South Dakota, 2022

Case status	Age, yrs, sex	Consumed bear meat	Signs and symptoms	Hospitalized	Received trichinellosis-directed treatment	WBC count, (x 1,000)/mL, (% eos)*	Creatine kinase,* units/L	*Trichinella* antibody test results	Metagenomic sequencing test results
Confirmed	12, F	Yes	Abdominal pain, myalgias, fever, and periorbital edema	Yes	Yes, albendazole	8 (37)	2,495†	Positive	Positive, *Trichinella* species
Confirmed	29, M	Yes	Abdominal pain, diarrhea, myalgias, fever, and periorbital edema	Yes	Yes, albendazole	27 (22)	1,040§	Positive	Positive, *Trichinella* species
Probable	29, F	No¶	Myalgias and fever	No	No	ND	ND	ND	ND
Probable	54, F	No¶	Headache and myalgias	No	No	ND	ND	Negative	ND
Probable	57, M	Yes	Diarrhea, myalgias, fever, and periorbital edema	Yes	Yes, albendazole	13 (9)	323**	Negative	ND
Probable	62, M	Yes	Diarrhea and headache	No	No	ND	ND	Negative	ND
Negative	14, M	Yes	None	NA	No	ND	ND	ND	ND
Negative	61, F	Yes	None	NA	No	ND	ND	Negative	ND

Abbreviations: eos = eosinophils; F = female; M = male; NA = not applicable; ND = not done; WBC = white blood cell.
* Initial results are from hospitalization during which trichinellosis was suspected. Reference ranges varied among different laboratories that conducted testing.
† Reference range = 4–88.
§ Reference range = 39–208.
¶ Consumed vegetables that were cooked and served with the bear meat.
** Reference range = 39–308.

for probable trichinellosis was initiated. An investigation was launched to confirm the diagnosis, identify additional cases, and ascertain the source of infection to prevent future cases. The index patient's diagnosis was confirmed by a positive *Trichinella* immunoglobulin (Ig) G antibody test result.

Potential Exposure Source Identification

Six days before symptom onset in the index patient, he and eight extended family members from three states (Arizona, Minnesota, and South Dakota) had gathered for several days in South Dakota and shared a meal that included kabobs made from the meat of a black bear (*Ursus americanus*), which had been harvested by one of the family members in northern Saskatchewan, Canada in May 2022. The hunting outfitter had recommended freezing the meat to kill parasites. The meat was frozen in a household freezer* for 45 days until being thawed and grilled with vegetables. The meat was initially inadvertently served rare, reportedly because the meat was dark in color, and it was difficult for the family members to visually ascertain the level of doneness. After some of the family members began eating the meat and noticed that it was undercooked, the meat was recooked before being served again. The family reunion concluded before onset of illness in the index patient.

Laboratory Investigation and Case Definition

Public health authorities in Arizona, Minnesota, and South Dakota interviewed eight of the nine persons who had attended the implicated meal. The ninth attendee was a person aged <18 years whose exposure status could not be confirmed; however, that person reportedly remained healthy. Testing of paired acute and convalescent sera for *Trichinella* IgG antibodies was recommended for the eight exposed persons and was completed for six. Pathogen-agnostic microbial cell-free metagenomic DNA sequencing (*1*) was performed on plasma samples from the index patient and one other person who had sought care twice before being hospitalized with fever, myalgias, abdominal pain, periorbital edema, and laboratory abnormalities. Trichinellosis cases were classified according to the 2014 case definition from the Council for State and Territorial Epidemiologists (CSTE),† (i.e., the presence of clinically compatible symptoms in a person who had consumed an epidemiologically implicated meal or meat in which the parasite was demonstrated [probable] or had a positive serologic test result for *Trichinella* antibodies [confirmed]). Samples of frozen bear meat were obtained from the household freezer and sent to CDC for artificial tissue digestion and microscopic examination for larvae and molecular testing for *Trichinella* spp.

Additional Case Detection and Exposure Source Confirmation

Among the eight interviewed persons, five consumed the bear meat, and eight consumed the vegetables that had been cooked with it. Six of the eight persons who attended the meal, including four who consumed the bear meat and the vegetables, and two who consumed only the vegetables (but no meat), had symptoms consistent with trichinellosis, and met case criteria (two confirmed and four probable). Patients with trichinellosis ranged in age from 12 to 62 years and lived in three states: Arizona (one), Minnesota (four), and South Dakota (one). All cases were diagnosed in the patients' state of residence. Three of the six symptomatic persons, two of whom sought care at least twice before being offered treatment, were hospitalized. The three hospitalized persons received trichinellosis-directed treatment with albendazole.§ All six symptomatic persons recovered; the nonhospitalized patients did not receive trichinellosis-directed treatment because their symptoms had resolved with supportive care only, and the benefit of treatment after larval invasion of muscle is unclear (*2*). Six persons submitted a serum sample, each collected within 4 weeks of symptom onset; two specimens tested positive for *Trichinella* IgG antibodies by enzyme-linked immunosorbent assay. Two persons submitted a plasma sample for microbial cell-free DNA sequencing during hospitalization for trichinellosis-compatible symptoms, and both plasma samples tested positive for *Trichinella* spp. DNA. Microscopy identified motile *Trichinella* larvae (>800 larvae/g) in samples of bear meat that had been frozen for 110 days in a household freezer (Figure). Real-time multiplex polymerase chain reaction testing (*3*) of the bear meat was positive for *T. nativa* and whole genome sequencing identified mitochondrial sequences 100% identical to *T. nativa.*

Public Health Response

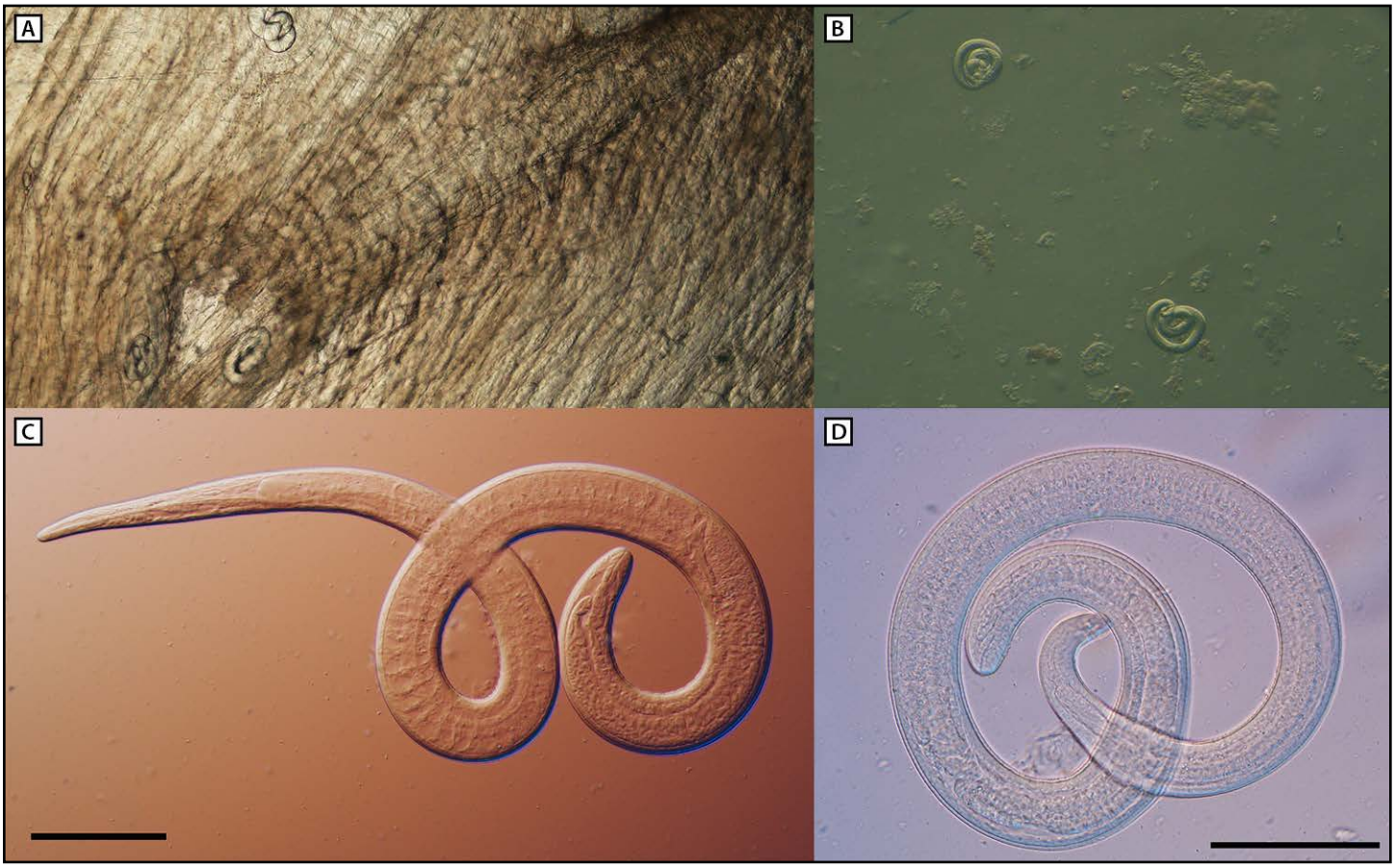
The family member who harvested the bear and provided meat samples for testing was advised to discard any remaining meat. All identified trichinellosis cases were reported to appropriate state health departments and to CDC. CDC notified the Public Health Agency of Canada of the outbreak and the confirmed source of infection. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.¶

Discussion

Trichinellosis is rarely reported in the United States. As a result of changes in pork production practices from historical

* The temperature of the freezer is not known.
† https://ndc.services.cdc.gov/case-definitions/trichinellosis-2014/
§ https://www.cdc.gov/trichinellosis/hcp/clinical-care/index.html
¶ 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE. Microscopic examination of encapsulated larvae in a direct black bear meat muscle squash prep (A), larvae liberated from artificially digested bear meat (B), and motile larvae viewed with differential interference contrast microscopy (C and D)* from black bear meat suspected as the source of an outbreak of human *Trichinella nativa* infections — Arizona, Minnesota, and South Dakota, 2022



Photos/Division of Parasitic Diseases and Malaria, Center for Global Health, CDC
* Scale bars = 100 μm.

norms that fostered transmission, most cases reported in recent years are attributed to consumption of meat from wild game (*4*). During January 2016–December 2022, seven U.S. trichinellosis outbreaks, including 35 probable and confirmed cases, were reported to CDC; bear meat was the suspected or confirmed source of infection in the majority of those outbreaks (CDC, unpublished data, 2022). Estimates of *Trichinella* infection prevalence among wild animal host species vary widely. A *Trichinella* infection prevalence range of at least 1% to 24% among black bears in Canada and Alaska has been reported, and even higher prevalences of *Trichinella* infection are reported among species of predators that are strict carnivores (e.g., polar bear, wolverine, and cougar) (*5*). The frequency with which black bear meat is the implicated source of human infection might be driven by hunting practices, ecological factors, and the relatively high parasite density observed in the muscle of infected black bears compared with that of other species (*6,7*).

Because symptoms of trichinellosis are typically nonspecific, diagnosis of infection requires a high index of suspicion; however, periorbital edema and certain laboratory abnormalities (e.g., eosinophilia and elevated creatine kinase levels) can provide etiologic clues. In this outbreak, two of the hospitalized patients sought care multiple times before receiving a diagnosis. Four of the six patients met clinical and epidemiologic criteria and thus were considered probable cases. Laboratory confirmation can be challenging because of the limited sensitivity of antibody testing early in illness (*8*); in this investigation, acute *Trichinella* IgG test results were positive in only two of six tested patient specimens. The clinical utility of trichinellosis test results obtained after acute illness is limited, and historically, public health investigators have had difficulty obtaining convalescent serum samples from persons who have recovered. Laboratory criteria in the current CSTE trichinellosis case definition do not include nucleic acid testing of human specimens. The sensitivity of such assays to detect *Trichinella* DNA in blood is uncharacterized; however, plasma samples from both patients tested by metagenomic sequencing (*1*) yielded positive results for *Trichinella* DNA. As demonstrated in this

Summary

What is already known about this topic?

Human trichinellosis cases in the United States are rare and are usually acquired through consumption of wild game.

What is added by this report?

Among eight persons who shared a meal that included the meat of a black bear harvested in Canada and frozen for 45 days, six trichinellosis cases were identified. The meat was grilled with vegetables and served rare; two cases occurred in persons who ate only the vegetables. Motile freeze-resistant *Trichinella nativa* larvae were identified in remaining meat frozen for >15 weeks.

What are the implications for public health practice?

Cooking meat to an internal temperature of ≥165°F (≥74°C) is necessary to kill *Trichinella* spp. parasites. *Trichinella*-infected meat can cross-contaminate other foods, and raw meat should be kept and prepared separate from other foods to prevent cross-contamination.

outbreak, pathogen-agnostic molecular assays can be useful for detection of rare diseases when standard workup is unrevealing and if other diagnostic tests lack sensitivity.

Implications for Public Health Practice

Although freezing kills *Trichinella* species commonly implicated in pork-associated outbreaks, freeze-resistant *Trichinella* species, including *T. nativa* and the T6 genotype (*9*), predominate in Arctic and sub-Arctic regions (*6*). Larval motility was observed in bear meat that had been frozen for nearly 4 months (110 days). Persons who consume game meat, especially that harvested in northern latitudes, should be informed that adequate cooking is the only reliable way to kill *Trichinella* parasites. Cooking wild game meat to an internal temperature of ≥165°F (≥74°C) is recommended by public health authorities**; temperatures should be verified with a meat thermometer. As demonstrated in this outbreak, the color of meat is not a good indicator of cooking adequacy. Safe handling of raw meat (i.e., separating raw or undercooked meat and its juices from other foods) is recommended to prevent trichinellosis; this investigation and previous investigations suggest that *Trichinella*-infected meat can cross-contaminate other foods (*10*). Government and private entities that oversee and organize hunting should educate hunters about these risks and effective preventative measures.

** https://www.cdc.gov/trichinellosis/prevention/index.html

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Monkeypox Virus Infections After 2 Preexposure Doses of JYNNEOS Vaccine — United States, May 2022–May 2024

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Abstract

Two doses of JYNNEOS vaccine are effective in preventing many mpox cases and can reduce the severity of symptoms in infected persons. However, infections among fully vaccinated persons can occur. During May 2022–May 2024, a total of 271 mpox cases among fully vaccinated persons were reported to CDC from 27 U.S. jurisdictions. These reported infections are estimated to have occurred in <1% of fully vaccinated persons. Compared with cases among unvaccinated persons, infections among fully vaccinated persons were more likely to occur among non-Hispanic White men aged 30–39 years, were associated with increased numbers of sexual partners, and resulted in less severe disease (p<0.001). Among infections in fully vaccinated persons with complete data, infections after vaccination were reported more commonly after receipt of heterologous (subcutaneous and intradermal) (46%) or homologous subcutaneous (32%) JYNNEOS vaccination than after homologous intradermal (22%) vaccination. Disparate time intervals from vaccination to infection among fully vaccinated persons suggest that immunity is not waning. The median interval between the second vaccine dose and illness onset was longer for cases among persons who had received 2 intradermal doses (median = 363 days; IQR = 221–444 days) compared with cases in persons who had received 2 subcutaneous doses (median = 263 days; IQR = 47–334 days) (p<0.001). The implications of this finding are not known; however, these data should increase confidence in the effectiveness of vaccine doses that were administered intradermally, the preferred method of administration during the peak of the outbreak when vaccine supply was limited. Persons recommended to receive the JYNNEOS vaccine should receive 2 doses, irrespective of the route of administration, and at this time, additional doses are not recommended for the affected population.

Introduction

JYNNEOS is a replication-deficient orthopoxvirus vaccine approved as a 2-dose series for prevention of smallpox and mpox.* This product was administered to nearly all vaccinated U.S. persons with risk factors for mpox during the ongoing global outbreak, which has disproportionately affected gay, bisexual, and other men who have sex with men (MSM) and transgender and nonbinary persons† (*1*). Real-world vaccine effectiveness studies have indicated that 2 JYNNEOS doses are effective in preventing many mpox cases (*2–4*); infections among persons who have received 2 JYNNEOS doses, when infection does occur, are less severe than are those among unvaccinated persons (*5*,*6*).

Most persons who received 2 JYNNEOS vaccine doses received both doses during 2022, but only 25% of the population at risk is estimated to have been fully vaccinated.§ Mpox case counts have decreased substantially in the United States since the peak of the outbreak; however, cases continue to occur, including, sometimes, among fully vaccinated persons (*7*). An mpox cluster recognized during May 2023 in Chicago, Illinois predominantly affected fully vaccinated persons (*7*) and raised several questions about the effectiveness of JYNNEOS vaccines, including the following: 1) the frequency of infection among fully vaccinated persons, 2) how often such infections are associated with receipt of 2 intradermal doses (i.e., the vaccination route less familiar to clinicians but preferentially recommended during the peak of the U.S. mpox response¶), 3) behavioral risk factors, and 4) potential need for booster doses. Public perception of an increase in monkeypox virus (MPXV) infections among fully vaccinated persons during 2024 has further fueled concerns about the 2-dose series. To answer these questions, including whether there are discernable indications for waning vaccine immunity, clinical and vaccination characteristics of nationally reported infections among fully vaccinated persons were evaluated.

Methods

The Council of State and Territorial Epidemiologists recommends that U.S. health departments report probable and confirmed mpox cases** to CDC's National Notifiable Diseases Surveillance System.†† Reported data include vaccination dates and demographic and clinical characteristics.§§ Probable

* https://www.fda.gov/media/131078/download?attachment
† https://www.cdc.gov/poxvirus/mpox/response/2022/index.html

§ Data were available through January 10, 2024. Fully vaccinated mpox cases were subsetted to match this same time frame (May 2022–January 2024) to estimate the proportion of infections among all vaccinated cases more accurately. https://www.cdc.gov/poxvirus/mpox/cases-data/mpx-jynneos-vaccine-coverage.html (Accessed March 20, 2024).
¶ https://www.cdc.gov/vaccines/covid-19/downloads/sovc-mpox-052223.pdf
** https://www.cdc.gov/poxvirus/mpox/clinicians/case-definition.html (Accessed March 20, 2024).
†† https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/ps2022/22-ID-10_Monkeypox_7.28.2022.pdf
§§ Vaccination status was determined by asking whether a patient had been vaccinated against smallpox or monkeypox virus. Dates that each dose was administered were also recorded.

or confirmed cases reported during May 11, 2022–May 1, 2024, were included in this analysis. An unvaccinated case was defined as a probable or confirmed mpox case in a person for whom 1) no history of vaccination with JYNNEOS was reported and 2) no vaccination dates were reported. Because a vaccine dose is considered to have maximum immunogenicity 14 days after administration, a case in a fully vaccinated person was defined as one in a person with documented receipt of 2 JYNNEOS doses ≥14 days before illness onset and with vaccination dates occurring since May 2022.¶¶ Cases among persons who had received a single vaccine dose or a second dose administered <14 days before mpox illness onset were excluded because these administration schedules are expected to provide suboptimal protection and are inconsistent with the recommended 2-dose series.

Cases among unvaccinated and fully vaccinated persons were compared by demographic characteristics, behaviors (i.e., number of recent sexual partners), and clinical presentations using chi-square and Fisher's exact tests and odds ratios (ORs). Among fully vaccinated persons, the interval from receipt of the second vaccine dose to illness onset and the routes of vaccination (i.e., 2 subcutaneous doses [homologous subcutaneous], 1 subcutaneous and 1 intradermal dose [heterologous], and 2 intradermal doses [homologous intradermal]) were compared using a Kruskal-Wallis test. The interval from receipt of the second vaccine dose to illness onset was also compared for homologous subcutaneous and intradermal doses using the Wilcoxon rank-sum test. To determine how missing vaccination data might have skewed findings, demographic characteristics of mpox patients with complete data on vaccination status were compared with those of patients who were missing vaccination status using chi-square tests. To assess the frequency of reported MPXV infections among fully vaccinated persons, the proportion of such reported infections among the total number of fully vaccinated persons was estimated for a subset of 31 jurisdictions with vaccination status reported for 95% of persons with infection.*** The proportion of fully vaccinated cases among mpox cases included in this analysis was plotted over time. Analyses were conducted using R software (version 4.3.2; R Foundation). This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.†††

¶¶ Symptom onset date was not always available. Therefore, the estimated illness onset date was assessed using one of the following three possible dates: 1) symptom onset date (when available), 2) date of the most recent positive orthopoxvirus test, or 3) date the surveillance record was created.

*** Data on vaccination coverage were available through January 10, 2024. Fully vaccinated mpox cases were subsetted to match this same time frame (May 2022–January 2024) to estimate the proportion of infections among all vaccinated cases more accurately.

††† 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

Results

Among 32,819 probable or confirmed U.S. mpox cases reported to CDC during May 11, 2022–May 1, 2024, a total of 24,507 (75%) occurred in unvaccinated persons, and 271 (0.8%) occurred among persons who were fully vaccinated (Table 1); of these 271 cases, 51 (19%) occurred during 2024. Vaccination status was missing for 3,737 (11%) cases; an additional 4,304 (13%) cases were excluded from analysis because the patient had received only 1 JYNNEOS vaccine dose or had received the second dose <14 days before illness onset, or because other exclusion criteria were met. Cases among unvaccinated and fully vaccinated persons were reported from 54 and 27 U.S. jurisdictions, respectively. Approximately 80% of cases with missing vaccination status were reported from four jurisdictions.

Compared with unvaccinated cases, a higher proportion of fully vaccinated cases occurred among non-Hispanic White persons (59%) and persons aged 30–39 years (47%) ($p<0.001$, Fisher's exact and chi-square tests, respectively). Information about the number of sexual partners was, over time, removed from the data requested by the CDC and, therefore, often missing, particularly during 2024. However, among 8,463 (34%) mpox patients with complete information on the number of sexual partners during the 21 days preceding symptom onset, the median number reported by those who were fully vaccinated (two; IQR = one to three) was higher than that reported by those who were unvaccinated (one; IQR = one to two) ($p<0.001$, Wilcoxon rank-sum test). A lower proportion of fully vaccinated patients were persons with HIV (29%) compared with unvaccinated patients (54%) ($p<0.001$, chi-square test). Compared with patients with complete data on vaccination status, missing data on vaccination status was more prevalent among mpox patients aged >40 years (36%), those of Hispanic or Latino ethnicity (38%), and those with an immunocompromising condition (excluding HIV) (22%).

Mpox cases among fully vaccinated persons occurred a median of 266 days after receipt of the second JYNNEOS dose (range = 14–621 days; IQR = 64–420 days). The vaccine administration route§§§ of both doses was reported for 139 (51%) of 271 infected persons; among these persons, 64 (46%) received heterologous doses, 45 (32%) received homologous subcutaneous doses, and 30 (22%) received homologous intradermal doses. Whereas no significant difference was detected among all three groups, a difference was found between

§§§ On August 9, 2022, to facilitate access to vaccination and conserve vaccine supply in light of the growing 2022 outbreak, the Food and Drug Administration issued an Emergency Use Authorization to allow for intradermal injection as a 2-dose series (0.1 mL per dose, administered 4 weeks apart). https://www.fda.gov/media/160774/download

TABLE 1. Demographic and underlying clinical characteristics of persons with mpox, by JYNNEOS vaccination status — United States, May 2022–May 2024

Characteristic	No. (%) Fully vaccinated* n = 271	No. (%) Unvaccinated n = 24,507	p-value†	No. (%) Total included (fully vaccinated and unvaccinated) N = 24,778	No. (%) Missing vaccination status n = 3,737	p-value†
Age group, yrs						
<30	44 (16.5)	7,120 (29.1)	<0.001	**7,164 (28.9)**	921 (25.6)	<0.001
30–39	126 (47.4)	10,107 (41.2)		**10,233 (41.3)**	1,397 (38.8)	
40–49	61 (22.9)	4,869 (19.9)		**4,930 (19.9)**	796 (22.1)	
50–59	24 (9.0)	2,017 (8.2)		**2,041 (8.2)**	399 (11.1)	
≥60	11 (4.1)	392 (1.6)		**403 (1.6)**	88 (2.4)	
Unknown or missing	5	2		**7**	136	
Race and ethnicity						
AI/AN, non-Hispanic	0 (—)	92 (0.4)	<0.001§	**92 (0.4)**	16 (0.5)	<0.001
Asian, non-Hispanic	7 (2.7)	556 (2.4)		**563 (2.4)**	164 (5.2)	
Black or African American, non-Hispanic	37 (14.3)	8,149 (34.9)		**8,186 (34.6)**	664 (21.2)	
NH/PI, non-Hispanic	0 (—)	57 (0.2)		**57 (0.2)**	10 (0.3)	
White, non-Hispanic	153 (59.1)	6,509 (27.9)		**6,662 (28.2)**	1,002 (32.0)	
Hispanic or Latino	49 (18.9)	7,127 (30.5)		**7,176 (30.4)**	1,198 (38.3)	
Multiple races, non-Hispanic	7 (2.7)	341 (1.5)		**348 (1.5)**	21 (0.7)	
Other races, non-Hispanic	6 (2.3)	536 (2.3)		**542 (2.3)**	53 (1.7)	
Unknown or missing	12	1,140		**1,152**	609	
Gender identity						
Female	0 (—)	748 (3.6)	0.02§	**748 (3.5)**	79 (2.7)	<0.001§
Male	207 (99.0)	19,808 (94.5)		**20,015 (94.5)**	2,742 (94.4)	
Transgender female	0 (—)	136 (0.6)		**136 (0.6)**	9 (0.3)	
Transgender male	0 (—)	29 (0.1)		**29 (0.1)**	4 (0.1)	
Another gender or multiple genders	2 (1.0)	240 (1.1)		**242 (1.1)**	72 (2.5)	
Unknown or missing	62	3,546		**3,608**	831	
HIV status						
Persons with HIV	55 (29.3)	4,061 (53.7)	<0.001	**4,116 (53.2)**	215 (56.6)	0.2
Persons without HIV	133 (70.7)	3,495 (46.3)		**3,628 (46.8)**	165 (43.4)	
Unknown or missing	83	16,951		**17,034**	3,357	
Immunocompromising condition (excluding HIV)						
No	131 (91.0)	9,212 (85.3)	0.07	**9,343 (85.4)**	284 (78.0)	<0.001
Yes	13 (9.0)	1,583 (14.7)		**1,596 (14.6)**	80 (22.0)	
Unknown or missing	127	13,712		**13,839**	3,373	
No. of recent sexual partners,¶ median (IQR)	**2 (1–3)**	**1 (1–2)**	**<0.001****	**1 (1–2)**	**1 (1–3)**	**<0.001****
Unknown or missing	196	16,119		**16,315**	3,346	

Abbreviations: AI/AN = American Indian or Alaska Native; NH/PI = Native Hawaiian or Pacific Islander.

* Probable or confirmed cases in persons who received 2 JYNNEOS doses, with the most recent dose received ≥14 days before illness onset and with vaccination dates occurring since May 2022.

† Chi-square test p-value except where noted; p<0.05 was considered statistically significant.

§ Fisher's exact test p-value.

¶ During the 21 days before symptom onset.

** Wilcoxon rank-sum test p-value.

homologous vaccine recipients: among all homologous 2-dose recipients, the median interval from receipt of the second dose to illness onset among persons who had received 2 intradermal doses was 363 days (IQR = 221–444 days), and the median interval among those who had received 2 subcutaneous doses was 263 days (IQR = 47–334 days) (p<0.001). The impact of HIV infection on interval from vaccination to infection could not be assessed because of missing viral load and other data necessary to stratify cases by immunocompromised status.

The odds of having systemic illness (e.g., fever, headache, lymphadenopathy, vomiting, abdominal pain, myalgia, chills, or malaise) were significantly lower among persons with mpox who were fully vaccinated than among those who were unvaccinated (p<0.05 for all tests) (Table 2). Although the median number of reported anatomic locations with rash was lower among fully vaccinated patients (one) than among unvaccinated patients (four), the odds of reported genital rash were higher among fully vaccinated patients than among those who were unvaccinated (OR = 2.3). Hospitalization was less

TABLE 2. Clinical manifestations of persons with probable or confirmed mpox, by JYNNEOS vaccination status — United States, May 2022–May 2024

Characteristic	No. (%) Fully vaccinated* n = 271	Unvaccinated n = 24,507	Odds ratio (95% CI)	p-value†
Outcomes				
Hospitalized because of mpox				
No	209 (98.6)	18,054 (91.6)	0.2 (0.0–0.5)	<0.001§
Yes	3 (1.4)	1,662 (8.4)		
Unknown or missing	59	4,791		
Death due to mpox				
No	116 (100.0)	13,521 (99.6)	Not tested	Not tested
Yes	0 (—)	56 (0.4)		
Unknown or missing	155	10,930		
Systemic illness¶				
No	36 (28.3)	915 (12.3)	0.4 (0.2–0.5)	<0.001
Yes	91 (71.7)	6,514 (87.7)		
Unknown or missing	144	17,078		
Fever				
No	90 (61.6)	4,283 (36.6)	0.4 (0.3–0.5)	<0.001
Yes	56 (38.4)	7,412 (63.4)		
Unknown or missing	125	12,812		
Headache				
No	96 (66.2)	5,932 (47.5)	0.5 (0.3–0.7)	<0.001
Yes	49 (33.8)	6,559 (52.5)		
Unknown or missing	126	12,016		
Lymphadenopathy				
No	83 (57.2)	4,963 (47.1)	0.7 (0.5–0.9)	0.02
Yes	62 (42.8)	5,583 (52.9)		
Unknown or missing	126	13,961		
Vomiting				
No	124 (91.9)	7,313 (81.8)	0.4 (0.2–0.7)	0.004
Yes	11 (8.1)	1,631 (18.2)		
Unknown or missing	136	15,563		
Abdominal pain				
No	128 (94.1)	9,330 (86.2)	0.4 (0.2–0.8)	0.01
Yes	8 (5.9)	1,495 (13.8)		
Unknown or missing	135	13,682		
Myalgia				
No	98 (70.0)	5,129 (48.0)	0.4 (0.3–0.6)	<0.001
Yes	42 (30.0)	5,555 (52.0)		
Unknown or missing	131	13,823		
Chills				
No	93 (66.0)	5,456 (42.4)	0.4 (0.3–0.5)	<0.001
Yes	48 (34.0)	7,414 (57.6)		
Unknown or missing	130	11,637		
Malaise				
No	69 (47.6)	4,097 (38.0)	0.7 (0.5–0.9)	0.02
Yes	76 (52.4)	6,685 (62.0)		
Unknown or missing	126	13,725		
Other symptoms				
No. of anatomic locations with rash, median (IQR)	1 (1–2)	4 (2–6)	—	<0.001**
Unknown or missing	183	10,935		
Genital rash				
No	29 (33.0)	7,161 (52.8)	2.3 (1.4–3.7)	0.003
Yes	59 (67.0)	6,411 (47.2)		
Unknown or missing	183	10,935		
Rash				
No	9 (5.1)	375 (2.7)	0.5 (0.3–1.2)	0.09
Yes	168 (94.9)	13,293 (97.3)		
Unknown or missing	94	10,839	—	
Rectal pain				
No	90 (61.6)	6,489 (63.2)	1.1 (0.7–1.5)	0.8
Yes	56 (38.4)	3,780 (36.8)		
Unknown or missing	125	14,238		
Proctitis				
No	121 (91.0)	6,762 (85.1)	0.6 (0.3–1.0)	0.08
Yes	12 (9.0)	1,186 (14.9)		
Unknown or missing	138	16,559		
Rectal bleeding				
No	112 (80.0)	7,350 (79.1)	1.1 (0.7–1.7)	0.9
Yes	28 (20.0)	1,945 (20.9)		
Unknown or missing	131	15,212		
Pus in stool				
No	117 (84.2)	7,389 (82.4)	0.9 (0.5–1.4)	0.7
Yes	22 (15.8)	1,578 (17.6)		
Unknown or missing	132	15,540		
Tenesmus				
No	113 (81.9)	7,736 (82.3)	1.0 (0.6–1.6)	1.0¶
Yes	25 (18.1)	1,669 (17.7)		
Unknown or missing	133	15,102		
Conjunctivitis				
No	117 (95.9)	8,624 (95.5)	0.9 (0.3–2.2)	1.0
Yes	5 (4.1)	405 (4.5)		
Unknown or missing	149	15,478		

* Probable or confirmed cases in persons who received 2 JYNNEOS doses, with the most recent dose received ≥14 days before illness onset and with vaccination dates occurring since May 2022.
† Chi-square test p-value except where noted; p<0.05 was considered statistically significant.
§ Fisher's exact test p-value.
¶ Systemic illness includes the presence of fever, headache, lymphadenopathy, vomiting, abdominal pain, myalgia, chills, or malaise.
** Wilcoxon rank-sum test p-value.

prevalent among vaccinated persons with mpox (three [1.4%] of 212) than among unvaccinated persons (1,662 [8.4%] of 19,716) (OR = 0.2); a total of 56 deaths occurred among unvaccinated mpox patients, and none occurred among those who were fully vaccinated.

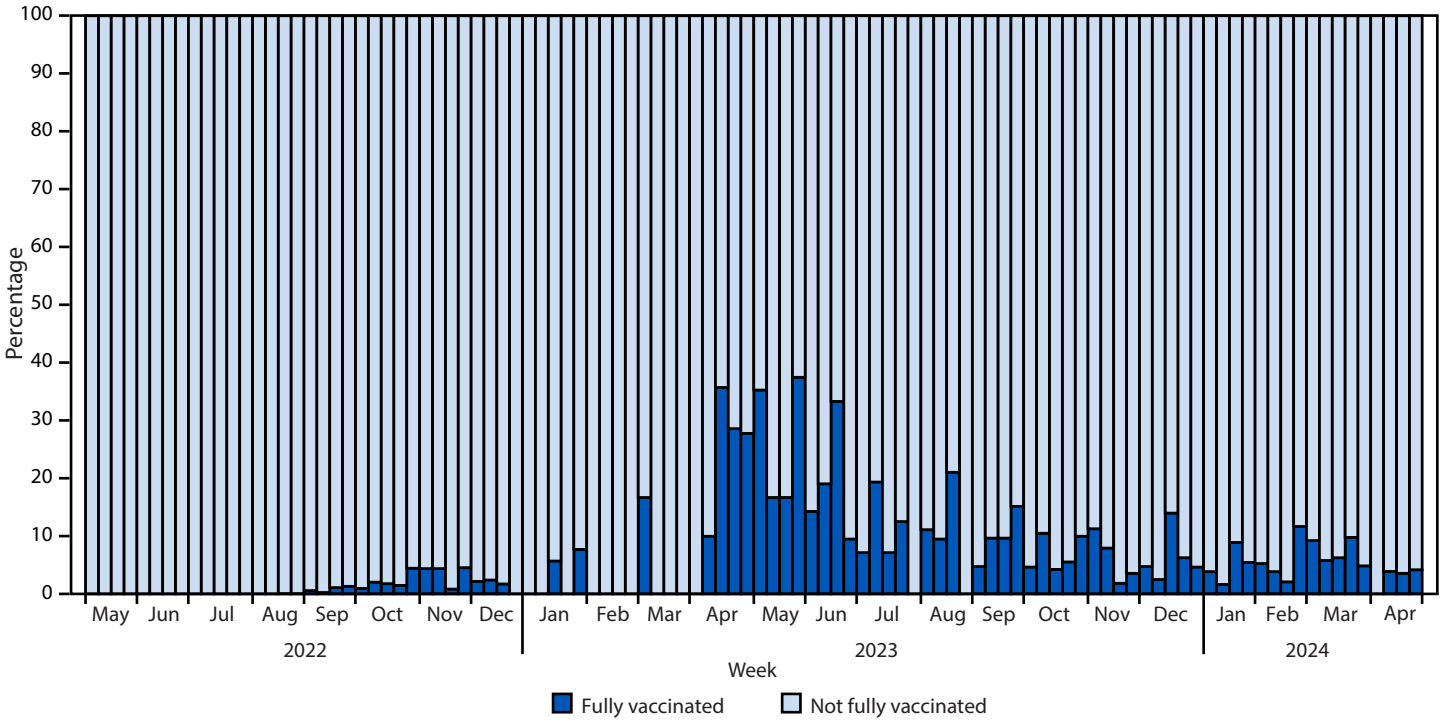
Among 31 jurisdictions¶¶¶ with complete vaccination status for 95% of persons, 187 infections were reported among 188,907 fully vaccinated persons (with 2 JYNNEOS doses), resulting in a 0.1% infection rate. The number of breakthrough infections did not comprise a significant proportion of infections, including during 2024 (Figure).

¶¶¶ These 31 jurisdictions represented approximately 33% of mpox cases nationally.

Discussion

This report corroborates other published findings indicating that MPXV infection in fully vaccinated U.S. persons is rare

FIGURE. Proportion of fully vaccinated mpox cases* among all mpox cases, by epidemiologic week — United States, May 2022–May 2024



* Probable or confirmed cases in persons who received 2 JYNNEOS doses, with the most recent dose received ≥14 days before illness onset and with vaccination dates occurring since May 2022.

and less severe regardless of the route of vaccination. For those for whom data on sexual exposures was reported, the difference between number of partners among fully vaccinated and unvaccinated cases was not large; however, similar to data from the May 2023 mpox cluster in Chicago, the results were statistically significant, suggesting that cases among fully vaccinated persons could be associated with increasing opportunities for MPXV exposure (*7*). Although no vaccine is 100% effective, persons who are fully vaccinated against mpox in the United States might have assumed that they are immune to infection and that other infection prevention strategies are no longer needed. Consistent with that, conclusions from the investigation in Chicago involving mpox cases in fully vaccinated persons were that they were likely due to frequent behaviors associated with mpox transmission, even with relatively high vaccine effectiveness and vaccine coverage (*7*).

Despite a perceived increase in MPXV infections among fully vaccinated persons during 2024, this report indicates that, to date, persistent vaccine-derived immunologic response among persons who received the 2-dose vaccine series exists. Illness onset occurred during varied periods after the second vaccination dose, starting as early as 14 days and as late as 621 days after the second dose. Studies have indicated that vaccine titers decrease a few months after vaccination (*8*); this finding has spurred concerns that additional vaccine doses might be indicated. However, the clinical significance of waning antibody levels is uncertain. CDC laboratory data (PS Satheshkumar, CDC, unpublished data, 2024) and the findings from this report indicate that level of circulating titers is not the only marker of protection conferred by mpox vaccinations. The role of innate and cell-mediated immunity in preventing MPXV infections is not known, and the robustness of memory or recall response after an exposure might be more important determinants of disease outcome.

With only one in four eligible U.S. persons fully vaccinated, clinicians and public health authorities should continue to focus efforts on increasing vaccine coverage, including among marginalized communities that are at risk for life-threatening mpox infections (*9*). During October 2023, the Advisory Committee on Immunization Practices (ACIP) recommended inclusion of JYNNEOS in the routine immunization schedule for persons at risk for mpox.**** Consistent with this recommendation, every opportunity should be taken to facilitate vaccination, including assessing behavioral risk factors and eligibility criteria during routine clinical appointments and vaccinating patients at those visits. Clinicians should remind patients that mpox is still circulating in the United States, and vaccination is an important tool in stopping the spread of mpox. In addition to vaccination,

**** https://www.cdc.gov/vaccines/schedules/index.html (Accessed April 15, 2024).

Summary

What is already known about this topic?

Two JYNNEOS vaccine doses prevent mpox; however, infection in fully vaccinated persons can occur.

What is added by this report?

Monkeypox virus infection after receipt of 2 JYNNEOS doses is estimated to have occurred in <1% of fully vaccinated persons and comprises a small proportion of national cases. Among persons who experienced infection after having received a complete 2-dose series and for whom complete data were available, infections have been milder than those among unvaccinated persons. Disparate time intervals from vaccination to infection among fully vaccinated persons suggest that immunity is not waning.

What are the implications for public health practice?

To optimize protection, persons recommended to receive mpox vaccination should complete the 2-dose JYNNEOS vaccination series. No additional vaccine doses are recommended at this time.

clinicians should educate patients about other prevention strategies such as talking with sex partners about any mpox signs and symptoms, being aware of any unexplained rashes or lesions on a partner's body, and avoiding close or intimate contact if they or a sex partner become sick with mpox or experience an mpox-like rash. Mpox vaccination should be included as part of broader prevention activities and sexual health care, including HIV and other sexually transmitted infection (STI) testing and linkage to services, such as HIV preexposure prophylaxis or HIV treatment, as indicated.[††††]

Limitations

The findings in this report are subject to at least three limitations. First, the total number of reported infections among fully vaccinated persons in this analysis might be underestimated because vaccination status was missing for 3,737 (11%) nationally reported cases; in addition, some mpox signs and symptoms after vaccination might be less severe (possibly subclinical), and therefore, might not have been evaluated by laboratory testing or included in national case counts. Second, the total number of cases among fully vaccinated persons was relatively small, which might have precluded detection of some associations, particularly for subgroup comparisons of interest (e.g., viral load status among patients with HIV). Finally, information about the type of sexual exposure was not reported and, therefore, could not be compared between vaccinated and unvaccinated cases. Relatedly, data about the number of sexual partners was reported for only a small number of patients because of changing reporting requirements over time.

[††††] https://www.cdc.gov/poxvirus/mpox/prevention/sexual-health.html (Accessed May 17, 2024).

Implications for Public Health Practice

CDC encourages clinicians and health departments to report vaccination status of persons with mpox because this data is essential to detecting waning immunity. When health departments identify infections among fully vaccinated persons, detailed jurisdictional-specific assessments of these cases (e.g., improved understanding of sexual behaviors, such as type of sex and vaccine status of partners) might elucidate risk for infection and potentially guide whether policy about additional vaccine doses should be considered. Regardless of the limitations of this data, the findings from this report indicate that at this time, booster doses are not recommended for patients at risk for mpox exposure during the ongoing outbreak. CDC will continue to monitor these data to assess trends among mpox cases occurring among vaccinated persons so that vaccination guidance can be updated accordingly. Currently, an adequate supply of JYNNEOS vaccine is available; therefore, clinicians can preferentially administer JYNNEOS via the subcutaneous route, although previously administered intradermal vaccine doses were effective and should be considered valid doses and not repeated. Despite concerns about the effectiveness of intradermal doses during the height of the national outbreak, this report reveals that infections among persons who received homologous intradermal doses occurred a median of 100 days later than infections among persons who received homologous subcutaneous doses. The significance of this observation is not known and requires further monitoring and study.

Clinicians, including those providing care for patients with HIV and other STIs, should counsel patients about the benefits of receiving 2 JYNNEOS vaccine doses to prevent mpox and explain that, although infection can occur among fully vaccinated persons, reports of such infections are rare (less than 1% among the fully vaccinated) and are typically milder than those among unvaccinated persons. Vaccinated persons should employ other prevention strategies in addition to vaccination. Currently available data should support vaccine confidence and encourage mpox vaccination according to the ACIP routine immunization schedule. Persons recommended to receive the vaccine and who received the first dose >28 days ago should receive their second vaccination as soon as possible to complete the 2-dose schedule; ensuring more persons are fully vaccinated will provide better overall protection for individual persons and for communities.

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Vital Signs: Drowning Death Rates, Self-Reported Swimming Skill, Swimming Lesson Participation, and Recreational Water Exposure — United States, 2019–2023

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Abstract

Introduction: Drowning is the cause of approximately 4,000 U.S. deaths each year and disproportionately affects some age, racial, and ethnic groups. Infrastructure disruptions during the COVID-19 pandemic, including limited access to supervised swimming settings, might have affected drowning rates and risk. Data on factors that contribute to drowning risk are limited. To assess the potential impact of the pandemic on drowning death rates, pre– and post–COVID-19 pandemic rates were compared.

Methods: National Vital Statistics System data were used to compare unintentional drowning death rates in 2019 (pre–COVID-19 pandemic onset) with those in 2020, 2021, and 2022 (post-pandemic onset) by age, sex, and race and ethnicity. National probability-based online panel survey (National Center for Health Statistics Rapid Surveys System) data from October–November 2023 were used to describe adults' self-reported swimming skill, swimming lesson participation, and exposure to recreational water.

Results: Unintentional drowning death rates were significantly higher during 2020, 2021, and 2022 compared with those in 2019. In all years, rates were highest among children aged 1–4 years; significant increases occurred in most age groups. The highest drowning rates were among non-Hispanic American Indian or Alaska Native and non-Hispanic Black or African American persons. Approximately one half (54.7%) of U.S. adults reported never having taken a swimming lesson. Swimming skill and swimming lesson participation differed by age, sex, and race and ethnicity.

Conclusions and Implications for Public Health Practice: Recent increases in drowning rates, including those among populations already at high risk, have increased the urgency of implementing prevention strategies. Basic swimming and water safety skills training can reduce the risk for drowning. Addressing social and structural barriers that limit access to this training might reduce drowning deaths and inequities. The U.S. National Water Safety Action Plan provides recommendations and tools for communities and organizations to enhance basic swimming and water safety skills training.

Introduction

Approximately 4,000 persons die from unintentional drowning in the United States each year, and some population groups are disproportionately affected. Drowning is the leading cause of death among children aged 1–4 years and one of the three leading causes of unintentional injury death among persons aged 5–34 years (*1*); the second highest drowning death rate is among adults aged ≥65 years (*2*). Drowning death rates are consistently highest among males, non-Hispanic Black or African American (Black), and non-Hispanic American Indian or Alaska Native (AI/AN) persons (*3*). After decades of decreasing drowning rates in the United States, drowning rates increased, and racial and ethnic disparities widened after the onset of the COVID-19 pandemic (*4*). During the COVID-19 pandemic, persons spent more recreational time in or near water, and availability of supervised swimming settings was limited (*4*).

Basic swimming and water safety skills training is an effective drowning prevention strategy (*5*,*6*); however, some groups, including those who have higher rates of drowning (e.g., AI/AN and Black persons) might have limited access to swimming lessons (*7*). In addition to disparities in access, the availability of swimming lessons was affected by infrastructure disruptions during the COVID-19 pandemic and subsequent lifeguard shortages (*8*). This report describes changes in unintentional drowning death rates by sex, age, and race and ethnicity coinciding with the COVID-19 pandemic and presents national estimates of adults' self-reported swimming skill, swimming lesson participation, and exposure to recreational water.

Methods

Mortality Data Analysis

Unintentional drowning deaths from the National Vital Statistics System (NVSS) mortality files for 2019–2022 were identified using the *International Classification of Diseases, Tenth Revision* underlying cause of death codes W65–W74, V90, and V92.* For each year, drowning death rates (unintentional drowning deaths per 100,000 population) were calculated using U.S. Census Bureau postcensal single race estimates of the residential population as of July 1. Rates (other than age-specific rates) were age-adjusted to the year 2000 U.S. Census Bureau standard population.† Percentage change and corresponding 95% CIs were calculated to compare rates from 2020, 2021, and 2022 with those in 2019, overall and by age group, sex, and race and ethnicity. For example, percentage change from 2019 to 2020 was calculated as ([2020 rate – 2019 rate] / [2019 rate]) × 100. Rates were rounded to four decimal places for all calculations and are presented rounded to one decimal place in this report. Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

Survey Data Analysis

Data on adults' self-reported swimming skill, swimming lesson participation, and water exposure were obtained from Round 2 of the National Center for Health Statistics Rapid Surveys System (RSS),§ fielded during October–November 2023. The RSS platform is designed to approximate national representation of the adult U.S. population and collects self-reported health data using two commercially available, statistically sampled national probability-based online panels: 1) National Opinion Research Center, at the University of Chicago's AmeriSpeak Panel (https://amerispeak.norc.org/) and 2) Ipsos's KnowledgePanel (https://www.ipsos.com/en-us/solutions/public-affairs/knowledgepanel). Nationally representative weights calibrated to the National Health Interview Survey were created to reduce coverage and nonresponse biases. Variances were estimated using the Taylor series linearization method that takes survey design into account. Self-reported swimming skill, swimming lesson participation, and recreational water exposure were described overall and by sex, age group, and race and ethnicity. Race and ethnicity were categorized as Black, non-Hispanic White (White), Hispanic, and non-Hispanic other race (other). Differences with nonoverlapping 95% CIs were considered significant. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.¶

Results

Drowning Death Rates

Compared with an overall unintentional drowning death rate of 1.2 per 100,000 persons in 2019, rates were significantly higher in 2020 (1.4; 10.5% increase), 2021 (1.4; 13.7%), and 2022 (1.3; 9.1%) (Table 1). Drowning death rates were higher among males (range = 1.9–2.1) than among females (range = 0.6–0.7) in all years. Compared with rates in 2019, drowning death rates among males were significantly higher in 2020 (2.1; 12.8%), 2021 (2.1; 12.8%), and 2022 (2.0; 6.5%), and rates among females were significantly higher in 2021 (0.7; 22.2%) and 2022 (0.6; 13.7%). Drowning death rates were highest among children aged 1–4 years in all years and increased significantly in 2021 (3.1; 28.9%) and 2022 (3.1; 28.3%) compared with 2019. The next highest death rate occurred among adults aged ≥65 years and, compared with rates in 2019, rates were significantly higher among persons aged 65–74 years in 2022 (1.8; 19.1%) and among persons aged ≥85 years in 2021 (2.4; 49.8%). The largest increase in drowning death rates in 2020 compared with 2019 occurred among persons aged 15–24 (1.4; 31.3%) and 25–34 years (1.3; 21.1%). When examined by race and ethnicity, the highest drowning rates were among AI/AN (range = 2.6–3.1) and Black persons (range = 1.5–1.9) in all years. The largest increases in drowning rates relative to 2019 occurred among Black persons in 2020 (1.8; 22.2%) and 2021 (1.9; 28.3%) and among Hispanic persons in 2022 (1.2; 24.8%).

Swimming Skill and Swimming Lessons

An estimated 40 million adults (15.4% of survey respondents) reported not knowing how to swim (Table 2). More than one half of adults (54.7%) reported never having taken a swimming lesson. Self-reported swimming skill and swimming lesson participation differed by sex, age, and race and ethnicity. Women were significantly more likely than were men to report that they did not know how to swim (19.4% versus 11.2%), and adults aged ≥65 years were more likely to report not knowing how to swim (18.6%) than were those aged 18–29 years (12.4%). Approximately one third (36.8%) of Black adults reported not knowing how to swim, a significantly higher percentage than that of Hispanic adults (25.8%), White adults (6.9%), and adults of other racial or ethnic groups (22.4%). Compared with White adults, approximately one half (51.8%) of whom reported ever having taken a swimming lesson, a significantly lower percentage of Black adults (36.9%) and Hispanic adults (28.1%) had ever taken a swimming lesson.

* W65–W74 = accidental drowning and submersion; V90 = accident to watercraft causing drowning and submersion; and V92 = drowning and submersion due to accident on board watercraft, without accident to watercraft.
† https://wonder.cdc.gov/wonder/help/ucd-expanded.html#Age-Adjusted%20Rates
§ https://www.cdc.gov/nchs/rss/rapid-surveys-system.html
¶ 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

TABLE 1. Changes in drowning* death rates,† by sex, age group, and race and ethnicity — National Vital Statistics System, United States, 2019–2022

Characteristic	2019	2020		2021		2022	
	No. (rate)§	No. (rate)§	% Change¶ (95% CI)	No. (rate)§	% Change¶ (95% CI)	No. (rate)§	% Change¶ (95% CI)
Sex							
Female	953 (0.6)	1,040 (0.6)	9.6 (−0.3 to 19.6)	1,137 (0.7)	22.2 (11.3 to 33.0)	1,113 (0.6)	13.7 (3.5 to 23.9)
Male	3,114 (1.9)	3,549 (2.1)	12.8 (7.2 to 18.3)	3,540 (2.1)	12.8 (7.2 to 18.3)	3,396 (2.0)	6.5 (1.2 to 11.7)
Age group, yrs							
<1	34 (0.9)	34 (0.9)	1.3 (−46.9 to 49.4)	38 (1.1)	18.6 (−36.2 to 73.5)	39 (1.1)	17.8 (−36.4 to 72.0)
1–4	382 (2.4)	425 (2.7)	12.9 (−2.7 to 28.5)	476 (3.1)	28.9 (11.6 to 46.3)	461 (3.1)	28.3 (10.9 to 45.7)
5–14	240 (0.6)	208 (0.5)	−13.3 (−29.4 to 2.8)	244 (0.6)	−0.1 (−17.9 to 17.7)	230 (0.6)	−3.9 (−21.3 to 13.5)
15–24	453 (1.1)	593 (1.4)	31.3 (15.2 to 47.4)	475 (1.1)	3.9 (−9.5 to 17.3)	488 (1.1)	3.7 (−9.6 to 17.0)
25–34	503 (1.1)	611 (1.3)	21.1 (6.8 to 35.4)	605 (1.3)	21.5 (7.1 to 35.8)	547 (1.2)	9.8 (−3.5 to 23.1)
35–44	481 (1.2)	568 (1.3)	16.8 (2.6 to 30.9)	642 (1.5)	28.1 (13.0 to 43.2)	549 (1.3)	8.8 (−4.5 to 22.1)
45–54	528 (1.3)	569 (1.4)	9.1 (−3.8 to 22.1)	511 (1.3)	−2.8 (−14.6 to 9.1)	483 (1.2)	−7.5 (−18.9 to 3.9)
55–64	568 (1.3)	639 (1.5)	12.6 (−0.1 to 25.3)	656 (1.5)	14.5 (1.7 to 27.4)	625 (1.5)	11.0 (−1.6 to 23.6)
65–74	475 (1.5)	503 (1.5)	2.4 (−10.4 to 15.3)	545 (1.6)	7.3 (−5.9 to 20.5)	607 (1.8)	19.1 (4.8 to 33.4)
75–84	293 (1.8)	307 (1.9)	1.7 (−14.6 to 18.0)	340 (2.1)	14.4 (−3.5 to 32.2)	342 (2.0)	6.4 (−10.2 to 23.0)
≥85	107 (1.6)	131 (2.0)	21.4 (−9.6 to 52.5)	145 (2.4)	49.8 (12.4 to 87.2)	136 (2.1)	29.4 (−3.3 to 62.2)
Race and ethnicity**							
AI/AN	74 (3.1)	72 (2.9)	−5.1 (−36.4 to 26.3)	62 (2.6)	−14.5 (−43.9 to 14.9)	68 (2.8)	−8.4 (−39.2 to 22.3)
Asian	185 (1.0)	209 (1.1)	8.3 (−13.5 to 30.0)	228 (1.2)	20.2 (−3.4 to 43.9)	183 (0.9)	−8.6 (−27.6 to 10.3)
Black or African American	601 (1.5)	750 (1.8)	22.2 (8.9 to 35.5)	780 (1.9)	28.3 (14.5 to 42.1)	675 (1.6)	9.5 (−2.7 to 21.6)
NH/OPI	—††	23 (3.6)	NA	17 (—)	NA	17 (—)	NA
White	2,548 (1.2)	2,791 (1.4)	13.2 (6.8 to 19.7)	2,843 (1.4)	12.5 (6.1 to 18.9)	2,725 (1.3)	4.7 (−1.3 to 10.8)
Hispanic or Latino	573 (0.9)	670 (1.1)	14.9 (1.7 to 28.2)	667 (1.1)	14.9 (1.7 to 28.1)	742 (1.2)	24.8 (10.7 to 38.8)
Multiracial	63 (0.9)	65 (0.9)	1.5 (−38.9 to 41.9)	70 (0.9)	−7.5 (−43.5 to 28.6)	85 (1.0)	9.1 (−31.3 to 49.6)
Total§§	**4,067 (1.2)**	**4,589 (1.4)**	**10.5 (5.7 to 15.3)**	**4,677 (1.4)**	**13.7 (8.8 to 18.6)**	**4,509 (1.3)**	**9.1 (4.4 to 13.9)**

Abbreviations: AI/AN = American Indian or Alaska Native; NA = not applicable; NH/OPI = Native Hawaiian or other Pacific Islander.

* *International Classification of Diseases, Tenth Revision* underlying cause of death codes W65–W74, V90, and V92.

† Unintentional drowning deaths per 100,000 population.

§ All rates are age-adjusted to the 2000 U.S. Census Bureau population using the direct method, except the age-group specific rates.

¶ Percentage change was compared with 2019 and was calculated comparing rates from each year to 2019. For example, percentage change from 2019 to 2020 was calculated as ([2020 rate − 2019 rate] / [2019 rate]) × 100; rates were rounded to four decimal places for all calculations and rounded to one decimal place in the table. Percentage change is considered significant if the 95% CI excludes zero.

** Hispanic or Latino ethnicity includes persons of any race. Racial groups exclude persons of Hispanic ethnicity. Persons with unknown ethnicity are excluded from race and ethnicity groups but are included in the overall total.

†† Dash indicates death counts based on fewer than 10 deaths suppressed for confidentiality; death rates based on fewer than 20 deaths are suppressed because of unreliability.

§§ Total rates include race and ethnicity and age group not stated.

Recreational Water Exposure

Approximately one half (51.2%) of adults reported spending time at a swimming pool in the preceding 6 months, and 44.5% reported spending time near other bodies of water, such as an ocean, lake, or river. Reported prevalence of having spent time at a swimming pool declined with increasing age: 59.0% of adults aged 18–29 and 58.4% of those aged 30–44 years reported having spent time at a swimming pool, compared with 37.9% of adults aged ≥65 years. Similarly, 49.5% of adults aged 18–29, 51.4% of those aged 30–44, and 45.3% of adults aged 45–64 years reported spending one or more days at other bodies of water, compared with 31.0% of older adults. A significantly higher percentage of Black adults reported spending no time at a swimming pool (67.0%) or other body of water (74.0%) during the previous 6 months than did White adults (43.9% and 49.8%, respectively) or Hispanic adults (47.7% and 58.6%, respectively).

Discussion

Unintentional drowning death rates in the United States were higher in 2020, 2021, and 2022 than in 2019. The increases in drowning deaths coinciding with the COVID-19 pandemic and new national estimates of self-reported swimming skill, swimming lesson participation, and recreational water exposure highlight the need to increase access to effective drowning prevention strategies such as basic swimming and water safety skills training to reduce drowning risk.

This analysis identified notable increases in drowning death rates among groups that were already disproportionately affected, including children aged 1–4 years, older adults, and Black persons. Although drowning rates among AI/AN persons did not increase, rates in this group continued to be the highest among any racial or ethnic group. Drowning death rates have not historically been disproportionately high among Hispanic persons; however, drowning death rates

TABLE 2. Self-reported swimming skill, swimming lesson participation, and exposure to recreational water during the previous 6 months among adults, by sex, age group, and race and ethnicity — National Center for Health Statistics Rapid Surveys System, United States, October–November 2023

Characteristic	Total	Sex		Age group, yrs				Race and ethnicity*			
		Female	Male	18–29	30–44	45–64	≥65	Black or African American	White	Hispanic or Latino	Other
Swim skill level†											
Does not know how to swim											
Weighted %	**15.4**	19.4	11.2	12.4	15.6	15.0	18.6	36.8	6.9	25.8	22.4
(95% CI)	**(14.3–16.6)**	(17.8–21.2)	(9.8–12.7)	(9.9–15.3)	(13.3–18.1)	(13.1–16.9)	(16.6–20.7)	(32.4–41.4)	(6.1–7.8)	(22.5–29.3)	(17.9–27.5)
Weighted no. (× 1,000)	**39,527**	25,529	13,998	6,848	10,299	11,649	10,732	11,719	10,896	11,429	4,545
Comfortable in water where they can stand											
Weighted %	**17.0**	19.4	14.4	19.8	14.5	14.8	20.0	27.0	13.7	20.0	20.4
(95% CI)	**(15.9–18.1)**	(17.8–21.0)	(12.9–16.0)	(16.5–23.5)	(12.6–16.6)	(13.1–16.6)	(18.0–22.1)	(23.0–31.2)	(12.6–14.9)	(16.9–23.3)	(16.3–25.0)
Weighted no. (× 1,000)	**43,547**	25,473	18,075	10,923	9,574	11,529	11,521	8,591	21,690	8,836	4,128
Can swim in water over their head											
Weighted %	**31.8**	30.8	32.8	32.9	30.0	32.1	32.4	18.8	36.7	25.7	29.1
(95% CI)	**(30.4–33.2)**	(29.0–32.7)	(30.8–34.9)	(29.4–36.7)	(27.6–32.6)	(29.8–34.4)	(30.0–34.9)	(15.5–22.4)	(35.0–38.5)	(22.3–29.3)	(24.3–34.3)
Weighted no. (× 1,000)	**81,656**	40,506	41,150	18,147	19,810	24,969	18,730	5,977	57,977	11,371	5,898
Can swim multiple strokes efficiently											
Weighted %	**35.8**	30.4	41.6	34.8	39.9	38.2	29.0	17.4	42.6	28.5	28.1
(95% CI)	**(34.5–37.2)**	(28.6–32.2)	(39.5–43.7)	(31.2–38.6)	(37.0–42.8)	(35.9–40.5)	(26.8–31.4)	(14.2–21.0)	(40.9–44.4)	(25.1–32.1)	(23.5–33.1)
Weighted no. (× 1,000)	**91,991**	39,897	52,095	19,170	26,314	29,745	16,762	5,549	67,299	12,626	5,694
Swimming lessons§											
Has taken private swimming lesson from a professional§											
Weighted %	**14.2**	13.5	14.9	16.2	15.0	13.5	12.2	12.6	15.7	10.0	14.3
(95% CI)	**(13.2–15.2)**	(12.2–14.9)	(13.4–16.4)	(13.5–19.2)	(13.0–17.2)	(12.0–15.1)	(10.6–13.9)	(9.8–15.8)	(14.4–16.9)	(7.8–12.7)	(10.9–18.4)
Weighted no. (× 1,000)	**36,320**	17,756	18,564	8,899	9,897	10,462	7,063	4,024	24,651	4,429	2,903
Has taken group swimming lesson from a professional§											
Weighted %	**33.9**	34.1	33.7	37.0	35.5	32.7	30.7	25.1	39.7	19.6	34.6
(95% CI)	**(32.5–35.3)**	(32.3–35.9)	(31.6–35.8)	(33.2–40.9)	(32.8–38.4)	(30.4–35.0)	(28.4–33.0)	(21.4–29.1)	(38.0–41.4)	(16.6–22.9)	(29.7–39.8)
Weighted no. (× 1,000)	**87,008**	44,809	42,199	20,392	23,430	25,431	17,756	8,002	62,623	8,709	7,015
Has taken other swimming lesson§											
Weighted %	**7.7**	7.2	8.2	5.4	7.7	8.4	9.1	8.1	8.3	5.3	7.9
(95% CI)	**(7.0–8.5)**	(6.3–8.2)	(7.2–9.4)	(3.9–7.2)	(6.2–9.3)	(7.2–9.7)	(7.7–10.6)	(6.0–10.5)	(7.4–9.3)	(3.9–7.1)	(5.3–11.4)
Weighted no. (× 1,000)	**19,799**	9,471	10,328	2,977	5,057	6,539	5,225	2,579	13,091	2,352	1,609
Has ever taken a swimming lesson§											
Weighted %	**45.3**	44.8	45.8	46.9	47.0	44.7	42.6	36.9	51.8	28.1	46.6
(95% CI)	**(43.8–46.8)**	(42.9–46.8)	(43.6–48.0)	(42.9–50.9)	(44.0–50.1)	(42.3–47.1)	(40.1–45.1)	(32.7–41.2)	(50.1–53.5)	(24.7–31.6)	(41.2–52.1)
Weighted no. (× 1,000)	**115,996**	58,772	57,224	25,779	30,925	34,727	24,564	11,704	81,609	12,356	9,423
Time at pool¶											
None											
Weighted %	**48.8**	47.5	50.3	41.0	41.6	50.6	62.1	67.0	43.9	47.7	58.9
(95% CI)	**(47.4–50.3)**	(45.5–49.5)	(48.2–52.3)	(37.1–44.9)	(38.8–44.6)	(48.2–53.0)	(59.6–64.5)	(62.7–71.1)	(42.2–45.6)	(43.9–51.6)	(53.4–64.3)
Weighted no. (× 1,000)	**125,352**	62,466	62,886	22,564	27,368	39,494	35,926	21,451	69,364	21,012	11,937
1–6 days											
Weighted %	**28.2**	28.8	27.5	36.5	31.6	26.0	19.2	22.5	28.5	32.9	25.8
(95% CI)	**(26.9–29.5)**	(27.0–30.7)	(25.6–29.3)	(32.9–40.3)	(28.9–34.3)	(23.9–28.2)	(17.3–21.3)	(18.8–26.5)	(26.9–30.1)	(29.2–36.7)	(21.0–31.1)
Weighted no. (× 1,000)	**72,253**	37,890	34,363	20,108	20,744	20,280	11,121	7,202	44,999	14,473	5,229
≥7 days											
Weighted %	**23.0**	23.7	22.3	22.5	26.8	23.4	18.7	10.5	27.6	19.4	15.2
(95% CI)	**(21.8–24.2)**	(22.1–25.3)	(20.6–24.0)	(19.3–25.9)	(24.3–29.4)	(21.4–25.5)	(16.7–20.7)	(8.0–13.5)	(26.1–29.2)	(16.6–22.6)	(11.8–19.2)
Weighted no. (× 1,000)	**59,050**	31,158	27,893	12,380	17,613	18,251	10,807	3,377	43,573	8,555	3,087

See table footnotes on the next page.

TABLE 2. (*Continued*) Self-reported swimming skill, swimming lesson participation, and exposure to recreational water during the previous 6 months among adults, by sex, age group, and race and ethnicity — National Center for Health Statistics Rapid Surveys System, United States, October–November 2023

Characteristic	Total	Sex		Age group, yrs				Race and ethnicity*			
		Female	Male	18–29	30–44	45–64	≥65	Black or African American	White	Hispanic or Latino	Other
Time at other body of water**											
None											
Weighted % (95% CI)	**55.4 (54.0–56.9)**	55.5 (53.6–57.5)	55.3 (53.2–57.4)	50.5 (46.5–54.5)	48.6 (45.6–51.6)	54.7 (52.3–57.2)	69.0 (66.5–71.3)	74.0 (70.0–77.7)	49.8 (48.1–51.6)	58.6 (54.5–62.7)	61.7 (56.2–66.9)
Weighted no. (× 1,000)	**141,865**	72,676	69,189	27,694	31,970	42,484	39,717	23,671	78,419	25,807	12,454
1–6 days											
Weighted % (95% CI)	**27.5 (26.2–28.9)**	28.3 (26.5–30.2)	26.7 (24.9–28.7)	33.8 (30.2–37.6)	31.1 (28.4–33.8)	26.4 (24.4–28.6)	19.0 (17.1–21.2)	20.3 (16.9–24.1)	29.3 (27.7–31.0)	28.0 (24.5–31.7)	24.6 (20.1–29.6)
Weighted no. (× 1,000)	**70,489**	37,058	33,431	18,560	20,438	20,521	10,970	6,503	46,143	12,326	4,974
≥7 days											
Weighted % (95% CI)	**17.0 (16.0–18.1)**	16.1 (14.7–17.6)	17.9 (16.4–19.5)	15.7 (13.0–18.8)	20.3 (18.1–22.7)	18.8 (16.9–20.8)	12.0 (10.4–13.7)	5.6 (3.8–8.0)	20.8 (19.4–22.3)	13.3 (10.7–16.4)	13.7 (10.2–17.9)
Weighted no. (× 1,000)	**43,519**	21,098	22,422	8,636	13,371	14,606	6,906	1,805	32,776	5,872	2,766

Source: National Center for Health Statistics (NCHS), Rapid Surveys System, Round 2, October–November 2023. All estimates shown meet the NCHS standards of reliability. https://www.cdc.gov/nchs/rss/rapid-surveys-system.html

* Persons identified as Hispanic or Latino (Hispanic) might be of any race. Persons identified as Black or African American, White, or Other are all non-Hispanic. Other race includes persons who identify as Asian, American Indian or Alaska Native, Middle Eastern or North African, Native Hawaiian or other Pacific Islander, or multiracial.

† Respondents were asked, "How would you rate your swimming skill level?"

§ Respondents were asked, "Have you taken private swim lessons from a professional or certified instructor?" and "Have you taken group swim lessons from a professional or certified instructor?" Respondents who answered "no" (or did not respond to the question) were asked, "Have you ever taken a swim lesson?" (other swim lesson). Respondents were coded as "Has ever taken a swim lesson" if they responded "yes" to any of those three questions.

¶ Respondents were asked, "In the past 6 months, on how many days in total did you spend time in or around a swimming pool?"

** Respondents were asked, "In the past 6 months, on how many days in total did you go swimming, boating, fishing, or participate in water sports in another body of water such as an ocean, lake, river, or stream?"

among Hispanic persons were significantly higher in 2020, 2021, and 2022, compared with the rate in 2019. Findings related to adults' exposure to recreational water suggest that population-based drowning rates might be underestimating disparities. For example, older adults and Black adults reported significantly less exposure to recreational water than did other adults, indicating that if drowning rates were calculated based on exposure rather than population, rates in these groups would be even higher.

Increasing unintentional drowning deaths among children aged 1–4 years might partly reflect disruptions caused by the COVID-19 pandemic. Although children spent more time at home, where exposure to backyard pools and other water sources might have increased, and family routines were modified, drowning death rates among children aged 1–4 years did not increase significantly in 2020, when these conditions were most likely to prevail. Significant increases in drowning death rates in this age group during 2021 and 2022 underscore the importance of implementing effective drowning prevention strategies including installing four-sided pool fencing; providing close, constant, and attentive supervision; using life jackets; and beginning swimming lessons as soon as children are developmentally ready (*9*).

Unintentional drowning death rates among persons aged 15–44 years increased in 2020. Although information on alcohol use was not included in this analysis, previous research has indicated that alcohol use is a major risk factor for drowning among teens and adults: a recent meta-analysis found that 31% of drowning deaths were attributable to alcohol (*10*). Previous studies have identified high self-reported alcohol use during aquatic activities, with 25%–61% of persons aged 15–34 years reporting alcohol use around water (*11*). Drowning prevention strategies for teens and adults should include comprehensive approaches to reducing alcohol use around water, in addition to learning basic swimming and water safety skills and wearing life jackets.

Unintentional drowning death rates among persons aged 65–74 years increased in 2022 and among persons aged ≥85 years in 2021. These increases align with recent trends: drowning death rates among adults aged ≥65 years have been increasing for decades (*2*), and survey respondents in this age group were significantly less likely to report knowing how to swim than were young adults. More work is needed to understand the circumstances of drowning among older adults in the United States and to develop tailored drowning prevention strategies.

Summary

What is already known about this topic?

Approximately 4,000 unintentional drowning deaths occur annually in the United States, and demographic disparities exist.

What is added by this report?

Compared with unintentional drowning death rates in 2019 (pre–COVID-19 pandemic), rates were significantly higher during 2020, 2021, and 2022, with highest rates among children aged 1–4 years, non-Hispanic American Indian and Alaska Native persons, and non-Hispanic Black or African American persons. National survey data revealed that 55% of U.S. adults have never taken a swimming lesson, and swimming lesson participation differed by demographic characteristics.

What are the implications for public health practice?

The U.S. National Water Safety Action Plan provides recommendations for drowning prevention actions, including increasing access to basic swimming and water safety skills training for all persons, which could reduce disparities in unintentional drowning deaths.

Survey data revealed lower self-reported swimming skill and swimming lesson participation among some of the groups with the highest drowning death rates or the highest percentage increases in drowning death rates, including among Black and Hispanic persons and older adults. For example, approximately one third of Black adults reported not knowing how to swim, and significantly more Black and Hispanic adults than White adults reported never having taken a swimming lesson. Taking formal swimming lessons reduces the risk for drowning (*5*,*6*). Disparities in access to swimming skills training might be one factor contributing to disproportionate drowning death rates among some groups. These disparities are influenced by complex historical, structural, and social factors. Research suggests that differences in participation in swimming has been affected by inequitable structural environments (e.g., availability of swimming pools) and social exclusivity (*7*). Historically, racially segregated pools led to fewer swimming options for Black persons, and available pools were often too small and shallow for swimming (*12*). When integration of public pools was mandated, many pools closed, fewer new pools were built, and private swimming clubs emerged that restricted access for Black persons through discriminatory membership or residential requirements (*12*).

Barriers to swimming participation persist: a recent survey identified nearby swimming pool access, among other social and structural factors, as a major barrier to swimming skills training reported by Black and AI/AN persons (*13*), two racial groups at increased risk for drowning. The COVID-19 pandemic also affected the availability of swimming lessons because local restrictions caused many pools to close, and once they reopened, they faced staffing shortages (*8*). Examining the factors that contribute to inequities in learning to swim is important for developing and implementing strategies that increase access to culturally responsive basic swimming and water safety skills training programs. The U.S. National Water Safety Action Plan** (2023–2032) serves as a roadmap for reducing drowning and provides a framework for communities to use to develop and implement local action plans. The plan calls upon communities and organizations to build or revitalize publicly accessible swimming pools; provide affordable, accessible, and culturally competent swimming lessons; embed diversity, equity, inclusion, and cultural training into aquatics programs; and hire and train diverse personnel. The plan includes tools to support communities in implementing these and other actions to increase access to swimming lessons and thereby reduce the risk for drowning (*14*).

Limitations

The findings in this report are subject to at least five limitations. First, racial and ethnic group designation might involve misclassification that could lead to over- or underestimating the rates among some groups (*15*). Second, the 2021 and 2022 NVSS population estimates are based on the blended base estimates calculated by the U.S. Census Bureau, which differ from the method for calculating population estimates in previous years (*16*,*17*). This change is specifically noticeable in the population aged ≥85 years in 2021 and might partially contribute to the large increase in unintentional drowning death rates in that population. Third, this analysis did not include information on the circumstances of the drowning deaths, which could guide the development of tailored drowning prevention strategies. Fourth, the RSS web-based panel survey has a lower response rate than do other large-scale national surveys conducted by CDC and might underrepresent certain subpopulations, increasing the potential for nonresponse bias (*18*). RSS reduces nonresponse bias through calibration and weighting of RSS data to benchmark National Center for Health Statistics surveys that use methods to maximize relevance, accuracy, and reliability but require a longer period for data collection and processing than do rapid surveys (*19*). Finally, respondents in both panels complete demographic questions before participating in any surveys; therefore, demographic measures were not collected at the same time as the swimming skill and water exposure measures, and this process might lead to some misclassification.

Implications for Public Health Practice

Increases in unintentional drowning death rates during 2020–2022, including increases among populations that were

** https://www.watersafetyusa.org/nwsap.html

already at elevated risk, such as young children, older adults, and Black persons, have highlighted the urgency of implementing evidence-based prevention strategies that can have immediate and lasting benefits. Basic swimming and water safety skills training can reduce the risk for drowning (*5*,*6*), but social and structural barriers to accessing this training persist; these barriers disproportionately affect groups at the highest risk for drowning. Addressing system-level barriers to accessing basic swimming and water safety skills training could curb increasing drowning rates and reduce inequities.

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Notes from the Field

Clade II Mpox Surveillance Update — United States, October 2023–April 2024

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Two clades of monkeypox virus (MPXV) are known to cause human illness: clade I, which is endemic in Central Africa and is currently increasing in the Democratic Republic of the Congo, and clade II, which caused a global outbreak starting in 2022. Clade II–associated disease is considered less severe than that of clade I and is typically self-limiting; however, immunocompromised persons, especially those with advanced HIV (i.e., CD4 T lymphocyte cell count <200 cells/mm^3), have experienced more severe infections (*1,2*). Clade II MPXV continues to circulate at low levels in the United States, but no cases of clade I MPXV have been reported. National mpox case counts peaked at approximately 3,000 per week during late July–August 2022 (Figure), then sharply declined and remain substantially lower than case counts during the peak (59 cases per week during October 1, 2023–April 30, 2024). This report summarizes mpox surveillance data reported to CDC during October 1, 2023–April 30, 2024. This activity was reviewed by CDC, deemed not research, and was conducted consistent with federal law and CDC policy.*

Investigation and Outcomes

During October 1, 2023–April 30, 2024, a total of 1,802 probable and confirmed† mpox cases were reported to CDC by 42 states, the District of Columbia, and Puerto Rico. Whereas local mpox case counts have fluctuated, national counts have remained steady, with an average of 59 cases per week. Cases continue to occur primarily among cisgender men (1,054 [94%] of 1,121 who reported data on gender identity) and those who identified as gay or bisexual (326 [90%] of 361 who reported sexual orientation data). Most cases (62%) occurred among persons aged 25–40 years, with a median age of 34 years (range = 0–76 years); six (0.4%) cases occurred among persons aged <18 years. Race and ethnicity were reported for 1,651 (98%) cases; among these persons, 526 (34%) identified as Hispanic or Latino (Hispanic), 535 (32%) as White, 410 (25%) as Black or African American (Black), 54 (3%) as Asian, 31 (2%) as multiracial, and 59 (4%) as another race, including American Indian or Alaska Native and Native Hawaiian or Pacific Islander.§ Among 593 persons with mpox who reported HIV status, 282 (48%) were HIV-positive. Among 1,429 patients with mpox and with hospitalization data reported, 145 (10%) were hospitalized during their illness; among these, 72 reported HIV status, 49 (68%) of whom were HIV-positive. Since October 2023, five patients with mpox have died. Among 684 (38%) persons with mpox who reported vaccination status, 458 (67%) persons reported no vaccination against mpox, and 226 (33%) had received at least 1 dose of vaccine against mpox or smallpox. Of those receiving at least 1 dose, only two (1%) were hospitalized during their illness.

Preliminary Conclusions and Actions

MPXV transmission continues at low levels in the United States. CDC continues to perform genomic sequencing and MPXV clade–specific testing to identify MPXV mutations that affect medical countermeasure effectiveness (i.e., resistance to the antiviral tecovirimat) and to aid in clade I surveillance. To date, no clade I mpox cases have been detected in the United States.

The current average of 59 reported cases per week represents a fifty-five-fold reduction, compared with the peak of 3,274 cases reported during the week beginning July 31, 2022 (the peak outbreak week); levels have remained stable since October 2023. Compared with cases reported during May 10, 2022–September 30, 2023, the proportion of cases among Black persons declined by 7 percentage points (from 32% to 25%) and increased among Hispanic persons by 3 percentage points (from 31% to 34%) since October 2023.¶ Hospitalizations during this period have increased slightly (10% of cases during October 1, 2023–April 30, 2024, compared with 8% during May 10, 2022–September 30, 2023). Mpox-related deaths in the United States remain rare (0.3% of cases since October 2023). More than two thirds (67%) of new mpox cases occur among persons not previously vaccinated. Since the start of the outbreak, 39% of persons at risk for mpox exposure have received at least 1 dose of vaccine, and 25% have received 2 doses (*3*). Thus, the majority of persons at risk for mpox exposure remain unvaccinated. CDC recommends that persons at risk for mpox exposure, who have not previously recovered from mpox, receive 2 doses of JYNNEOS vaccine and complete the 2-dose vaccination series, irrespective of time since initial dose or route of vaccination.**,††

* 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

† https://www.cdc.gov/poxvirus/mpox/clinicians/case-definition.html (Accessed April 24, 2024).

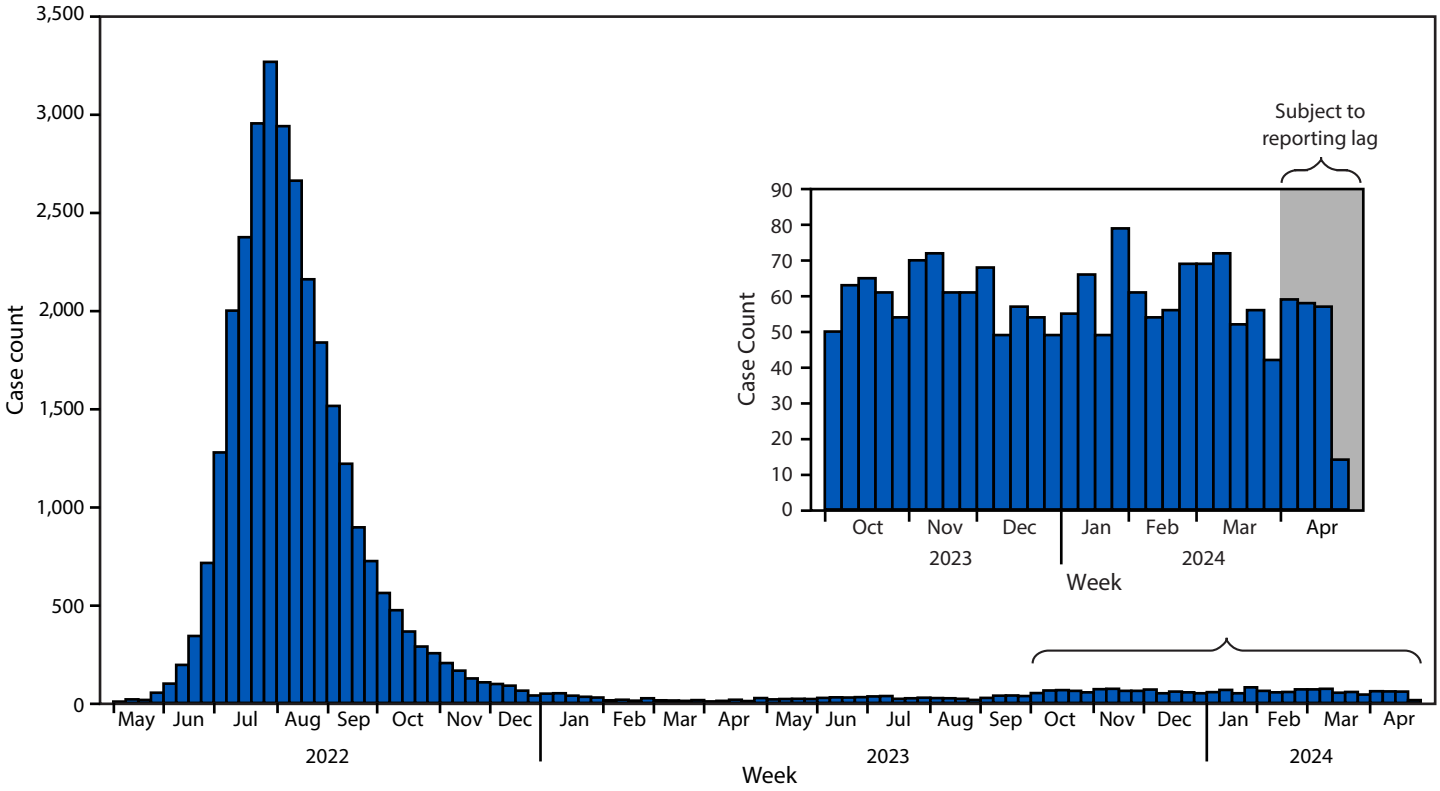
§ Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

¶ https://www.cdc.gov/poxvirus/mpox/response/2022/demographics.html

** https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/smallpox.html (Accessed April 24, 2024).

†† https://www.cdc.gov/poxvirus/mpox/vaccines/vaccine-recommendations.html (Accessed May 9, 2024).

FIGURE. Clade II mpox cases (probable* and confirmed†), by epidemiologic week — United States, May 2022–April 2024§



Abbreviations: IgM = immunoglobulin M; MPXV = monkeypox virus; PCR = polymerase chain reaction.

* Probable cases are defined as infections in persons with no suspicion of other recent *Orthopoxvirus* exposure (e.g., Vaccinia virus in ACAM2000 vaccination) and demonstration of the presence of at least one of the following criteria: 1) *Orthopoxvirus* DNA by PCR testing of a clinical specimen, 2) *Orthopoxvirus* using immunohistochemical or electron microscopy testing methods, or 3) demonstration of detectable levels of antiorthopoxvirus IgM antibody during the 4–56 days after rash onset.

† Confirmed cases are defined as demonstrated presence of MPXV DNA by PCR testing or next-generation sequencing of a clinical specimen or isolation or MPXV in culture from a clinical specimen.

§ Data on confirmed and probable mpox cases collected by jurisdictional public health departments and electronically reported through the National Notifiable Disease Surveillance System or via a standardized case report form.

Summary

What is already known about this topic?

Since the global mpox outbreak began in 2022, mpox cases have continued to occur in the United States.

What is added by this report?

After the peak of the 2022 mpox outbreak, when approximately 3,000 cases per week were reported, cases declined sharply and remain significantly lower (approximately 59 reported cases per week during October 1, 2023–April 30, 2024). Most new mpox cases occur in unvaccinated persons.

What are the implications for public health practice?

CDC recommends that persons at risk for mpox exposure, who have not previously recovered from mpox (including certain gay, bisexual, and other men who have sex with men) complete the 2-dose JYNNEOS vaccination series.

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