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Prevalence of Disability by Occupation Group — United States, 2016–2020

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In 2020, approximately 21.5 million employed U.S. adults aged 18–64 years had some form of disability. Although 75.8% of noninstitutionalized persons without disability aged 18–64 were employed, only 38.4% of their counterparts with disability were employed (*1*). Persons with disability have job preferences similar to persons without disability but might encounter barriers (e.g., lower average training or education levels, discrimination, or limited transportation options) that affect the types of jobs they hold (*2*,*3*). CDC analyzed 2016–2020 Behavioral Risk Factor Surveillance System (BRFSS) data from 35 states and Guam to estimate disability prevalences, by type and occupation group, among currently employed U.S. adults aged 18–64 years. The highest adjusted disability prevalences were among workers in three of the 22 major occupation groups: food preparation and serving-related (19.9%); personal care and service (19.4%); and arts, design, entertainment, sports, and media (17.7%). Occupation groups with the lowest adjusted disability prevalences were business and financial operations (11.3%), health care practitioners and technicians (11.1%), and architecture and engineering (11.0%). The distributions of persons with and without disability differ across occupations. Workplace programs that address the training, education, and workplace needs of employees with disability might improve workers' ability to enter, thrive in, and advance in a wider range of occupations.

BRFSS is an annual, random-digit–dialed telephone survey of noninstitutionalized, U.S. civilian residents aged ≥18 years. Conducted by states and territories, BRFSS gathers data on health-related risk behaviors, chronic illnesses and conditions, and use of health-related services.* The BRFSS questionnaire comprises standard and rotating core questions asked by all states and territories, as well as optionally administered topical modules and state-added questions. Thirty-five states and Guam† administered the optional industry and occupation module at least 1 year during 2016–2020. The median, combined mobile phone and landline response rate during the 2016–2020 survey years for all states, territories, and the District of Columbia ranged from 45.9% to 49.9%.§

* https://www.cdc.gov/brfss/about/index.htm

† States and territories contributing data for at least 1 year during 2016–2020: Alaska, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Iowa, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Vermont, Washington, Wisconsin, and Guam.

§ https://www.cdc.gov/brfss/annual_data/2016/pdf/2016-sdqr.pdf; https://www.cdc.gov/brfss/annual_data/2017/pdf/2017-sdqr-508.pdf; https://www.cdc.gov/brfss/annual_data/2018/pdf/2018-sdqr-508.pdf; https://www.cdc.gov/brfss/annual_data/2019/pdf/2019-sdqr-508.pdf; https://www.cdc.gov/brfss/annual_data/2020/pdf/2020-sdqr-508.pdf

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To determine occupation, employed respondents were asked, "What kind of work do you do, for example, registered nurse, janitor, cashier, auto mechanic?"[¶] Participants' responses were recorded as free text and later coded by an auto-coding system or computer-assisted human coders[**] to one of 22 two-digit standard occupational classification major groups promulgated by the U.S. Department of Labor Bureau of Labor Statistics.[††] To assess disability, respondents were asked the six-item question set on hearing, vision, cognition, mobility, self-care, and independent living[§§] in the BRFSS core questionnaire. Respondents replying "Yes" to at least one of these questions are considered to have a disability.

Among the 2016–2020 BRFSS participants who completed the industry and occupation optional module (1,053,331), 50.1% were currently employed and considered for analyses. Among respondents, those on active military duty (0.3%); those who were employed but reported "unpaid," "retired," or "disabled" as their occupation (0.1%); those who provided insufficient information to code occupation (6.9%); those who were missing information for occupation (7.4%); and adults ≥aged 65 years (11.5%) were excluded. The final analytic sample contained 395,141 respondents. Respondents with missing information for a specific disability type (2.2% missing for hearing, 2.4% for vision, 2.7% for cognitive, 2.7% for mobility, 2.7% for self-care, 2.9% for independent living, and 3.2% for any disability) were removed from the respective analyses. Prevalence of disability status and types were calculated for the 22 major occupation groups with and without adjustment for these sociodemographic variables: age group (18–24, 25–34, 35–44, 45–54, or 55–64 years), sex, race and ethnicity (non-Hispanic Black or African American, non-Hispanic White, Hispanic or Latino [Hispanic], or non-Hispanic other race or multiracial), and education level (less than high school diploma, high school diploma, some college, or college graduate or above). Adjusted prevalence estimates were obtained using log-linear regression analyses with a robust variance estimator while adjusting for sociodemographic variables. Analyses were conducted with SAS-callable SUDAAN (version 11.0.3; RTI International) to account for the complex survey design. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[¶¶]

Overall, 14.8% of currently employed U.S. adults aged 18–64 years reported having a disability (Table 1). Cognitive disability (7.0%) was the most frequently reported disability type; self-care disability (1.0%) was least frequently reported.

¶ https://www.cdc.gov/niosh/docs/2022-125/pdf/2022-125.pdf?id=10.26616/NIOSHPUB2022125
** https://csams.cdc.gov/nioccs/HelpCodingSchemes.aspx
†† https://www.bls.gov/soc/2010/2010_major_groups.htm
§§ https://www.cdc.gov/brfss/data_documentation/pdf/BRFSS_Data_Users_Guide_on_Disability_Questions_2018-508.pdf

¶¶ 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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TABLE 1. Unadjusted, weighted prevalence estimates of any disability and disability type* among currently employed† U.S. adults aged 18–64 years, by selected characteristics — Behavioral Risk Factor Surveillance System, 35 states and Guam, 2016–2020

Characteristic	No. of respondents§	Disability type,¶ % (95% CI)						
		Hearing	Vision	Cognitive	Mobility	Self-care	Independent living	Any
All currently employed	**395,141**	**2.9 (2.8–3.1)**	**2.6 (2.5–2.8)**	**7.0 (6.8–7.2)**	**4.6 (4.4–4.7)**	**1.0 (0.9–1.0)**	**2.2 (2.1–2.4)**	**14.8 (14.4–15.1)**
Age group, yrs								
18–24	27,515	1.9 (1.6–2.3)	3.6 (3.0–4.2)	13.9 (13.1–14.9)	1.9 (1.5–2.3)	0.6 (0.4–0.8)	4.4 (3.7–5.1)	19.5 (18.4–20.7)
25–34	68,325	1.7 (1.5–2.0)	2.5 (2.2–2.7)	8.8 (8.3–9.4)	2.4 (2.2–2.7)	0.7 (0.6–0.8)	2.7 (2.4–3.0)	14.0 (13.4–14.7)
35–44	82,164	2.1 (1.9–2.4)	1.8 (1.6–2.1)	6.0 (5.7–6.4)	3.4 (3.2–3.7)	0.8 (0.7–0.9)	1.8 (1.6–2.0)	11.7 (11.2–12.2)
45–54	103,278	3.2 (3.0–3.5)	3.1 (2.8–3.3)	5.1 (4.8–5.4)	5.6 (5.2–6.0)	1.1 (0.9–1.2)	1.7 (1.5–1.9)	13.9 (13.3–14.5)
55–64	113,859	5.4 (5.1–5.8)	2.8 (2.6–3.1)	4.5 (4.2–4.8)	8.7 (8.3–9.2)	1.5 (1.3–1.7)	1.6 (1.5–1.8)	17.7 (17.1–18.3)
Sex								
Men	200,106	3.8 (3.5–4.0)	2.5 (2.3–2.7)	6.3 (6.0–6.6)	3.9 (3.7–4.1)	1.0 (0.9–1.1)	1.7 (1.6–1.9)	14.1 (13.7–14.5)
Women	194,880	1.9 (1.8–2.1)	2.8 (2.6–3.0)	7.8 (7.5–8.2)	5.4 (5.2–5.7)	0.9 (0.8–1.0)	2.8 (2.6–3.0)	15.5 (15.1–16.0)
Race and ethnicity								
Black or African American, non-Hispanic	30,214	2.0 (1.7–2.4)	4.1 (3.6–4.5)	7.3 (6.8–7.8)	5.5 (5.1–6.0)	1.1 (0.9–1.4)	1.9 (1.7–2.3)	15.4 (14.7–16.2)
White, non-Hispanic	289,478	3.1 (3.0–3.3)	1.8 (1.7–2.0)	6.5 (6.2–6.7)	4.2 (4.0–4.3)	0.8 (0.8–0.9)	2.1 (2.0–2.2)	13.6 (13.2–14.0)
Hispanic or Latino	39,744	2.8 (2.4–3.1)	4.4 (3.9–4.8)	9.1 (8.5–9.7)	5.7 (5.2–6.2)	1.3 (1.1–1.6)	2.9 (2.5–3.4)	18.8 (17.9–19.7)
Other race or multiracial, non-Hispanic	30,074	2.8 (2.2–3.5)	2.2 (1.8–2.7)	5.8 (5.2–6.4)	3.5 (3.0–4.1)	0.8 (0.6–1.0)	1.8 (1.5–2.2)	12.5 (11.5–13.7)
Education level								
Less than high school	20,244	4.4 (3.9–4.9)	6.4 (5.7–7.2)	12.7 (11.7–13.7)	9.2 (8.5–10.0)	2.2 (1.8–2.6)	4.1 (3.6–4.6)	25.9 (24.8–27.1)
High school	94,389	3.6 (3.3–3.9)	3.4 (3.1–3.7)	9.2 (8.7–9.6)	5.2 (4.9–5.5)	1.1 (1.0–1.2)	2.8 (2.5–3.1)	18.1 (17.5–18.7)
Some college	109,255	3.2 (3.0–3.5)	2.4 (2.2–2.6)	7.5 (7.1–7.8)	4.9 (4.6–5.3)	1.0 (0.9–1.1)	2.5 (2.3–2.7)	15.9 (15.3–16.4)
College graduate	170,562	1.7 (1.5–1.8)	1.2 (1.1–1.3)	3.3 (3.1–3.5)	2.4 (2.3–2.6)	0.4 (0.4–0.5)	1.0 (0.9–1.1)	8.0 (7.6–8.3)
Veteran status								
Veteran	29,471	6.5 (5.8–7.2)	2.2 (1.8–2.8)	7.1 (6.5–7.8)	5.9 (5.4–6.6)	1.4 (1.2–1.8)	2.2 (1.9–2.6)	17.5 (16.5–18.5)
Nonveteran	365,344	2.7 (2.5–2.8)	2.7 (2.5–2.8)	7.0 (6.8–7.2)	4.5 (4.3–4.6)	0.9 (0.8–1.0)	2.2 (2.1–2.4)	14.6 (14.2–14.9)
Access to health care coverage								
Has access to health care coverage	350,384	2.7 (2.6–2.9)	2.2 (2.1–2.4)	6.2 (6.0–6.4)	4.4 (4.2–4.5)	0.9 (0.8–0.9)	2.0 (1.9–2.2)	13.5 (13.2–13.8)
Does not have access to health care coverage	43,458	4.0 (3.6–4.4)	5.1 (4.7–5.6)	11.9 (11.2–12.7)	6.0 (5.5–6.5)	1.6 (1.3–1.9)	3.5 (3.1–3.9)	22.2 (21.3–23.2)
Household income								
<$25,000	50,076	3.9 (3.5–4.3)	6.1 (5.6–6.6)	14.7 (13.9–15.6)	9.1 (8.5–9.6)	1.9 (1.7–2.2)	5.0 (4.5–5.5)	26.7 (25.7–27.7)
$25,000–$49,999	75,651	3.3 (3.0–3.6)	3.3 (3.0–3.5)	8.9 (8.4–9.4)	5.3 (5.0–5.6)	1.1 (1.0–1.3)	2.6 (2.4–2.9)	18.0 (17.4–18.6)
$50,000–$74,999	62,037	2.9 (2.6–3.2)	2.1 (1.8–2.4)	5.6 (5.2–6.1)	4.2 (3.8–4.7)	0.8 (0.6–1.0)	1.7 (1.5–2.0)	13.4 (12.7–14.1)
≥$75,000	164,319	2.2 (2.1–2.4)	1.1 (1.0–1.2)	3.4 (3.2–3.6)	2.6 (2.4–2.8)	0.5 (0.4–0.6)	1.0 (0.9–1.1)	8.7 (8.4–9.0)
Unknown	43,058	3.4 (3.0–3.9)	3.5 (3.1–4.0)	8.7 (8.1–9.4)	5.2 (4.7–5.7)	1.1 (0.9–1.4)	3.1 (2.7–3.6)	17.9 (16.9–18.9)

* Respondents were asked, "Are you deaf or do you have serious difficulty hearing?" (hearing); "Are you blind or do you have serious difficulty seeing, even when wearing glasses?" (vision); "Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?" (cognitive); "Do you have serious difficulty walking or climbing stairs?" (mobility); "Do you have difficulty dressing or bathing?" (self-care); and "Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping?" (independent living). Respondents who refused to answer, reported "don't know," and had other missing responses were excluded from the analyses.

† Respondents reported being either "employed for wages" or "self-employed" at the time of the interview, excluding active duty military or those missing information for occupation.

§ Unweighted.

¶ Each disability type might not be independent; one respondent might have two or more disability types.

Prevalences of all disability types were elevated among workers who had <a high school education, were Hispanic, were veterans, lacked access to health care coverage, or had a household income <$25,000 per year. Prevalence of the following types of disability were highest among workers aged 18–24 years: vision (3.6%), cognitive (13.9%), and independent living (4.4%). Prevalences were slightly higher among women than among men for any disability (15.5% versus 14.1%), vision (2.8% versus 2.5%), cognitive (7.8% versus 6.3%), mobility (5.4% versus 3.9%), and independent living (2.8% versus 1.7%) disability.

Prevalence of disability was highest in food preparation and serving-related (24.7%) and personal care and service (22.8%) occupation groups and lowest in the architecture and engineering group (8%) (Table 2). After adjustment for demographic characteristics (Table 3), occupation groups with

TABLE 2. Unadjusted, weighted prevalence estimates of any disability and disability type* among currently employed† U.S. adults aged 18–64 years, by major occupation groups§ — Behavioral Risk Factor Surveillance System, 35 states and Guam, 2016–2020

		Disability type**													
		Hearing		Vision		Cognitive		Mobility		Self-care		Independent living		Any	
Major occupation group	No. of respondents¶	Rank††	% (95% CI)	Rank††	% (95% CI)	Rank††	% (95% CI)	Rank††	% (95% CI)	Rank††	% (95% CI)	Rank††	% (95% CI)	Rank††	% (95% CI)
Management	46,710	10	2.7 (2.3–3.1)	18	1.3 (1.1–1.6)	18	3.9 (3.5–4.4)	14	3.6 (3.2–4.0)	14	0.7 (0.5–1.0)	16	1.4 (1.1–1.7)	15	10.3 (9.7–11.0)
Business and financial operations	17,691	21	1.6 (1.2–2.1)	20	1.2 (0.9–1.6)	17	4.1 (3.5–4.7)	17	2.9 (2.5–3.5)	18	0.6 (0.4–0.9)	15	1.6 (1.2–2.0)	19	9.3 (8.4–10.2)
Computer and mathematical	12,290	18	1.7 (1.3–2.3)	21	1.1 (0.8–1.6)	18	3.9 (3.3–4.6)	21	2.4 (1.8–3.1)	20	0.5 (0.3–0.7)	20	1.0 (0.8–1.3)	21	8.7 (7.7–9.8)
Architecture and engineering	11,076	13	2.2 (1.7–2.7)	22	0.9 (0.7–1.3)	22	2.9 (2.2–3.8)	17	2.9 (2.0–4.2)	14	—§§	20	1.0 (0.6–1.7)¶¶	22	8.0 (6.8–9.4)
Life, physical, and social science	5,913	14	2.1 (1.2–3.6)¶¶	16	1.6 (0.9–2.8)¶¶	15	4.7 (3.5–6.4)	22	1.6 (1.0–2.5)¶¶	11	0.8 (0.4–1.4)¶¶	17	1.2 (0.7–2.1)¶¶	17	9.7 (7.9–12.0)
Community and social services	9,220	18	1.7 (1.2–2.4)	13	1.9 (1.4–2.8)	13	5.5 (4.6–6.5)	11	4.8 (3.9–6.0)	11	0.8 (0.5–1.2)¶¶	14	1.8 (1.3–2.4)	13	12.4 (11.0–14.0)
Legal	4,768	21	1.6 (1.1–2.5)¶¶	14	1.7 (1.1–2.5)¶¶	21	3.5 (2.5–4.9)	20	2.8 (1.9–4.2)	22	0.3 (0.2–0.5)¶¶	22	0.8 (0.5–1.3)¶¶	20	9.2 (7.5–11.1)
Education, training, and library	29,714	18	1.7 (1.4–2.1)	18	1.3 (1.1–1.5)	16	4.6 (4.1–5.2)	15	3.4 (2.9–3.8)	18	0.6 (0.4–0.8)	17	1.2 (0.9–1.5)	16	9.9 (9.1–10.8)
Arts, design, entertainment, sports, and media	7,503	16	1.8 (1.4–2.4)	10	2.8 (2.0–4.0)	6	9.2 (7.7–10.9)	15	3.4 (2.8–4.3)	14	0.7 (0.5–1.1)§§	6	2.7 (2.1–3.4)	11	15.3 (13.5–17.4)
Health care practitioners and technicians	33,670	16	1.8 (1.4–2.2)	16	1.6 (1.3–1.9)	20	3.8 (3.2–4.4)	17	2.9 (2.6–3.3)	20	0.5 (0.4–0.6)	19	1.1 (0.9–1.4)	18	9.5 (8.6–10.5)
Health care support	9,627	14	2.1 (1.7–2.7)	5	4.3 (3.5–5.2)	4	10.9 (9.5–12.4)	3	6.9 (6.0–8.0)	9	1.1 (0.8–1.5)	3	3.6 (2.9–4.5)	4	20.0 (18.2–21.8)
Protective service	8,509	6	3.7 (2.7–4.9)	14	1.7 (1.2–2.4)	14	5.3 (4.2–6.7)	13	4.3 (3.4–5.4)	14	0.7 (0.4–1.2)¶¶	13	1.9 (1.3–2.7)	13	12.4 (10.7–14.3)
Food preparation and serving related	13,574	8	3.1 (2.6–3.7)	1	5.8 (4.8–7.1)	1	13.7 (12.5–15.1)	4	6.1 (5.4–6.9)	3	1.5 (1.2–2.0)	1	4.4 (3.7–5.3)	1	24.7 (23.1–26.4)
Building and grounds cleaning and maintenance	15,296	5	3.8 (3.2–4.7)	3	5.2 (4.5–6.1)	3	11.1 (10.1–12.3)	1	8.3 (7.4–9.2)	2	1.6 (1.3–2.1)	4	3.5 (2.9–4.2)	3	22.7 (21.2–24.3)
Personal care and service	12,249	9	2.8 (2.2–3.7)	4	4.8 (4.0–5.8)	2	11.7 (10.5–13.1)	2	7.6 (6.5–9.0)	4	1.4 (1.0–1.8)	2	4.3 (3.4–5.4)	2	22.8 (20.9–24.8)
Sales and related	35,095	11	2.5 (2.1–2.9)	12	2.6 (2.2–3.0)	5	9.6 (8.9–10.4)	12	4.5 (4.1–4.9)	10	0.9 (0.7–1.2)	5	2.9 (2.5–3.4)	9	16.5 (15.5–17.5)
Office and administrative support	37,977	12	2.4 (2.0–2.8)	11	2.7 (2.3–3.1)	12	7.2 (6.6–7.8)	6	5.2 (4.7–5.7)	11	0.8 (0.7–1.0)	8	2.6 (2.2–3.1)	12	14.9 (14.0–15.8)
Farming, fishing, and forestry	4,046	4	4.3 (3.1–6.0)	2	—§§	11	7.3 (5.4–9.8)	5	5.5 (3.4–8.8)¶¶	1	—§§	8	2.6 (1.4–4.6)¶¶	5	19.7 (15.8–24.4)
Construction and extraction	26,217	2	5.0 (4.4–5.7)	6	3.5 (2.9–4.2)	9	7.6 (6.9–8.4)	9	5.1 (4.5–5.8)	7	1.2 (1.0–1.5)	11	2.2 (1.9–2.6)	7	17.8 (16.7–18.9)
Installation, maintenance, and repair	15,034	1	5.9 (5.0–6.8)	7	3.1 (2.6–3.8)	10	7.4 (6.4–8.4)	10	5.0 (4.4–5.8)	4	1.4 (1.1–1.9)	6	2.7 (1.9–3.8)	6	18.0 (16.6–19.4)
Production	18,406	3	4.4 (3.9–5.0)	7	3.1 (2.6–3.7)	7	7.9 (7.1–8.9)	6	5.2 (4.6–5.9)	7	1.2 (0.9–1.6)	10	2.5 (2.1–2.9)	8	17.2 (16.1–18.4)
Transportation and material moving	20,556	6	3.7 (3.2–4.3)	9	3.0 (2.6–3.5)	8	7.8 (7.0–8.6)	6	5.2 (4.6–5.9)	6	1.3 (1.0–1.8)	12	2.0 (1.6–2.4)	9	16.5 (15.5–17.6)

See table footnotes on the next page.

TABLE 2. (*Continued*) Unadjusted, weighted prevalence estimates of any disability and disability type* among currently employed† U.S. adults aged 18–64 years, by major occupation groups§ — Behavioral Risk Factor Surveillance System, 35 states and Guam, 2016–2020

Abbreviation: SOC = Standard Occupational Classification.

* Respondents were asked, "Are you deaf, or do you have serious difficulty hearing?" (hearing); "Are you blind, or do you have serious difficulty seeing, even when wearing glasses?" (vision); "Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?" (cognitive); "Do you have serious difficulty walking or climbing stairs?" (mobility); "Do you have difficulty dressing or bathing?" (self-care); and "Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping?" (independent living). Respondents who refused to answer reported "don't know," and had other missing responses were excluded from the analyses.

† Respondents reported being either "employed for wages" or "self-employed" at the time of the interview, excluding active duty military or those missing information for occupation.

§ Twenty-two two-digit SOC major occupation groups (excluding military specific occupation group).

¶ Unweighted.

** Each disability type might not be independent; one respondent might have two or more disability types.

†† Occupation groups ranked in order of descending prevalence of disability type or any disability (highest prevalence = 1 to lowest prevalence = 22); rankings not indicative of statistical significance.

§§ Estimates suppressed because the relative SE is >30%.

¶¶ Estimates might be unstable because the relative SE is 20%–30%.

the highest disability prevalences were food preparation and serving-related (19.9%); personal care and service (19.4%); and arts, design, entertainment, sports, and media (17.7%). Disability prevalences were lowest for business and financial operations (11.3%), health care practitioners and technicians (11.1%), and architecture and engineering (11.0%) (Table 3). The highest prevalences of specific disability types were in food preparation and serving-related for vision (4.2%), personal care and service for mobility (6.0%), and arts, design, entertainment, sports, and media for cognitive (10.8%). The prevalence of hearing disability was highest for the following occupational groups: installation, maintenance, and repair (4.2%); construction and extraction (3.8%); production (3.5%); protective services (3.5%); and farming, fishing, and forestry (3.5%).

Discussion

This report is the first to examine differences in disability prevalence by occupation group and includes adjustment for age, sex, race and ethnicity, and education. Persons with disability face employment disparities, a multidimensional issue involving barriers to finding and keeping jobs, including noninclusive recruitment and hiring practices, lack of workplace communication and support, discrimination, and reduced workplace opportunities (*4,5*). Although the Americans with Disabilities Act protects the rights of most persons with disability who are employed or seeking jobs, additional resources could do more to shift attitudes and improve workplace equity (*6*). The higher percentage of persons with disability in service occupations (e.g., personal care and food preparation) might reflect better workplace programs, employees self-selecting into these jobs on the basis of perceived skill levels, less competition for these generally lower-wage jobs ($29,450–$33,620 mean annual wage compared with $58,260 for all occupations***), and other factors. Understanding differences in disability prevalence within and among occupation groups can help focus interventions and future research.

The proportion of working adults who reported a disability was highest among young adult workers and declined by age. This finding primarily reflects higher prevalences of cognitive disability among these younger workers. The ascertainment or prevalence of cognitive disabilities, which include autism spectrum differences, attention-deficit/hyperactivity disorder, and intellectual disability, has increased in recent years, particularly among children and adolescents; this finding might explain the higher prevalence of self-reported cognitive disabilities among young adult workers in the current study (*7*). With early diagnosis and interventions, young persons with disability are likely better positioned for productive employment and successful integration into the workforce (*8*). Alternatively, the declining prevalence of cognitive disability in older age groups might reflect longer continued employment among workers without congenital or acquired cognitive disabilities.

The highest prevalences of hearing disability were reported among five occupation groups: installation, maintenance, and repair; construction and extraction; production; farming, fishing, and forestry; and protective service. Several occupations within these groups involve loud work processes and equipment that increase the risk for occupational noise exposure (*9*); findings in these groups might be linked to the higher rates of occupational hearing loss. During 2006–2010, prevalence and incidence of occupational hearing loss was highest for mining, which encompasses many extraction occupations and construction industries (*9*). In addition, limited hearing function might not be a substantial entry barrier for these occupations. Hearing conservation programs and use of hearing protection might be important for these occupation groups.

The findings in this report are subject to at least five limitations. First, BRFSS data are self-reported, and recall or social desirability bias might influence the responses. Second, BRFSS data are cross-sectional, so temporality and causality cannot be inferred, and the work-relatedness of any reported disability is unknown. Third, the major occupation groups are broad and include component occupations with differing disability profiles. Fourth, the data do not allow differentiation of part-time

*** https://www.bls.gov/oes/current/oes_nat.htm

TABLE 3. Adjusted,* weighted prevalence estimates of any disability and disability type† among currently employed§ adults aged 18–64 years, by major occupation groups¶ — Behavioral Risk Factor Surveillance System, 35 states and Guam, 2016–2020

Major occupation group	No. of respondents**	Disability type††													
		Hearing		Vision		Cognitive		Mobility		Self-care		Independent living		Any	
		Rank§§	% (95% CI)	Rank§§	% (95% CI)	Rank§§	% (95% CI)	Rank§§	% (95% CI)	Rank§§	% (95% CI)	Rank§§	% (95% CI)	Rank§§	% (95% CI)
Management	46,710	14	2.5 (2.2–2.9)	19	1.7 (1.4–2.0)	20	5.0 (4.4–5.5)	17	3.8 (3.4–4.3)	15	0.8 (0.6–1.1)	18	1.7 (1.4–2.1)	18	11.8 (11.1–12.6)
Business and financial operation	17,691	21	1.9 (1.4–2.6)	21	1.6 (1.2–2.1)	17	5.3 (4.5–6.2)	20	3.3 (2.8–3.9)	15	0.8 (0.5–1.2)¶¶	13	1.9 (1.5–2.5)	20	11.3 (10.2–12.5)
Computer and mathematical	12,290	22	1.8 (1.3–2.5)	19	1.7 (1.3–2.4)	15	5.8 (4.9–6.9)	18	3.6 (2.8–4.6)	20	0.7 (0.5–1.0)	19	1.6 (1.3–2.1)	18	11.8 (10.4–13.3)
Architecture and engineering	11,076	18	2.1 (1.7–2.7)	22	1.5 (1.1–2.1)	22	4.4 (3.3–5.9)	11	4.4 (3.1–6.2)	9	—***	15	1.8 (1.0–3.0)¶¶	22	11.0 (9.3–13.0)
Life, physical, and social Science	5,913	11	2.6 (1.4–4.6)¶¶	9	2.7 (1.5–4.7)¶¶	9	7.0 (5.2–9.6)	22	2.3 (1.4–3.7)¶¶	3	1.2 (0.7–2.2)¶¶	15	1.8 (1.0–3.2)¶¶	13	13.7 (11.1–17.0)
Community and social services	9,220	15	2.4 (1.7–3.4)	10	2.6 (1.8–3.7)	7	7.4 (6.2–8.7)	2	5.9 (4.8–7.4)	6	1.1 (0.6–1.8)¶¶	9	2.3 (1.7–3.1)	7	16.1 (14.2–18.1)
Legal	4,768	18	2.1 (1.3–3.1)¶¶	10	2.6 (1.7–3.9)¶¶	18	5.2 (3.7–7.4)	19	3.5 (2.3–5.1)¶¶	22	—***	22	1.1 (0.7–1.8)¶¶	17	12.3 (10.0–15.1)
Education, training, and library	29,714	15	2.4 (2.0–3.0)	18	1.8 (1.5–2.1)	14	6.3 (5.6–7.1)	14	4.2 (3.6–4.7)	15	0.8 (0.6–1.2)	20	1.5 (1.2–1.9)	16	12.9 (11.9–14.1)
Arts, design, entertainment, sports, and media	7,503	18	2.1 (1.6–2.7)	3	3.6 (2.5–5.1)	1	10.8 (9.1–12.9)	15	4.1 (3.2–5.1)	13	0.9 (0.6–1.4)¶¶	1	3.1 (2.4–3.9)	3	17.7 (15.6–20.2)
Health care practitioners and technicians	33,670	17	2.3 (1.8–3.1)	16	2.0 (1.7–2.4)	21	4.5 (3.8–5.4)	21	3.2 (2.8–3.6)	21	0.6 (0.4–0.8)	21	1.2 (1.0–1.5)	21	11.1 (10.0–12.3)
Health care support	9,627	10	2.8 (2.2–3.5)	6	3.2 (2.6–4.0)	6	8.3 (7.3–9.5)	5	5.5 (4.8–6.3)	13	0.9 (0.6–1.3)	7	2.4 (1.9–3.0)	6	16.8 (15.2–18.4)
Protective service	8,509	3	3.5 (2.6–4.8)	17	1.9 (1.3–2.6)	16	5.7 (4.5–7.3)	7	5.0 (3.9–6.3)	15	0.8 (0.5–1.3)¶¶	11	2.2 (1.6–3.2)	15	13.2 (11.4–15.3)
Food preparation and serving related	13,574	6	3.4 (2.8–4.1)	1	4.2 (3.4–5.1)	2	9.2 (8.4 –10.2)	3	5.8 (5.1–6.6)	1	1.3 (1.0–1.6)	4	2.8 (2.4–3.3)	1	19.9 (18.6–21.2)
Building and grounds cleaning and maintenance	15,296	8	3.3 (2.7–4.0)	5	3.3 (2.8–3.9)	4	8.6 (7.7–9.5)	4	5.6 (5.0–6.2)	6	1.1 (0.8–1.4)	5	2.7 (2.2–3.3)	4	17.3 (16.0–18.6)
Personal care and service	12,249	6	3.4 (2.5–4.5)	2	4.0 (3.2–4.9)	2	9.2 (8.2 –10.3)	1	6.0 (5.0–7.1)	3	1.2 (0.9–1.6)	1	3.1 (2.4–4.0)	2	19.4 (17.8–21.2)
Sales and related	35,095	11	2.6 (2.2–3.1)	13	2.5 (2.2–2.9)	5	8.4 (7.8–9.1)	8	4.9 (4.5–5.3)	9	1.0 (0.8–1.3)	6	2.5 (2.1–2.9)	8	15.8 (14.9–16.8)
Office and administrative support	37,977	11	2.6 (2.2–3.2)	13	2.5 (2.2–2.9)	13	6.6 (6.0–7.2)	13	4.3 (3.9–4.7)	15	0.8 (0.6–1.0)	11	2.2 (1.8–2.7)	13	13.7 (12.9–14.6)
Farming, fishing, and forestry	4,046	3	3.5 (2.5–4.9)	4	3.4 (1.9–6.10)¶¶	18	5.2 (3.7–7.2)	15	4.1 (2.5–6.6)¶¶	3	—***	15	1.8 (1.0–3.2)¶¶	11	14.5 (11.9–17.7)
Construction and extraction	26,217	2	3.8 (3.3–4.3)	8	2.9 (2.3–3.5)	12	6.8 (6.1–7.5)	8	4.9 (4.3–5.6)	9	1.0 (0.8–1.2)	7	2.4 (2.0–2.9)	9	15.7 (14.7–16.8)
Installation, maintenance, and repair	15,034	1	4.2 (3.6–4.9)	7	3.0 (2.5–3.7)	8	7.3 (6.4–8.4)	6	5.3 (4.6–6.2)	1	1.3 (1.0–1.8)	1	3.1 (2.2–4.4)	5	17.0 (15.7–18.4)
Production	18,406	3	3.5 (3.0–3.9)	10	2.6 (2.2–3.0)	9	7.0 (6.3–7.9)	11	4.4 (3.9–5.0)	9	1.0 (0.7–1.3)	9	2.3 (1.9–2.7)	10	14.9 (13.9–16.0)
Transportation and material moving	20,556	9	2.9 (2.5–3.4)	15	2.4 (2.0–2.8)	9	7.0 (6.3–7.9)	10	4.6 (4.0–5.3)	6	1.1 (0.8–1.5)	13	1.9 (1.5–2.4)	11	14.5 (13.6–15.5)

Abbreviation: SOC = Standard Occupational Classification.

* Adjusted for age, sex, race and ethnicity, and education.

† Respondents were asked, "Are you deaf or do you have serious difficulty hearing?" (hearing); "Are you blind or do you have serious difficulty seeing, even when wearing glasses?" (vision); "Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?" (cognitive); "Do you have serious difficulty walking or climbing stairs?" (mobility); "Do you have difficulty dressing or bathing?" (self-care); and "Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping?" (independent living). Respondents who refused to answer, reported "don't know," and had other missing responses were excluded from the analyses.

§ Respondents reported being either "employed for wages" or "self-employed" at the time of the interview, excluding active duty military or those missing information for occupation.

¶ Twenty-two two-digit SOC major occupation groups (excluding military specific occupation group).

** Each disability type might not be independent; one respondent might have two or more disability types.

†† Unweighted.

§§ Occupation groups ranked in order of descending prevalence of disability type or any disability (highest prevalence = 1 to lowest prevalence = 22); rankings not indicative of statistical significance.

¶¶ Estimates might be unstable because the relative SE is 20%–30%.

*** Estimates suppressed because the relative SE is >30%.

Summary

What is already known about this topic?

Persons with disability are less likely to be employed compared with persons without disability due to various barriers related to hiring practices, training opportunities, and daily working experiences.

What is added by this report?

During 2016–2020, 14.8% of currently employed U.S. adults aged 18–64 years from 35 states and Guam reported having a disability. Among 22 major occupation groups, the prevalence of any disability was highest for food preparation and serving-related professions (19.9%).

What are the implications for public health practice?

Workplace programs that address the training, education, and workplace needs of employees with disability might improve workers' ability to enter, thrive in, and advance in a wider range of occupations.

and full-time workers. Finally, the results are not nationally representative; data were available from 35 states and Guam.

Employer measures to increase workplace accessibility measures and training designed to meet the needs of employees with disability might broaden the range of occupations in which these workers can succeed. To support employment of persons with disability, the U.S. Department of Labor sponsors technical assistance resources including the Employer Assistance and Resource Network on Disability Inclusion and Partnership on Employment and Accessible Technology.[†††] These programs offer services to help employers integrate persons with disability into the workforce, including a framework with strategies for building a disability-inclusive organization and improving workplace access to new and emerging technologies. An increase in home-based, part-time, and computer-based jobs during the previous decade has provided a wider variety of job types for persons with disability (*3*). Improving access to computer-based technologies for persons with disability could further this progress and increase the availability of higher-wage, skilled jobs. According to the Job Accommodation Network, approximately one half of job accommodations cost employers nothing, and three fourths of implemented job accommodations were found to be very or extremely effective.[§§§] Additional research is needed to improve understanding of how employers can improve disability practices, including accommodations, interventions, and programs to promote the hiring and retention of employees with disability. Both employees with disabilities and employers can benefit from a more equitable and inclusive workforce.

[†††] https://www.dol.gov/agencies/odep
[§§§] https://askjan.org/topics/costs.cfm?cssearch

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The CDC Domestic Mpox Response — United States, 2022–2023

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Monkeypox (mpox) is a serious viral zoonosis endemic in west and central Africa. An unprecedented global outbreak was first detected in May 2022. CDC activated its emergency outbreak response on May 23, 2022, and the outbreak was declared a Public Health Emergency of International Concern on July 23, 2022, by the World Health Organization (WHO),* and a U.S. Public Health Emergency on August 4, 2022, by the U.S. Department of Health and Human Services.† A U.S. government response was initiated, and CDC coordinated activities with the White House, the U.S. Department of Health and Human Services, and many other federal, state, and local partners. CDC quickly adapted surveillance systems, diagnostic tests, vaccines, therapeutics, grants, and communication systems originally developed for U.S. smallpox preparedness and other infectious diseases to fit the unique needs of the outbreak. In 1 year, more than 30,000 U.S. mpox cases were reported, more than 140,000 specimens were tested, >1.2 million doses of vaccine were administered, and more than 6,900 patients were treated with tecovirimat, an antiviral medication with activity against orthopoxviruses such as *Variola virus* and *Monkeypox virus*. Non-Hispanic Black (Black) and Hispanic or Latino (Hispanic) persons represented 33% and 31% of mpox cases, respectively; 87% of 42 fatal cases occurred in Black persons. Sexual contact among gay, bisexual, and other men who have sex with men (MSM) was rapidly identified as the primary risk for infection, resulting in profound changes in our scientific understanding of mpox clinical presentation, pathogenesis, and transmission dynamics. This report provides an overview of the first year of the response to the U.S. mpox outbreak by CDC, reviews lessons learned to improve response and future readiness, and previews continued mpox response and prevention activities as local viral transmission continues in multiple U.S. jurisdictions (Figure).

Epidemiology and Clinical Management of Cases

CDC partnered with state and local health departments to identify cases, analyze trends, and implement public health measures. Initial cases of mpox were associated with international travel, and cases associated with domestic transmission were quickly identified throughout all 50 states, the District of Columbia, and Puerto Rico. Case numbers peaked in early August 2022; as of May 10, 2023, a total of 30,395 cases and 42 mpox-associated deaths were reported to CDC. An overwhelming majority of cases occurred among adult MSM and persons aged 21–55 years (Table). The outbreak disproportionately affected persons with HIV: 38% of cases occurred among persons with known HIV. Health disparities were observed among racial and ethnic minority groups, including Black (33%) and Hispanic persons (31%). These disparities have been more pronounced among fatal cases: among 38 mpox-associated deaths reported through March 7, 2023, Black persons accounted for 33 (87%). Among decedents with information available, 94% were immunocompromised because of HIV infection (*1*). CDC investigations found that in addition to male-to-male sexual contact, transmission also occurred, albeit uncommonly, through close household contact (including from a caregiver), heterosexual sexual contact, and injury from a sharp object (e.g., needles and scalpels) (*2*–*5*). Three cases occurred in infants born to mothers who reported peripartum mpox symptoms.

The clinical presentation of cases in this outbreak (caused by clade IIb) was often different from those in historic reports. Whereas disseminated skin lesions had been previously considered a hallmark of mpox (*6*), many cases in the current outbreak involved small, localized skin lesions, with some patients experiencing symptoms of proctitis. Before this outbreak, tecovirimat had only been administered for rare orthopoxvirus infections, and apart from animal studies, safety and effectiveness data were lacking. During the outbreak, however, tecovirimat was widely used under an expanded access, investigational new drug (IND) protocol.§ As of April 25, 2023, tecovirimat had been administered to 6,932 patients.

In September 2022, clinical consultants at CDC began to receive queries about treatment of patients who were severely ill with mpox, including persons with disseminated infections attributed to uncontrolled viral replication due to severe immunocompromise, particularly in persons with advanced HIV disease (*7*). Early optimization of immune status recovery

* https://www.who.int/europe/news/item/23-07-2022-who-director-general-declares-the-ongoing-monkeypox-outbreak-a-public-health-event-of-international-concern

† https://www.hhs.gov/about/news/2022/08/04/biden-harris-administration-bolsters-monkeypox-response-hhs-secretary-becerra-declares-public-health-emergency.html

§ https://www.cdc.gov/poxvirus/mpox/clinicians/Tecovirimat.html

with the administration of antiretroviral therapy was identified as important to improving patient outcomes.

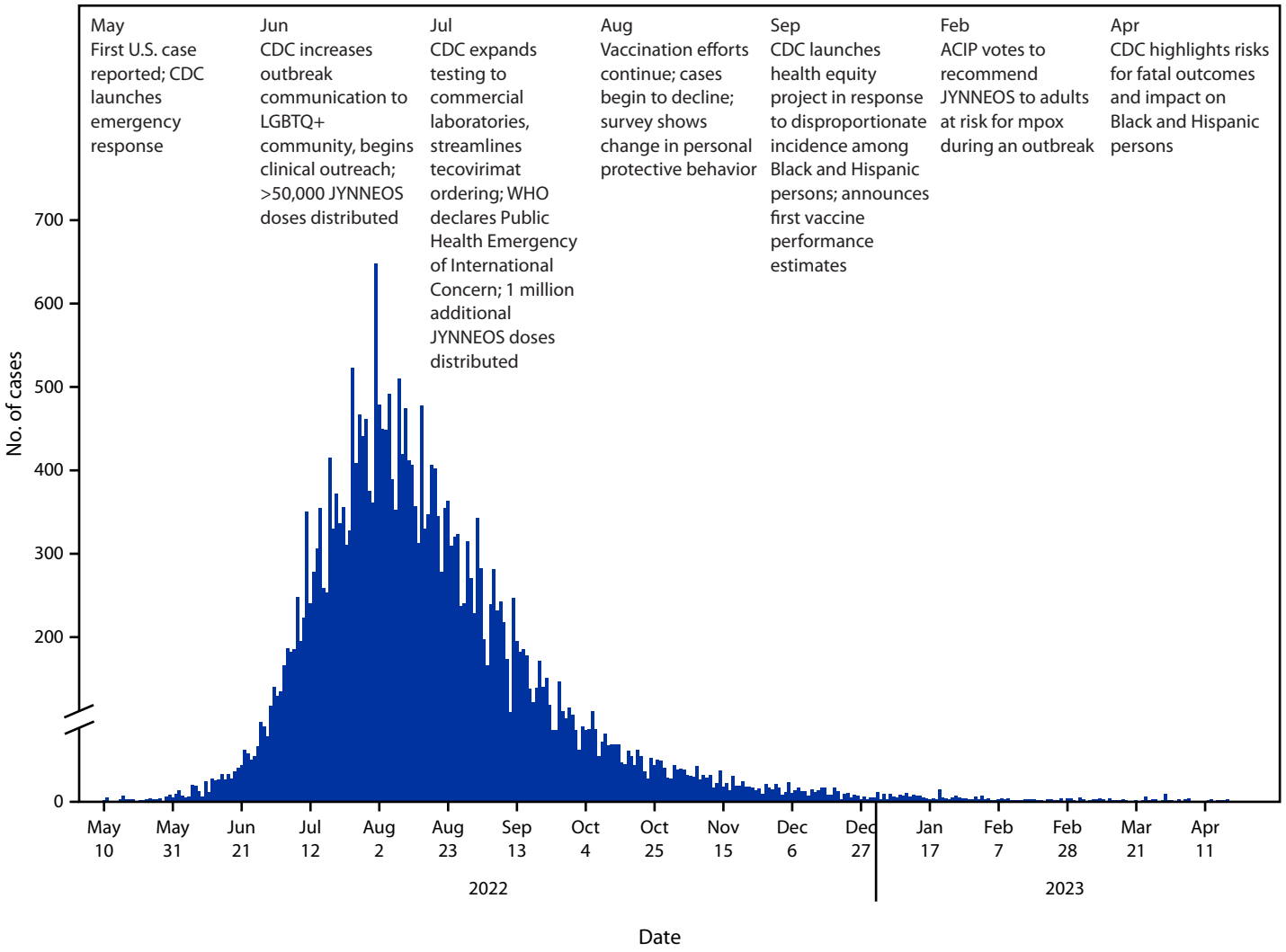
Data-Driven Public Health Response

As part of national smallpox preparedness, CDC had previously developed a Food and Drug Administration (FDA)–approved nonvariola orthopoxvirus (NVO) polymerase chain reaction test[¶] for use at Laboratory Response Network (LRN) laboratories in 68 U.S. locations; in May 2022, the capacity was 6,000 tests per week. By early July 2022, in collaboration with other government partners including FDA, NVO testing capacity was expanded to five commercial laboratory companies with broad U.S. coverage, thereby increasing national testing capacity to more than 80,000 specimens per week. As of April 6, 2023, a total of 144,209 NVO tests had been performed.

CDC successfully leveraged a SARS-CoV-2 wastewater surveillance system for mpox, with 533 testing sites across the country. During July 6, 2022–April 16, 2023, a total of 20,928 wastewater samples were collected; results from 162 sites (30%) were positive at any time, and positive results were often associated with geographic areas where cases had been reported. Although numbers of mpox cases in the United States have continued to decline, continued testing remains useful as an early warning signal; during April 2023, only 1% of sites reported positive test results.

[¶] https://www.cdc.gov/poxvirus/mpox/pdf/non-variola-orthopoxvirus-generic-real-time-pcr-test.pdf

FIGURE. Mpox outbreak and CDC response — United States, May 2022–April 2023



Abbreviations: ACIP = Advisory Committee on Immunization Practices; LGBTQ+ = lesbian, gay, bisexual, transgender, queer, and other; mpox = monkeypox; WHO = World Health Organization.

TABLE. Demographic characteristics of persons with outbreak-associated mpox (N = 29,988)* — United States, May 2022–April 12, 2023

Characteristic (no. with available data)	No. of cases (%)
Gender (29,988)	
Cisgender man	28,535 (95)
Cisgender woman	878 (3)
Transgender man	67 (<1)
Transgender woman	273 (1)
Other gender	235 (1)
Age group, yrs (29,988)	
≤10	45 (<1)
11–15	16 (<1)
16–20	678 (2)
21–55	27,936 (93)
>55	1,313 (4)
Race and ethnicity (28,350)†	
American Indian or Alaska Native, non-Hispanic	124 (<1)
Asian, non-Hispanic	805 (3)
Black or African American, non-Hispanic	9,359 (33)
Native Hawaiian or other Pacific Islander, non-Hispanic	78 (<1)
White, non-Hispanic	8,373 (30)
Hispanic or Latino	8,798 (31)
Multiple races or other	813 (3)

* https://www.cdc.gov/poxvirus/mpox/response/2022/demographics.html (Accessed April 21, 2023).
† Data are missing for 1,638 cases.

CDC deposited viral sequence data from the first U.S. case specimen into a public database** within 3 days of diagnosis. To date, CDC has analyzed more than 7,000 sequences within databases and deposited 366 whole genomes into public databases, thereby helping to monitor viral strains and potential tecovirimat resistant mutations; fewer than 1.0% of sequences examined had mutations associated with in vitro resistance. When such mutations were identified, CDC attempted viral isolation and cell culture–based testing to confirm resistance, and most resistant specimens were associated with severely immunocompromised patients on prolonged courses of tecovirimat treatment. The collection of sequence data, resistance testing results, and clinical outcomes will help guide future decisions about tecovirimat use and any regulatory actions by FDA.

JYNNEOS, a third-generation smallpox vaccine approved for both smallpox and mpox, was used widely during the response. Because of limited supplies during May–June 2022, CDC initially recommended that vaccine be prioritized for postexposure prophylaxis of known contacts; this was later expanded to include persons at potential risk for recent exposure. Decisions on equitable distribution of vaccine were made by the U.S. government and included consideration of the number of mpox cases per state and estimates of at-risk populations. Aided by FDA's August 9, 2022, authorization for a dose-sparing intradermal administration strategy in adults, 1.2 million doses of JYNNEOS were administered during May 2022–May 2023, resulting in 37% first-dose coverage of the estimated at-risk population and 23% completed second-dose vaccination coverage, nationally. Rapidly conducted vaccine effectiveness (VE) analyses using data reported from state and local health officials demonstrated that mpox incidence among unvaccinated persons was 9.6 times higher than that among persons who received 2 doses of vaccine (*8*). A matched case control study found an adjusted VE of 85.9% for 2 doses and 75.2% for 1 dose across all routes of administration, with a lower VE of 70.2% among fully vaccinated immunocompromised persons (*9*); no new or unexpected safety concerns were identified, and serious adverse events were rare (*10*). Outbreak data were instrumental in the Advisory Committee on Immunization Practices' 2023 vote†† in favor of the use of JYNNEOS for adults at risk for acquiring mpox during an outbreak. The course of the outbreak during the ensuing months and years will help guide future vaccine administration policies.

Clinician and Community Engagement and Communications

To familiarize U.S. health care professionals with mpox, CDC released seven Health Alert Network notices (https://emergency.cdc.gov/han) and held six Clinician Outreach and Communication Activity calls, beginning in May 2022, to provide clinicians with up-to-date information, including images of the different stages of mpox rash on various skin tones, and to communicate about nontraditional rash locations including anal-genital and oropharyngeal sites. Regular updates to clinical care recommendations provided rapid dissemination of advancing knowledge of diagnostics and vaccine and therapeutics use.

A health equity approach guided CDC's response; an effort to ensure that the voices of affected communities were heard and honored was central to response activities. CDC tested messages and participated in approximately 50 community engagement and listening sessions to develop and refine mpox-related communications. Listening sessions included 26 owners and operators of sex-on-premises venues, 16 sex workers, and 28 harm reduction organizations. Early dissemination of key messaging via dating apps and lesbian, gay, bisexual, transgender, queer, and other (LGBTQ+) media targeted communities disproportionately affected by mpox. CDC resources were adopted and promoted by some prominent LGBTQ+ advocates and influencers, amplifying prevention messages. By August 2022, a survey of MSM indicated that 50% of respondents reported a reduction in the numbers of

** https://ncbiinsights.ncbi.nlm.nih.gov/2022/05/26/monkeypox-virus-genome/

†† https://www.cdc.gov/vaccines/acip/recommendations.html

sex partners, one-time sexual encounters, and sex with partners met on dating apps or at sex-on-premises venues, which coincided with a significant decrease in reported mpox cases (*11*). Effectively communicating prevention messages to at-risk populations, including the importance of vaccination, is a critical component of continued prevention efforts.

Recognizing racial and ethnic disparities in incidence, illness outcomes, and vaccination coverage, CDC partnered with community organizations in 22 locations to pilot innovative vaccine equity projects to improve vaccination among disproportionately affected populations, including administering >25,000 vaccine doses at various locations across the nation, such as the largest HIV-related conference in the United States, at large festivals and Pride events, and through mobile vans (*12*,*13*).

Lessons Learned and Future Challenges

Understanding the trajectory and subsequent mitigation of the outbreak was dependent upon collection and analysis of timely and reliable data on mpox cases, laboratory testing, and administration of countermeasures, such as vaccine and treatments that were tracked by state and local partners and health care providers and reported to CDC. Multiple successes were recognized, as were learning moments that can be studied and leveraged, which could lead to a more robust response to future epidemics. Control of the mpox outbreak was dependent on years of research related to diagnostics, therapeutics and vaccine development and approval, surveillance systems enhancements, and community partnerships. This type of research and preparation needs to continue for smallpox, mpox, and other biothreats. Public health agencies at all levels and the affected communities have made substantial progress in the year since the outbreak began, but the outbreak is not over. The United States remains at risk for increasing mpox transmission and reignited outbreaks. Continued prevention efforts are needed to interrupt viral transmission in countries where the virus is not endemic and to control transmission in areas were zoonotic mpox is endemic.

Based on decades of U.S. smallpox research, an FDA-approved test and surveillance network, as well as approved vaccines and therapeutics, were already in place and available to be used for mpox. Limited early availability of JYNNEOS vaccine required careful allocation to facilitate receipt of vaccine by persons at highest risk for exposure, with eligibility criteria expanding as additional vaccine supplies became available. This outbreak underscored the need to anticipate higher demand for JYNNEOS in the event of a future smallpox or mpox outbreak, as well as for advance planning for equitable distribution of and access to limited or scarce resources. The 2022–2023 mpox outbreak was driven by sexual contact as the most common mode of transmission, primarily among MSM populations.

Summary

What is already known about this topic?

After being detected in May 2022, U.S. monkeypox (mpox) cases increased rapidly, peaking in August. Infection was primarily spread by sexual contact among gay, bisexual, and other men who have sex with men.

What is added by this report?

Rapid adaptation of smallpox preparedness systems and tools, and prioritized communication expertise from HIV prevention programs, were leveraged to reach communities at risk. In 1 year, more than 30,000 cases were reported and >1 million JYNNEOS vaccine doses were administered. Black and Hispanic persons represented 33% and 31% of cases, respectively; 87% of 42 fatal cases occurred in Black persons.

What are the implications for public health practice?

The U.S. risk for future mpox outbreaks remains. Ongoing surveillance, vaccination, and communication are important prevention tools, especially for Black and Hispanic persons in groups at risk.

High rates of HIV in the affected population, as well as risks for significant side effects associated with ACAM2000 (a second generation smallpox vaccine) drove interest in JYNNEOS during this outbreak. The mpox outbreak response highlighted that early reporting requirements for the tecovirimat IND were too cumbersome for practical use during an outbreak; accordingly, CDC worked to simplify IND reporting requirements, reducing barriers to therapeutic administration.

Substantial LRN laboratory capacity was in place at the start of the mpox outbreak; however, easier access to and higher capacity for testing through commercial platforms was requested by providers. CDC worked quickly with other federal partners and commercial laboratories to rapidly increase national testing capacity and access within 2 months. These government and commercial partnerships were crucial during the height of the outbreak; similar partnerships are important to consider in future outbreak preparedness and response planning.

Because of the atypical clinical presentation and transmission dynamics in this outbreak compared with historic reports of mpox, rapid sharing of clear information was essential, and CDC's ability to rapidly develop and disseminate messages and tools for partners during the mpox response hinged on leveraging expertise from sexual health and HIV prevention programs. Early engagement with and respect for persons at risk for mpox were central to CDC's communications strategy with a focus on cultural sensitivity and competency (*14*). Rapid epidemiologic analyses and incorporation of findings into changing messages for risk reduction were also critical. However, even with these efforts, early messaging might have missed opportunities to improve understanding of sexual transmission risks among MSM. Communications evolved with the

outbreak, with bidirectional feedback from communities and community champions critical to the learning process. CDC also relied on frequent communications with federal officials, state and local health officials, and WHO to ensure timely sharing of new information and joint prioritization.

During the outbreak, persons from racial and ethnic minority groups accounted for a large number of cases and severe outcomes, and a low proportion of persons receiving vaccines. Concerted efforts to reach affected communities with vaccination events mitigated but did not overcome these disparities. Equitable access to prevention and care, a critical component of strategy and policy, is ideally addressed before an outbreak but is also critical during the response. Assuring continued access to vaccines for persons at increased risk for mpox, increasing second-dose coverage, and closing equity gaps remain important goals to reduce the risk for mpox resurgence in the United States and worldwide, including having an ample supply of vaccine in countries in Africa with endemic disease to rapidly respond to outbreaks.

Research to evaluate the effectiveness, safety, and immunogenicity of JYNNEOS for mpox prevention is ongoing, with a need to determine whether booster immunization is needed. New medical countermeasures are being investigated, as well as continued molecular surveillance of the virus to monitor for mutations that might affect efficacy of current therapeutics. Studies at the animal-human interface for mpox continue, including the identification of animal reservoirs in countries that have historically had endemic mpox. New diagnostic assays, including specific detection of antibodies to the virus causing mpox in humans and animals, are in development.

The elimination of human transmission is a near-term goal for many countries where mpox is not endemic.[§§] The association of mpox cases with HIV infection highlights the need for a syndemic approach to care for HIV, sexually transmitted infections, and mpox in the context of comprehensive sexual health care. The mpox outbreak occurred with little warning, peaked quickly, and waned 5 months after the first case was reported in the United States. Even as WHO declared the outbreak no longer a public health emergency on May 11, 2023, a cluster of mpox cases occurred in Chicago, Illinois, including among some previously vaccinated persons, demonstrating the ongoing risk for new cases and outbreaks and the need for continued vigilance and prevention efforts.[¶¶] CDC continues to focus on surveillance, vaccination, and communication for populations at risk for mpox as important prevention tools.

[§§] https://www.who.int/europe/publications/i/item/WHO-EURO-2023-6007-45772-69163#

[¶¶] https://www.chicagohan.org/alert-detail/-/alert-details/46678186

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Estimated Effectiveness of JYNNEOS Vaccine in Preventing Mpox: A Multijurisdictional Case-Control Study — United States, August 19, 2022–March 31, 2023

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As of March 31, 2023, more than 30,000 monkeypox (mpox) cases had been reported in the United States in an outbreak that has disproportionately affected gay, bisexual, and other men who have sex with men (MSM) and transgender persons (*1*). JYNNEOS vaccine (Modified Vaccinia Ankara vaccine, Bavarian Nordic) was approved by the Food and Drug Administration (FDA) in 2019 for the prevention of smallpox and mpox via subcutaneous injection as a 2-dose series (0.5 mL per dose, administered 4 weeks apart) (*2*). To expand vaccine access, an Emergency Use Authorization was issued by FDA on August 9, 2022, for dose-sparing intradermal injection of JYNNEOS as a 2-dose series (0.1 mL per dose, administered 4 weeks apart) (*3*). Vaccination was available to persons with known or presumed exposure to a person with mpox (postexposure prophylaxis [PEP]), as well as persons at increased risk for mpox or who might benefit from vaccination (preexposure mpox prophylaxis [PrEP]) (*4*). Because information on JYNNEOS vaccine effectiveness (VE) is limited, a matched case-control study was conducted in 12 U.S. jurisdictions,† including nine Emerging Infections Program sites and three Epidemiology and Laboratory Capacity sites,§ to evaluate VE against mpox among MSM and transgender adults aged 18–49 years. During August 19, 2022–March 31, 2023, a total of 309 case-patients were matched to 608 control patients. Adjusted VE was 75.2% (95% CI = 61.2% to 84.2%) for partial vaccination (1 dose) and 85.9% (95% CI = 73.8% to 92.4%) for full vaccination (2 doses). Adjusted VE for full vaccination by subcutaneous, intradermal, and heterologous routes of administration was 88.9% (95% CI = 56.0% to 97.2%), 80.3% (95% CI = 22.9% to 95.0%), and 86.9% (95% CI = 69.1% to 94.5%), respectively. Adjusted VE for full vaccination among immunocompromised participants was 70.2% (95% CI = –37.9% to 93.6%) and among immunocompetent participants was 87.8% (95% CI = 57.5% to 96.5%). JYNNEOS is effective at reducing the risk for mpox. Because duration of protection of 1 versus 2 doses remains unknown, persons at increased risk for mpox exposure should receive the 2-dose series as recommended by the Advisory Committee on Immunization Practices (ACIP),¶ regardless of administration route or immunocompromise status.

A matched case-control study was conducted in 12 U.S. jurisdictions. Case-patients had a confirmed or probable *Monkeypox virus* or *Orthopoxvirus* diagnosis on or after August 19, 2022; they were identified or verified through jurisdiction health departments' case registries. Control patients had visited a sexual health, HIV care, or HIV PrEP clinic on or after August 19, 2022, and did not receive an mpox diagnosis; they were identified through active and passive recruitment approaches at local clinics in each jurisdiction.** Participation was restricted to sexually active†† persons aged 18–49 years who self-identified as MSM or transgender. Eligible participants were invited to complete a survey administered online or by telephone in English or Spanish. The survey included questions about demographic characteristics, mpox vaccination, mpox diagnosis, immunocompromising conditions, and exposure history anchored to an index date, defined as date of positive test result (case-patients) or clinic visit (control patients). Survey responses were recorded in REDCap (version 13.1.26; Vanderbilt University). Participants' vaccination status was verified using state vaccination registries, where available. Participants were categorized as fully vaccinated,

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† Case-patients and control patients were recruited from the following 12 U.S. jurisdictions: California (excluding Los Angeles County), Colorado, Connecticut, District of Columbia, Georgia, Los Angeles County, Maryland, Minnesota, New York City, New York (excluding New York City), Oregon, and Tennessee.

§ The Emerging Infections Program is a network of 10 state health departments that conduct surveillance and other public health activities to detect, control, and prevent emerging infectious diseases. CDC's Epidemiology Laboratory Capacity for Prevention and Control of Emerging Infectious Diseases includes 64 U.S. jurisdictions focused on detecting, preventing, and responding to emerging infectious diseases.

¶ https://www.cdc.gov/vaccines/acip/recommendations.html

** Participants with an mpox diagnosis before August 19, 2022, were ineligible for inclusion in the study. This date was selected to coincide with widespread availability of vaccine.

†† Sexually active was defined as having one or more sexual partners during the 3 months before survey completion.

partially vaccinated, or unvaccinated based on the number of JYNNEOS doses they received relative to their index date.[§§]

Each case-patient was matched with up to four control patients based on state or region[¶¶] and index date (within 4 weeks). Conditional logistic regression models were used to estimate crude and adjusted odds ratios evaluating the association between vaccination status and case- or control patient status. The adjusted model accounted for covariates identified a priori, including age, race and ethnicity, immunocompromising conditions,[***] and close contact with a person with known mpox.[†††] VE was calculated as (1 – odds ratio) x 100%. VE estimates were stratified a priori by immunocompromise status and route of vaccine administration (subcutaneous, intradermal, or heterologous [i.e., a different route for each dose]). Analyses were conducted using the survival package in R statistical software (version 4.2.2; The R Foundation). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[§§§]

Among 1,414 respondents, 1,127 (86.1%) met the minimum data element requirements[¶¶¶] for inclusion in the analysis, and 309 (89.6%) of 345 case-patients and 608 (77.7%) of 782 control patients were matched. A larger proportion of case- than control patients identified as non-Hispanic Black or African American (27.2% versus 16.9%) or Hispanic or Latino (32.4% versus 23.4%) (Table 1). Larger proportions of case- than control patients reported experiencing recent homelessness (7.9% versus 2.7%), engaging in transactional sex (9.1% versus 3.3%), and living with HIV (48.1% versus 24.0%); among participants who did not report living with HIV, a smaller proportion of case- than control patients reported using HIV PrEP (54.4% versus 66.8%). Larger proportions of case- than control patients were classified as immunocompromised

TABLE 1. Selected characteristics of matched mpox case-patients and control patients — 12 jurisdictions,* United States, August 2022–March 2023

	Matched data		
	Case-patient[†] (n = 309)	Control patient[§] (n = 608)	
Characteristic	No. (%)[¶]	No. (%)[¶]	p-value[**]
Age group, yrs			
18–29	78 (25.2)	184 (30.3)	0.065
30–39	144 (46.6)	292 (48.0)	
40–49	87 (28.2)	132 (21.7)	
Race and ethnicity[††]			
Black or African American, non-Hispanic	84 (27.2)	103 (16.9)	<0.001
White, non-Hispanic	93 (30.1)	291 (47.9)	
Hispanic or Latino	100 (32.4)	142 (23.4)	
Other, non-Hispanic	32 (10.4)	72 (11.8)	
Gender identity			
Male	290 (94.2)	544 (89.5)	0.070
Transgender female	6 (1.9)	13 (2.1)	
Transgender male	1 (0.3)	7 (1.2)	
Another gender identity	11 (3.6)	44 (7.2)	
Insurance status			
Public	102 (33.2)	165 (27.3)	0.180
Private	155 (50.5)	329 (54.5)	
Both	14 (4.6)	18 (3.0)	
None	32 (10.4)	81 (13.4)	
Unknown	4 (1.3)	11 (1.8)	
Reported experiencing homelessness in previous 3 wks			
Yes	24 (7.9)	16 (2.7)	0.001
No	272 (89.5)	573 (95.3)	
Prefer not to answer	8 (2.6)	12 (2.0)	
Transactional sex[§§]			
Yes	28 (9.1)	20 (3.3)	0.001
No	275 (89.0)	576 (95.4)	
Prefer not to answer	6 (1.9)	8 (1.3)	
HIV status			
Living with HIV	128 (48.1)	137 (24.0)	<0.001
Not living with HIV	123 (46.2)	419 (73.5)	
Unknown HIV status	6 (2.3)	6 (1.1)	
Prefer not to answer	9 (3.4)	8 (1.4)	
Clinical characteristic among persons living with HIV			
CD4 count <200 cells/μL	27 (21.4)	28 (20.4)	0.964
Missed >2 days of medication	56 (44.1)	43 (31.4)	0.045
HIV PrEP[¶¶]			
Yes	98 (54.4)	312 (66.8)	0.012
No	81 (45.0)	154 (33.0)	
Unknown	1 (0.6)	1 (0.2)	
Immunocompromising condition or medication[***]			
Yes	144 (46.6)	158 (26.0)	<0.001
No	117 (37.9)	393 (64.6)	
Don't know/Prefer not to answer	48 (15.5)	57 (9.4)	
Close contact with someone who received an mpox diagnosis[†††]			
Yes	71 (23.0)	24 (3.9)	<0.001
No	98 (31.7)	417 (68.6)	
Unknown	140 (45.3)	167 (27.5)	
No. of sexual partners[§§§]			
0	18 (6.1)	25 (4.9)	0.348
1	67 (22.8)	108 (21.1)	
2	68 (23.1)	122 (23.9)	
3	59 (20.1)	83 (16.2)	
≥4	82 (27.9)	173 (33.9)	

See table footnotes on the next page.

[§§] Participants were categorized as unvaccinated if no reported doses were received on or before the index date. Participants were categorized as partially vaccinated if they received 1 dose ≥14 days before the index date and fully vaccinated if they received 2 doses ≥24 days apart (to allow for a 4-day grace period) and the second dose was received ≥14 days before the index date. Participants who received their first vaccine dose ≤13 days before their index date were excluded. When vaccination status as recorded in state vaccination registries was unavailable, participant-reported vaccination status was used.

[¶¶] Case-patient and control patient matching was maximized by combining the following jurisdictions: California (excluding Los Angeles County) and Los Angeles County, District of Columbia and Maryland, New York (excluding New York City) and New York City.

[***] Immunocompromising conditions were based on self-report and defined as living with HIV, having a medical condition that weakens the immune response, or taking a medication that weakens the immune response.

[†††] Close contact with an mpox case-patient was defined as intimate or nonintimate contact, including sex, hugging, kissing, sharing food or utensils, sharing sheets or towels, or sharing a living space, during the 3 weeks preceding the onset of mpox signs and symptoms.

[§§§] 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.

[¶¶¶] Minimum data elements included index date, case status, and vaccination status based on data reported from participants or health departments.

TABLE 1. (*Continued*) Selected characteristics of matched mpox case-patients and control patients — 12 jurisdictions,* United States, August 2022–March 2023

Characteristic	Matched data: Case-patient† (n = 309) No. (%)¶	Matched data: Control patient§ (n = 608) No. (%)¶	p-value**
STI¶¶¶			
Gonorrhea	34 (11.0)	39 (6.4)	0.022
Chlamydia	32 (10.4)	38 (6.2)	0.037
Syphilis	44 (14.2)	21 (3.5)	<0.001
Other	13 (4.2)	7 (1.2)	0.006
At least one STI	81 (26.2)	79 (13.0)	<0.001
Vaccination status**			
Fully vaccinated			
Overall	**28 (9.1)**	**178 (29.3)**	**<0.001**
Administration route			
Both administrations subcutaneous	7 (25.0)	27 (15.3)	0.490
Both administrations intradermal	5 (17.9)	25 (14.1)	
Heterologous administration	16 (57.1)	125 (70.6)	
Partially vaccinated			
Overall	**58 (18.8)**	**237 (39.0)**	**<0.001**
Administration route			
Subcutaneous administration	38 (65.5)	159 (67.1)	0.307
Intradermal administration	18 (31.0)	76 (32.1)	
Other/Missing	2 (3.4)	2 (0.8)	
Unvaccinated			
Overall	**223 (72.2)**	**193 (31.7)**	**<0.001**
Site			
California (excluding Los Angeles County)	43 (13.9)	35 (5.8)	<0.001
Colorado	19 (6.1)	38 (6.2)	
Connecticut	3 (1.0)	3 (0.5)	
District of Columbia	5 (1.6)	5 (0.8)	
Georgia	69 (22.3)	90 (14.8)	
Los Angeles County	73 (23.6)	130 (21.4)	
Maryland	6 (1.9)	6 (1.0)	
Minnesota	26 (8.4)	98 (16.1)	
New York (excluding New York City)	11 (3.6)	41 (6.7)	
New York City	29 (9.4)	93 (15.3)	
Oregon	15 (4.9)	57 (9.4)	
Tennessee	10 (3.2)	12 (2.0)	

(46.6% versus 26.0%) and reported recent close contact with a known mpox case (23.0% versus 3.9%).

Among the 917 participants included in the VE analysis, 206 (22.5%) were fully vaccinated, 295 (32.2%) were partially vaccinated, and 416 (45.4%) were unvaccinated. Unadjusted VE was 75.7% for partial vaccination and 87.4% for full vaccination (Table 2). After adjusting for age, race and ethnicity, immunocompromise status, and close contact with a person with known mpox, VE was 75.2% for partial vaccination and 85.9% for full vaccination. Among partially vaccinated participants, adjusted VE by route of administration was 77.0%

TABLE 1. (*Continued*) Selected characteristics of matched mpox case-patients and control patients — 12 jurisdictions,* United States, August 2022–March 2023

Characteristic	Matched data: Case-patient† (n = 309) No. (%)¶	Matched data: Control patient§ (n = 608) No. (%)¶	p-value**
Index event epidemiological week (yr)††††			
33–36 (2022)	152 (49.2)	191 (31.4)	<0.001
37–40 (2022)	106 (34.3)	208 (34.2)	
41–44 (2022)	32 (10.4)	120 (19.7)	
45–48 (2022)	14 (4.5)	58 (9.5)	
49–52 (2022)	4 (1.3)	23 (3.8)	
1–4 (2023)	1 (0.3)	8 (1.3)	

Abbreviations: PrEP = preexposure prophylaxis; STI = sexually transmitted infection.

* Case-patients and control patients were recruited from the following 12 U.S. jurisdictions: California (excluding Los Angeles County), Colorado, Connecticut, Georgia, District of Columbia, Los Angeles County, Maryland, Minnesota, New York (excluding New York City), New York City, Oregon, and Tennessee.

† Case-patients were identified or verified by jurisdiction health departments and had a confirmed or probable *Monkeypox virus* or *Orthopoxvirus* diagnosis on or after August 19, 2022.

§ Control patients visited an STI, HIV care, or HIV PrEP clinic on or after August 19, 2022.

¶ Numbers might not sum to case- or control patient totals due to missing data. Percentages were calculated using nonmissing data.

** P-values comparing the percentage of case-patients to control patients by sociodemographic and health categories were calculated using Pearson's chi-square test. P-values for continuous variables were calculated using the Kruskal-Wallis test.

†† Participants reporting Hispanic ethnicity were categorized as Hispanic or Latino and might be of any race. The Other race category includes Asian, Native Hawaiian or other Pacific Islander, and American Indian or Alaska Native persons.

§§ Transactional sex was defined as a respondent's affirmative response when asked whether someone gave them money, drugs, or other resources (e.g., housing) in exchange for sex during the 3 weeks before completing the survey.

¶¶ HIV PrEP use was calculated among persons who did not report living with HIV.

*** Immunocompromising conditions were based on self-report and defined as living with HIV, having a medical condition that weakens the immune response, or taking a medicine that weakens the immune response.

††† Close contact with an mpox case-patient was defined as intimate or nonintimate contact, including sex, hugging, kissing, sharing food or utensils, sharing sheets or towels, or sharing a living space, during the 3 weeks preceding the onset of mpox signs and symptoms.

§§§ Participants were asked to report the number of sexual partners they had during the 3 weeks before completing the survey.

¶¶¶ Participants were asked to report STI diagnoses during the 3 weeks before completing the survey.

**** Participants were categorized as unvaccinated if no reported doses were received on or before the index date. Participants were categorized as partially vaccinated if they received 1 dose ≥14 days before the index date and fully vaccinated if they received 2 doses ≥24 days apart (to allow for a 4-day window) and the second dose was received ≥14 days before the index date. Participants who received their first vaccine dose ≤13 days before their index date were excluded. When vaccination status as recorded in state vaccination registries was unavailable, participant-recorded vaccination status was used.

†††† Index event was defined as the date of positive test result for case-patients or clinic visit for control patients.

TABLE 2. Estimated JYNNEOS vaccine effectiveness against mpox — United States, August 2022–March 2023

Characteristic	Case-patients*	Control patients*	VE (95% CI)	
			Unadjusted	Adjusted†
Overall, full vaccination§	**28**	**178**	**87.4 (78.6 to 92.6)**	**85.9 (73.8 to 92.4)**
Overall, partial vaccination¶	**58**	**237**	**75.7 (64.5 to 83.3)**	**75.2 (61.2 to 84.2)**
By administration route				
Full vaccination				
Subcutaneous	7	27	88.7 (60.9 to 96.7)	88.9 (56.0 to 97.2)
Intradermal	5	25	80.7 (37.6 to 94.0)	80.3 (22.9 to 95.0)
Heterologous	16	125	88.3 (75.7 to 94.4)	86.9 (69.1 to 94.5)
Partial vaccination				
Subcutaneous	38	159	75.6 (61.2 to 84.6)	77.0 (59.7 to 86.8)
Intradermal	18	76	77.4 (57.4 to 88.1)	80.6 (56.1 to 91.4)
By immunocompromise status**				
Full vaccination				
Immunocompromised	9	31	72.9 (−11.8 to 93.4)	70.2 (−37.9 to 93.6)
Immunocompetent	14	126	86.2 (64.8 to 94.6)	87.8 (57.5 to 96.5)
Partial vaccination				
Immunocompromised	22	52	55.5 (4.3 to 79.3)	51.0 (−27.6 to 81.2)
Immunocompetent	27	162	68.9 (38.2 to 84.4)	72.1 (36.2 to 87.8)

Abbreviation: VE = vaccine effectiveness.

* Numbers in subanalyses might not sum to case- or control patient totals from the overall analysis because matched case-control pairs might have differed by route of administration or immunocompromise status and were therefore excluded when restricted to these populations.

† Overall models and models by administration route were adjusted for age, race and ethnicity, immunocompromising conditions, and close contact with a person with known mpox. Models by immunocompromise status were adjusted for age, race and ethnicity, and close contact with a person with known mpox.

§ Participants were categorized as fully vaccinated if they received 2 doses ≥24 days apart (to allow for a 4-day window), and the second dose was received ≥14 days before the index date.

¶ Participants were categorized as partially vaccinated if they received 1 dose ≥14 days before the index date.

** Immunocompromising conditions were based on self-report and defined as living with HIV, having a medical condition that weakens the immune response, or taking a medicine that weakens the immune response.

for subcutaneous and 80.6% for intradermal administration. Among fully vaccinated participants, adjusted VE was 88.9% for subcutaneous, 80.3% for intradermal, and 86.9% for heterologous administration. Among participants with an immunocompromising condition, adjusted VE was 51.0% for partial vaccination and 70.2% for full vaccination, both with negative lower 95% CI bounds. Among participants without an immunocompromising condition, adjusted VE was 72.1% for partial vaccination and 87.8% for full vaccination.

Discussion

In this real-world assessment of JYNNEOS VE in 12 U.S. jurisdictions during the 2022 mpox outbreak, adjusted VE against mpox was 75.2% for partial vaccination and 85.9% for full vaccination. The results from this study are consistent with those from previous studies evaluating vaccine performance or effectiveness (*5*–*7*) and strengthen the evidence base supporting vaccination with JYNNEOS for protection against mpox.

This study is the first to estimate VE by route of administration. Similar point estimates and overlapping CIs for estimates by route of administration suggest that, in the context of the current outbreak, vaccine administration by any route provides comparable protection against mpox.

This study also estimated VE for immunocompromised persons. Although the lower bounds of the 95% CIs for immunocompromised persons were negative (indicating the need for more data to obtain more precise estimates), adjusted VE estimates were 51.0% for partial vaccination and 70.2% for full vaccination among immunocompromised participants, and 72.1% for partial and 87.8% for full vaccination among immunocompetent participants. Overlapping CIs for these VE estimates suggest no difference by immunocompromise status, although the lower VE point estimates in participants who are immunocompromised might suggest a less robust response to

Summary

What is already known about this topic?

Real-world vaccine effectiveness (VE) estimates for JYNNEOS vaccine against monkeypox (mpox) are limited. To date, no VE estimates by route of administration or for immunocompromised persons have been published.

What is added by this report?

In this study, adjusted VE was 75% for 1 dose and 86% for 2 doses of JYNNEOS vaccine, indicating substantial protection against mpox, irrespective of route of administration or immunocompromise status.

What are the implications for public health practice?

Persons at high risk for mpox exposure should be vaccinated with the recommended 2-dose JYNNEOS series.

the vaccine. Persons with immunocompromising conditions might mount a less effective immune response after vaccination**** and might choose to take additional precautions to reduce their risk for mpox infection, such as reducing their number of sex partners and one-time sexual encounters (*8*).

The findings in this report are subject to at least seven limitations. First, selection bias was likely present because participation was voluntary and recruitment for controls took place in sexual health, HIV care, or HIV PrEP clinics. Second, survey data were self-reported and might be subject to social desirability or recall bias, particularly because the time between index event and survey completion varied. Third, vaccination status could have been misclassified if participants were vaccinated outside of their jurisdiction or if a participant's vaccination dates were incorrectly reported. Fourth, immunocompromise status was based on self-report; these persons might not be considered immunocompromised by clinical standards. In addition, because of limited data on HIV status, some participants with well-controlled HIV might have been incorrectly classified as immunocompromised. Fifth, some jurisdictions had challenges recruiting controls. As a result, 35 case-patients were not matched and were excluded from the analysis. Sixth, because of small sample sizes, VE for PEP could not be estimated. Finally, although the 12 U.S. jurisdictions included in this study covered a broad geographic area, data might not be generalizable to the entire U.S. population.

Vaccination is an important tool for preventing mpox,†††† and this report demonstrates that the JYNNEOS vaccine is effective at reducing risk for mpox; however, additional precautions to reduce exposure should be considered, particularly among immunocompromised persons (*8*). Both 1 and 2 doses provided substantial protection against mpox, irrespective of route of administration. However, additional research is needed to assess duration of protection, which might differ by number of doses or route of administration. JYNNEOS vaccination coverage among persons at risk is low, and many eligible persons have not received both doses (*9*–*10*). For optimal protection, persons at risk for mpox should receive the 2-dose series, as recommended by ACIP, irrespective of administration route.

**** https://www.cdc.gov/poxvirus/mpox/clinicians/faq.html#People-who-are-Immunocompromised

†††† https://www.cdc.gov/poxvirus/mpox/response/2022/risk-assessment-of-resurgence.html

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Effectiveness of JYNNEOS Vaccine Against Diagnosed Mpox Infection — New York, 2022

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In 2022, an international *Monkeypox virus* outbreak, characterized by transmission primarily through sexual contact among gay, bisexual, and other men who have sex with men (MSM), resulted in 375 monkeypox (mpox) cases in the state of New York outside of New York City (NYC).*,† The JYNNEOS vaccine (Modified Vaccinia Ankara vaccine, Bavarian Nordic), licensed by the U.S. Food and Drug Administration (FDA) against mpox as a 2-dose series, with doses administered 4 weeks apart,§ was deployed in a national vaccination campaign.¶ Before this outbreak, evidence to support vaccine effectiveness (VE) against mpox was based on human immunologic and animal challenge studies (*1*–*3*). New York State Department of Health (NYSDOH) conducted a case-control study to estimate JYNNEOS VE against diagnosed mpox in New York residents outside of NYC, using data from systematic surveillance reporting. A case-patient was defined as a man aged ≥18 years who received a diagnosis of mpox during July 24–October 31, 2022. Contemporaneous control patients were men aged ≥18 years with diagnosed rectal gonorrhea or primary syphilis and a history of male-to-male sexual contact, without mpox. Case-patients and control patients were matched to records in state immunization systems. JYNNEOS VE was estimated as 1 – odds ratio (OR) x 100, and JYNNEOS vaccination status (vaccinated versus unvaccinated) at the time of diagnosis was compared, using conditional logistic regression models that adjusted for week of diagnosis, region, patient age, and patient race and ethnicity. Among 252 eligible mpox case-patients and 255 control patients, the adjusted VE of 1 dose (received ≥14 days earlier) or 2 doses combined was 75.7% (95% CI = 48.5%–88.5%); the VE for 1 dose was 68.1% (95% CI = 24.9%–86.5%) and for 2 doses was 88.5% (95% CI = 44.1%–97.6%). These findings support recommended 2-dose JYNNEOS vaccination consistent with CDC and NYSDOH guidance.

The first mpox case in New York outside NYC was reported on June 2, 2022. On June 28, the U.S. Department of Health and Human Services' Administration for Strategic Preparedness and Response announced a phased, jurisdictional rollout of the JYNNEOS vaccine from the Strategic National Stockpile, prioritizing postexposure prophylaxis (PEP) and vaccination of persons with recent or ongoing risks for mpox infection.** The first New York allocation of 2,206 vials was received July 6. By September 12, a total of 35,666 vials had been delivered.†† NYSDOH coordinated vaccine distribution in New York outside NYC with local health departments and community organizations.

All mpox, gonorrhea, and syphilis diagnoses in New York outside of NYC are reportable to NYSDOH.§§ Reports are investigated by public health staff members and entered into the Communicable Disease Electronic Surveillance System (CDESS). Case-patients were males at birth aged ≥18 years with a diagnosis of laboratory-confirmed mpox from whom specimens were collected during July 24–October 31, 2022 (2 weeks after vaccine campaign launch through the end of mandatory dose reporting to the New York State Immunization Information System [NYSIIS]). Control patients were males at birth aged ≥18 years with rectal gonorrhea or primary syphilis diagnosed within the same time frame as the mpox cases, and with presumptive sexual contact with a male or transgender person.¶¶

Demographic characteristics of case- and control patients were compared using Wilcoxon rank-sum and Pearson's chi-square tests. Case- and control patient records in CDESS were matched to NYSIIS*** by name and date of birth to ascertain JYNNEOS vaccination status and history, an approach similar

* https://www.cdc.gov/poxvirus/mpox/response/2022/world-map.html

† https://www.health.ny.gov/diseases/communicable/zoonoses/mpox/data/

§ The JYNNEOS vaccine is FDA-licensed for 0.5 mL doses, administered subcutaneously. Beginning August 9, 2022, FDA authorized 0.1 mL intradermal administration as a dose-sparing strategy, based on available evidence. NYSDOH implemented intradermal administration on August 29, 2022, after a brief transition period.

¶ https://www.fda.gov/media/131078/download

** https://www.hhs.gov/about/news/2022/06/28/hhs-announces-enhanced-strategy-vaccinate-protect-at-risk-individuals-from-current-monkeypox-outbreak.html

†† https://aspr.hhs.gov/SNS/Pages/JYNNEOS-Distribution.aspx

§§ https://regs.health.ny.gov/content/section-210-reporting-cases-or-suspected-cases-or-outbreaks-communicable-disease-physicians

¶¶ Persons reported as male mpox case-patients were presumed to be MSM in this analysis (among 70% of patients with recorded sexual activity within 21 days, 85% reported male or transgender partners). All rectal gonorrhea diagnoses were included (among 63% of patients with partner data, 98% reported male or transgender partners). For primary syphilis, diagnoses were excluded if the person reported no male-to-male sexual contact (84% reported risk factor data).

*** Doses of JYNNEOS vaccine administered in New York outside of NYC are reportable to NYSIIS. Doses given to persons in NYC are reported to the Citywide Immunization Registry, which sends all non-NYC New York residents' records to NYSIIS.

to that used in a COVID-19 VE study (*4*). Vaccination status was categorized into four groups, including one unvaccinated group (no JYNNEOS doses received) or one of three vaccinated groups: 1) with mpox or sexually transmitted infection (STI) specimen collected <14 days after receipt of dose 1; 2) ≥14 days after dose 1; or 3) after dose 2 (*5*,*6*). To estimate adjusted VE, conditional logistic regression models of case- and control patient vaccination status and dose history were used, matched on diagnosis week, with covariates including age, race and ethnicity, and region within New York outside NYC. VE values (with 95% CIs) were estimated as 1 – OR x 100, comparing each vaccinated category with the unvaccinated group.††† Four sensitivity analyses were conducted to examine uncertainties in case- and control patient definitions. All 1-dose VE estimates were reported for doses received ≥14 days earlier, unless otherwise specified. Statistical analyses were carried out using SAS software (version 9.4; SAS Institute). This analysis was determined to be nonresearch by the NYSDOH Institutional Review Board.

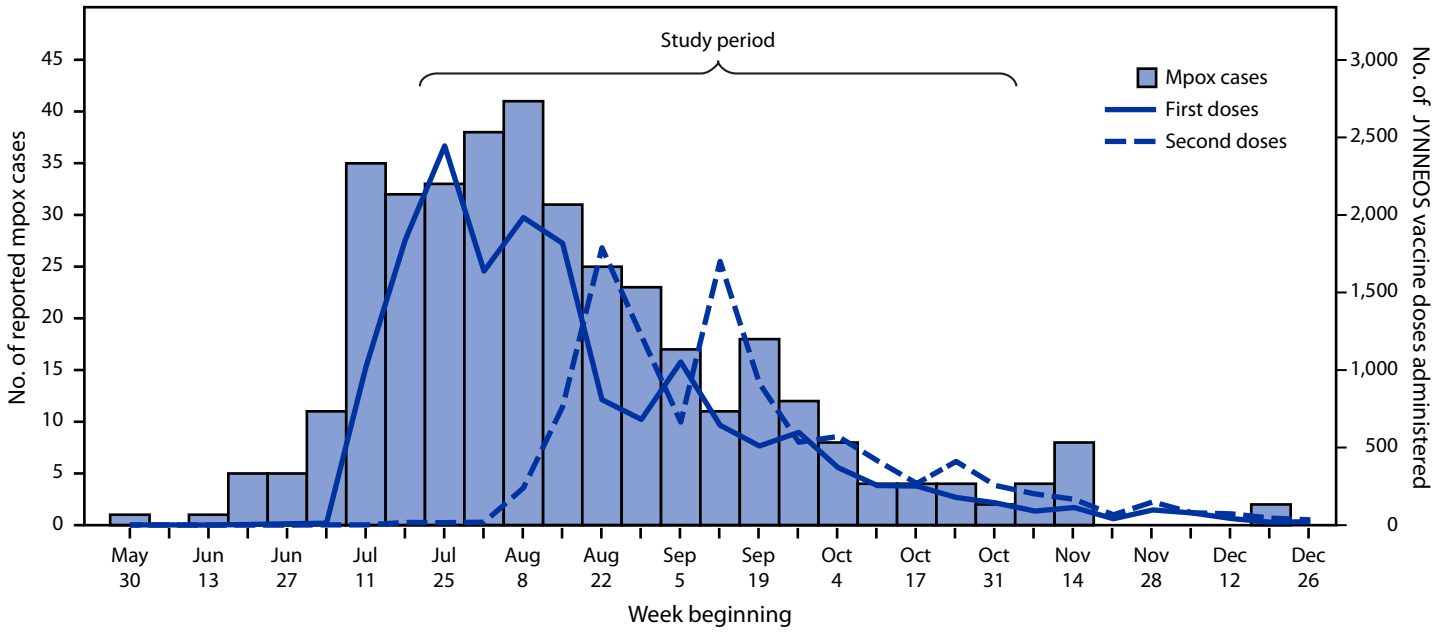
During June 2–December 31, 2022, a total of 375 mpox cases were reported to NYSDOH and the administration of 27,385 JYNNEOS doses was recorded in NYSIIS, including 16,769 (61%) first doses and 10,616 (39%) second doses (Figure). The reported number of cases peaked in mid-August, 5 weeks after launch of the JYNNEOS vaccination campaign. During July 24–October 31, a total of 252 male mpox case-patients and 255 STI control patients (175 with rectal gonorrhea and 80 with primary syphilis) met inclusion criteria. The age distribution was similar for case-patients (median = 32.1 years; range = 18.5–66.4 years) and control patients (median = 31.3 years; range = 19.4–74.3 years) (p = 0.47). Among persons with known ethnicity, Hispanic ethnicity was more prevalent among case-patients (43.6%) than among controls (18.9%; p<0.001) (Table 1). In addition, 68.7% of case-patients lived in the metropolitan region outside NYC, compared with 35.7% of control patients (p<0.001).

Among the 252 mpox case-patients, 22 (8.7%) had received the JYNNEOS vaccine, including 10 (4.0%) who had received 1 dose <14 days earlier, 10 (4.0%) who had received 1 dose ≥14 days earlier, and two (0.8%) who had received 2 doses; 230 (91.3%) were not vaccinated (Table 2). Among 255 control patients, 51 (20%) had received the JYNNEOS vaccine, including 42 (16.5%) who received an STI diagnosis ≥14 days after receiving 1 dose (23; 9.0%) or 2 doses (19; 7.5%). This corresponded to adjusted VE for combined 1 dose or 2 doses of 75.7% (95% CI = 48.5%–88.5%); 1-dose VE was 68.1% (95% CI = 24.9%–86.5%) and 2-dose VE was 88.5% (95% CI = 44.1%–97.6%). No significant VE was observed within 13 days of receipt of dose 1.

The first of the four sensitivity analyses (Supplementary Table, https://stacks.cdc.gov/view/cdc/128142) excluded men

††† Two separate models considered the main four-level dose classification and one that combined "≥14 days after dose 1" and "dose 2" into a single level.

FIGURE. Reported mpox cases and first and second JYNNEOS vaccine doses administered, by week — New York,* June 2–December 31, 2022



Abbreviation: Mpox = monkeypox.
* Outside of New York City.

aged ≥50 years, who might have received a smallpox vaccine before routine nonmilitary U.S. vaccination ended in 1972; this analysis detected nearly identical VE as the main sensitivity analysis. The second sensitivity analysis included 71 secondary syphilis diagnoses in the control group, resulting in 1-dose or 2-dose combined VE of 64.8% (95% CI = 26.7%–83.1%). Among control patients, 213 (83.5%) had known reasons for testing: 88 (41.3%) because of symptoms, 19 (8.9%) because of partner referral, 103 (48.4%) for screening, and three (1.4%) for another reason. The third analysis restricted control patients to those persons testing for symptoms or referrals; 1-dose or 2-dose VE was 63.6% (95% CI = 8.0%–85.6%).[§§§] The final sensitivity analysis limited observations to persons with known race and ethnicity and estimates increased modestly from the primary analysis, with 1-dose or 2-dose VE of 80.5% (95% CI = 56.1%–91.3%).

TABLE 1. Demographic characteristics of case-patients with mpox and control patients with sexually transmitted infections* — New York,† July 24, 2022–October 31, 2022

Characteristic	No. (%) Mpox case-patients (n = 252)	No. (%) STI control patients* (n = 255)	p-value
Age group, yrs			
18–29	94 (37.3)	111 (43.5)	0.34
30–39	90 (35.7)	75 (29.4)	
40–49	37 (14.7)	33 (12.9)	
≥50	31 (12.3)	36 (14.1)	
Race and ethnicity§			
Black or African American, NH	48 (19.8)	68 (32.1)	<0.001
White, NH	69 (28.4)	90 (42.5)	
Hispanic or Latino	106 (43.6)	40 (18.9)	
Other, NH	20 (8.2)	14 (6.6)	
Unknown	9 (3.6)	43 (16.7)	
Region			
Metropolitan region outside NYC¶	173 (68.7)	91 (35.7)	<0.001
Rest of New York outside NYC	79 (31.3)	164 (64.3)	

Abbreviations: Mpox = monkeypox; NH = non-Hispanic; NYC = New York City; STI = sexually transmitted infection.
* Men with diagnosed rectal gonorrhea or primary syphilis and a history of male-to-male sexual contact.
† Outside of New York City.
§ For race and ethnicity, the percentages and chi-square p-values are among case-patients and control patients for whom race and ethnicity were known.
¶ Includes Nassau, Putnam, Rockland, Suffolk, and Westchester counties.

TABLE 2. JYNNEOS vaccination history and estimated vaccine effectiveness among case-patients with mpox and control patients with sexually transmitted infections — New York,* July 24, 2022–October 31, 2022

Vaccination status	Mpox case-patients (n = 252) No. (%)	All STI controls (n = 255) No. (%)	All STI controls (n = 255) VE (95% CI)
Unvaccinated	230 (91.3)	204 (80.0)	Ref
0–13 days after first dose	10 (4.0)	9 (3.5)	−36.2 (<−100 to 56.3)
≥14 days after first dose	10 (4.0)	23 (9.0)	68.1 (24.9 to 86.5)
≥0 days after second dose	2 (0.8)	19 (7.5)	88.5 (44.1 to 97.6)
≥14 days after first dose or ≥0 days after second dose	12 (4.8)	42 (16.5)	75.7 (48.5 to 88.5)

Abbreviations: Mpox = monkeypox; Ref = referent group; STI = sexually transmitted infection; VE = vaccine effectiveness.
* Outside of New York City.

Discussion

Receipt of 1 or 2 JYNNEOS doses was effective in preventing diagnosed mpox infection, with higher 2-dose VE of >88%. These findings support the approved use of the JYNNEOS vaccine as a 2-dose series for mpox prevention and, amid ongoing sexually related transmission of mpox, incorporating the JYNNEOS vaccine into a broader program of sexual health services.

Before this outbreak, evidence to support VE against mpox was based on human immunologic and animal challenge studies (*1*–*3*). Since the outbreak began, new estimates have been generated. CDC used multi-jurisdictional data on mpox patient vaccination status to estimate 9.6- and 7.4-fold incidence for unvaccinated at-risk males compared with 2-dose and 1-dose recipients, respectively (*5*,*6*). A similar United Kingdom analysis found 78% 1-dose VE,[¶¶¶] and an Israeli cohort study found 86% 1-dose VE (*7*). These cohort studies are subject to biases; at-risk unvaccinated population estimates are uncertain and afford limited ability to control for confounding variables. For example, incidence among vaccinated persons might be reduced by persons with lower risk behaviors seeking vaccination, inflating incidence risk ratios and VE estimates. Case-control studies such as this one and others (*8*) can build in control for both risk factors and test-seeking, which was achieved in this study by sampling persons with diagnosed infections.

VE was moderately high according to the results of all sensitivity analyses. Lower VE observed when including secondary syphilis might reflect control patients with more remote risk behaviors or different clinical presentation. Lower VE when

§§§ STIs detected via asymptomatic screening might have been acquired several weeks or months previously, whereas symptomatic STIs are likely more recently acquired. Thus, persons with STIs detected via asymptomatic screening might be at lower current risk for mpox than are persons with symptomatic STIs. Also, persons with health-seeking behaviors (such as STI screening) might be more likely to receive the JYNNEOS vaccine. Alternatively, because asymptomatic screening is recommended annually for all sexually active MSM and every 3–6 months for those with increased behavioral risk, sampling routinely screening MSM might select for those at elevated risk for mpox. https://www.cdc.gov/std/treatment-guidelines/default.htm

¶¶¶ http://medrxiv.org/content/early/2022/12/14/2022.12.13.22282654.abstract

Summary

What is already known about this topic?

The JYNNEOS vaccine was deployed in a national and state vaccination campaign during the 2022 monkeypox (mpox) outbreak. Postexposure prophylaxis and vaccination of persons at highest risk (primarily men who have sex with men) were prioritized. Evidence of vaccine effectiveness (VE) from controlled studies has been limited.

What is added by this report?

A comparison of men aged ≥18 years who received a diagnosis of mpox during July 24–October 31 in New York to controls with rectal gonorrhea or primary syphilis, based on systematically collected surveillance data, found adjusted combined 1-dose (received ≥14 days earlier) or 2-dose VE of 75.7%.

What are the implications for public health practice?

These findings support recommended 2-dose JYNNEOS vaccination consistent with CDC and New York State Department of Health guidance.

limiting control patients to persons who had testing because of symptoms or partner referral could reflect intended removal of persons at lower risk seeking health care or inadvertent removal of persons at higher risk accessing frequent screening.

No protection was present for 1 dose received <14 days earlier; however, this interval could include both persons who received PEP and those who were exposed after vaccination but before a protective immune response might be anticipated. Additional studies are needed to resolve these scenarios, with control groups better selected for studying PEP.

The findings in this report are subject to at least six limitations. First, uncontrolled confounding might remain, which could lead to under- or overestimation of VE. For example, some factors might positively link persons more likely to acquire mpox and receive the JYNNEOS vaccine, compared with the overall population of persons who acquire an STI. These factors would render observed VE as underestimates. Second, JYNNEOS vaccine doses might be undercounted. Reporting doses to NYSIIS was optional before the July 29 state executive order mandated reporting; however, reporting was determined to be mostly complete via inventory surveys.**** Doses administered to New York residents while out of state are not reported to NYSIIS, unless entered afterward by an in-state provider. Both undercounts would cause nondifferential misclassification of coverage, lowering observed VE. Third, as with other studies, it was not possible to account for postvaccination behavior change; however, to the extent that vaccinated case- and control patients became infected in the postvaccination period, observed VE would represent unbiased estimates for those with ongoing risk. Fourth, the outbreak trajectory precluded determining duration of protection. Fifth, data were insufficient to calculate VE by subcutaneous or intradermal administration modes or by HIV-related factors. Finally, the findings describe diagnosed, symptomatic mpox, but not prevention of asymptomatic infection or secondary transmission.

The mpox outbreak rapidly declined during summer 2022 after extensive public health and vaccination efforts and individual behavior changes (*9*). How much decline was attributable to VE, behavior changes, or seasonal variation in viral transmission or behavior is unknown†††† (*9*,*10*). Nonetheless, this study leveraged systematically collected patient and vaccine registry data to demonstrate a protective effect of the JYNNEOS vaccine, controlling for outbreak trajectory, among persons with behavioral risk. Global mpox spread continues and might accelerate during summer 2023, given remaining unvaccinated persons with behavioral risk§§§§ These findings support recommended 2-dose JYNNEOS vaccination consistent with CDC and NYSDOH guidance.¶¶¶¶

**** A weekly NYSDOH inventory survey of all counties tracked aggregate JYNNEOS dose administrations and found 4,460 more doses administered than were in NYSIIS in the period before mandatory reporting. These doses account for 15% of doses administered during the study analytic period.

†††† http://medrxiv.org/content/early/2023/02/14/2023.02.10.23285772.abstract

§§§§ https://www.cdc.gov/poxvirus/mpox/response/2022/risk-assessment-of-resurgence.html

¶¶¶¶ https://www.cdc.gov/poxvirus/mpox/vaccines/index.html

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Notes from the Field:

Legionnaires Disease in a U.S. Traveler After Staying in a Private Vacation Rental House in the U.S. Virgin Islands — United States, February 2022

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On February 1, 2022, the U.S. Virgin Islands (USVI) Department of Health (VIDOH) was notified of a confirmed case of Legionnaires disease in an adult U.S. resident (Figure). The patient, a man aged 55 years, returned to his U.S. state of residence from leisure travel in USVI on January 22 and developed a cough, shortness of breath, and fatigue on January 23. On January 29, he was hospitalized for shortness of breath and received a positive SARS-CoV-2 test result at admission. The combination of the patient's symptoms and recent travel history prompted administration of a urinary antigen test (UAT) for Legionnaires disease specific to *Legionella pneumophila* serogroup 1 (Lp1); a positive result was returned on January 31. Inpatient treatment administered for COVID-19 pneumonia and Legionnaires disease included remdesivir, oral levofloxacin, oral and intravenous steroid therapy, and as-needed use of a bronchodilator inhaler and an expectorant. Remdesivir was discontinued during inpatient treatment because of elevated liver enzymes. The patient recovered and was discharged on February 2.

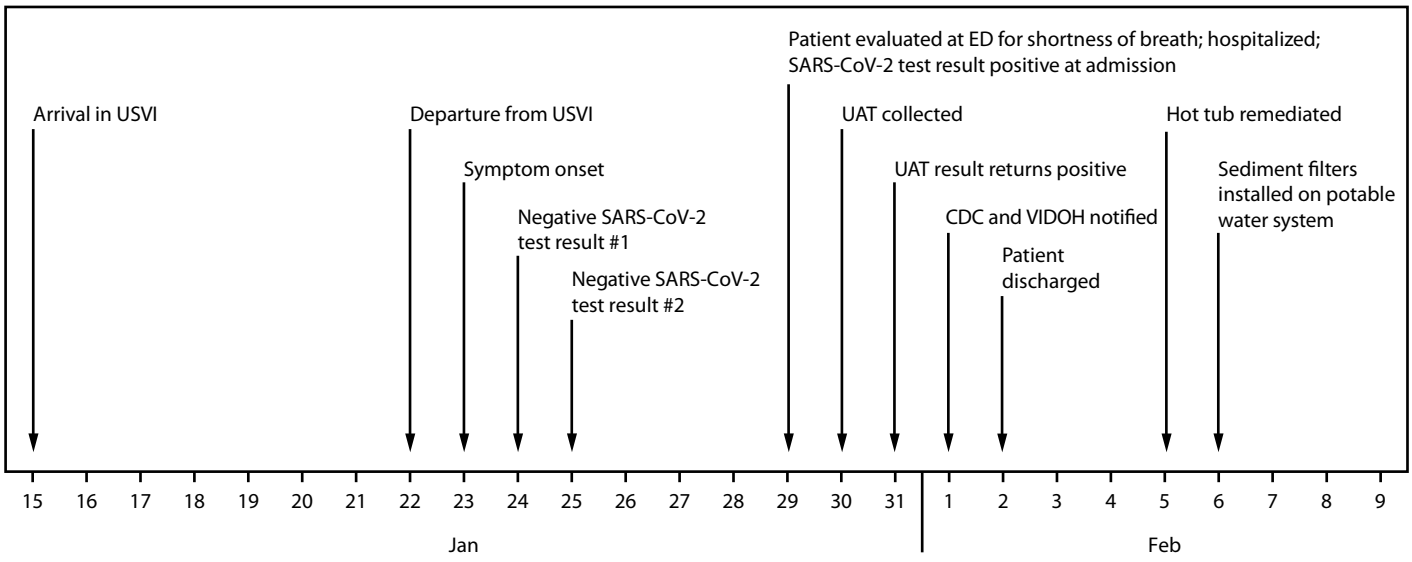
Interviews with the patient indicated that he had stayed at a privately owned vacation rental property during January 15–22. As is the case with most USVI residential properties, rainwater collected into a cistern under the home was the property's potable water source (*1*), which supplies water for drinking, bathing, a swimming pool, and two hot tubs. Water is heated by a solar water heater, which does not allow for water temperature control. The property owner reported that no routine chlorine treatment or water filtration systems were used to maintain the potable water source during the patient's stay.

On February 3, VIDOH requested assistance from CDC's Legionella program to conduct environmental sampling and testing for *Legionella* bacteria. Twenty-five bulk water, swab, and cartridge filter samples were collected at the property. *L. pneumophila* nonserogroup 1 was detected in 11 locations, including one hot tub cartridge filter, all showers, the two sampled bathroom sinks, and two critical control points: the cistern and solar water heater. Lp1, the only strain detectable by UAT, was not detected in environmental samples.

No respiratory specimen was collected from the patient, which would have been needed to detect and directly link an *L. pneumophila* nonserogroup 1 infection to the property; however, *L. pneumophila* of any serogroup can infect humans, and any environment hospitable to *L. pneumophila* nonserogroup 1

*These authors have contributed equally to this report.

FIGURE. Time line of patient travel, illness onset, diagnosis, and environmental remediation for a case of Legionnaires disease in a U.S. traveler visiting the U.S. Virgin Islands — United States, January–February 2022



Abbreviations: ED = emergency department; UAT = urinary antigen test; USVI = U.S. Virgin Islands; VIDOH = Virgin Islands Department of Health.

is also hospitable to Lp1 (*2*,*3*). Thus, even without a direct linkage of the *L. pneumophila* strain detected in the patient to the property, the high prevalence (44%) of samples positive for *L. pneumophila* nonserogroup 1 in environmental samples collected at a single time point revealed favorable environmental conditions for widespread, uncontrolled *Legionella* growth of multiple serogroups at the property.

Given the detection of *L. pneumophila* nonserogroup 1 at multiple sampling locations on the same day, VIDOH provided recommendations to disinfect the property's plumbing system and implement water system maintenance (installing a multistage ultraviolet filtration system and performing routine chlorination). The property owner completed remediation recommendations during February 5–6. However, a request by VIDOH for retesting in September was declined by the property owner, highlighting a gap in VIDOH's ability to evaluate maintenance effectiveness.

Vacation rental properties represent a growing proportion of the accommodation types identified in U.S. travel-associated Legionnaires disease cases and outbreaks (*4*). In resource-constrained settings such as USVI, commonly recommended water quality maintenance strategies (e.g., controlled temperature water heating and multistage water filtration) are not easily implemented, highlighting territory-specific potable water maintenance and testing needs. In light of these maintenance challenges, and that an estimated 90% of USVI residences rely on cisterns as their potable water source, the environmental assessment and sampling results of this investigation underscore the potential for undetected Legionnaires disease cases among USVI residents and travelers (*1*). Patients with clinical signs consistent with Legionnaires disease such as shortness of breath, cough, fatigue, and a history of travel to USVI should be tested for *Legionella,* even if, as was the case for the patient described in this report, another respiratory virus test result is positive. When cases are identified, environmental assessment and sampling, remediation strategy implementation, and timely postremediation testing are central to ensuring treatment success. VIDOH continues to work with CDC's *Legionella* program to improve territory Legionnaires disease case surveillance, *Legionella* environmental assessment and sampling practices, and educational outreach to vacation rental owners.

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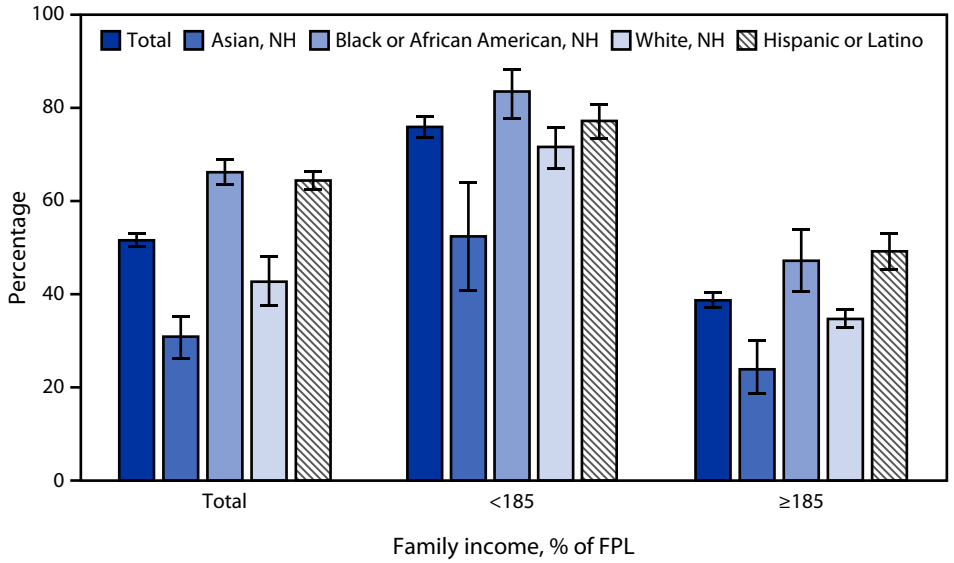
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Children and Adolescents Aged 5–17 Years Who Received Free or Reduced-Cost Meals at School During the Previous 12 Months,† by Race and Hispanic Ethnicity§ and Family Income¶ — National Health Interview Survey, United States, 2021



Abbreviations: FPL = federal poverty level; NH = non-Hispanic.
* With 95% CIs indicated by error bars.
† Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the question, "At any time in the last 12 months, did this child receive free or reduced-cost breakfasts or lunches at school?"
§ Children and adolescents categorized as NH Asian, NH Black or African American, and NH White indicated one race only; respondents for children had the option to select more than one racial group. Hispanic or Latino children might be of any race or combination of races. Total includes all children regardless of income or race and ethnicity.
¶ As a percentage of FPL, which is based on family income and family size, using the U.S. Census Bureau's poverty thresholds. Family income was imputed when missing.

In 2021, 51.6% of all U.S. children and adolescents aged 5–17 years received free or reduced-cost meals at school during the previous 12 months; NH Black or African American (66.2%) and Hispanic or Latino (Hispanic) (64.4%) children and adolescents were more likely to receive free or reduced-cost meals at school than were NH White (42.7%) children and adolescents, with NH Asian (30.9%) children and adolescents having the lowest percentage. The same pattern was observed for children and adolescents in families with income ≥185% of the FPL, but the observed difference in receiving free or reduced-cost meals between Hispanic and NH White children and adolescents was not significant for the lower-income group. Children and adolescents in families with incomes <185% of the FPL were more likely to receive free or reduced-cost meals compared with children and adolescents in families with incomes ≥185% of the FPL (75.9% versus 38.7%).

Source: National Center for Health Statistics, National Health Interview Survey, 2021. https://www.cdc.gov/nchs/nhis.htm

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