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Arthritis Prevalence Among Veterans — United States, 2017–2021

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Abstract

Arthritis is a chronic inflammatory condition and a leading cause of chronic pain and disability. Because arthritis prevalence is higher among U.S. military veterans (veterans), and because the veteran population has become more sexually, racially, ethnically, and geographically diverse, updated arthritis prevalence estimates are needed. CDC analyzed pooled 2017–2021 Behavioral Risk Factor Surveillance System data to estimate the prevalence of diagnosed arthritis among veterans and nonveterans, stratified by sex and selected demographic characteristics. Approximately one third of veterans had diagnosed arthritis (unadjusted prevalence = 34.7% [men] and 31.9% [women]). Among men aged 18–44 years, arthritis prevalence among veterans was double that of nonveterans (prevalence ratio [PR] = 2.1; 95% CI = 1.9–2.2), and among men aged 45–64 years, arthritis prevalence among veterans was 30% higher than that among nonveterans (PR = 1.3; 95% CI = 1.3–1.4). Among women aged 18–44 years, arthritis prevalence among veterans was 60% higher than that among nonveterans (PR = 1.6; 95% CI = 1.4–1.7); among women aged 45–64 years, arthritis prevalence among veterans was 20% higher than that among nonveterans (PR = 1.2; 95% CI = 1.1–1.3). Cultivating partnerships with veteran-serving organizations to promote or deliver arthritis-appropriate interventions might be advantageous, especially for states where arthritis prevalence among veterans is highest. The high prevalence of arthritis among female veterans, veterans aged ≥65 years, and veterans with disabilities highlights the importance of ensuring equitable access and inclusion when offering arthritis-appropriate interventions.

Introduction

Arthritis is a chronic inflammatory condition and a leading cause of chronic pain and disability (*1*,*2*). A recent report determined that arthritis prevalence is higher among U.S. military veterans (veterans) than among nonveterans; 35.2% of veterans (6.8 million) report diagnosed arthritis (*3*). Previous estimates indicate that arthritis prevalence is higher among female veterans, veterans self-identifying as non-Hispanic Black or African American or non-Hispanic White, and those living in southern and Appalachian states (*4*). Because arthritis prevalence is higher among veterans and the veteran population has become more sexually, racially, ethnically, and geographically diverse (*5*), a comprehensive understanding of arthritis prevalence estimates among veterans can guide strategic partnership development and equitable resource allocation for delivery of arthritis-appropriate, evidence-based interventions to veterans.

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Methods

Data Source and Primary Measures

Behavioral Risk Factor Surveillance System (BRFSS) is an annual, state-based, random-digit–dialed telephone survey of the noninstitutionalized U.S. adult population aged ≥18 years in all 50 states, the District of Columbia (DC), and U.S. territories.* Respondents were classified as having arthritis if they answered "yes" to the question, "Has a doctor, nurse, or other health professional ever told you that you had some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?" Respondents were classified as veterans if they answered "yes" when asked, "Have you ever served on active duty in the United States Armed Forces, either in the regular military or in a National Guard or military reserve unit?"

Data Analysis

CDC analyzed pooled BRFSS data for 2017–2021.† The median response rate during the 2017–2021 survey years ranged from 44.0% to 49.9%,§ with a total analytic sample size of 2,087,387.¶ Crude, age-specific, and age-standardized** prevalences of diagnosed arthritis were estimated overall and by veteran status, sex, and selected sociodemographic,††,§§,¶¶,***,†††,§§§ health,¶¶¶,**** and disability characteristics.†††† T-tests were used to assess differences between veterans and nonveterans overall and by subgroup, as well as to test differences in subgroup categories among veterans using a reference group. All differences are statistically significant at $\alpha = 0.05$. Age-standardized diagnosed arthritis prevalences among male and female veterans and nonveterans were estimated in the 50 states, DC, and U.S. territories. Prevalence ratios (PRs) were calculated by dividing the prevalence of arthritis among veterans by the prevalence of arthritis among nonveterans. SAS (version 9.4; SAS Institute) and SUDAAN (version 11.0; RTI International) were used for analysis to account for complex design and weighting. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.§§§§

Results

Approximately one third of veterans had diagnosed arthritis (unadjusted prevalence = 34.7% [men] and 31.9% [women]). Age-adjusted prevalence was higher among women (30.5%) than among men (25.2%; p<0.001) (Table 1). Among men, age-specific arthritis prevalences were higher among veterans

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

† Data collected in 2021 from the U.S. Virgin Islands were not included in this analysis. In 2019 and 2021, New Jersey and Florida, respectively, were unable to collect BRFSS data during enough months to meet the minimum requirements for inclusion in the annual aggregate data set. No statistically significant differences in arthritis prevalence among veterans by survey year were found, enabling the use of a 2017–2021 aggregated data set.

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than among nonveterans across all age groups (18–44, 45–64, and ≥65 years; p<0.001); among women, prevalences were higher among veterans than among nonveterans in two age groups (18–44 and 45–64 years; p<0.001). The age-specific arthritis PRs for veterans compared with nonveterans decreased as age group increased; among men aged 18–44 years, arthritis prevalence among veterans (12.7%) was double that of nonveterans (6.2%; PR = 2.1; 95% CI = 1.9–2.2), whereas among men aged 45–64 years, arthritis prevalence among veterans (34.9%) was 30% higher than that among nonveterans (26.2%; PR = 1.3; 95% CI = 1.3–1.4), and among men aged ≥65 years, arthritis prevalence among veterans (47.2%) was 10% higher than that among nonveterans (42.0%; PR = 1.1; 95% CI = 1.1–1.1). A similar pattern was observed among female veterans and nonveterans. Among women aged 18–44 years, arthritis prevalence among veterans (15.1%) was 60% higher than that among nonveterans (9.5%; PR = 1.6; 95% CI = 1.4–1.7); among women aged 45–64 years, arthritis prevalence among veterans (43.0%) was 20% higher than that among nonveterans (35.8%; PR = 1.2; 95% CI = 1.1–1.3); and among women aged ≥65 years, arthritis prevalence (56.4%) was similar to that among nonveterans (56.1%; PR = 1.0; 95% CI = 1.0–1.1).

Among men with disabilities, prevalences of arthritis were higher among veterans for all six disability types (hearing, vision, cognitive, mobility, self-care, and independent living) than among nonveterans (p<0.001). Among women with a disability, veterans had higher prevalences of arthritis among five of six disability types (all except self-care [p = 0.07]) than nonveterans (p<0.001). Age-adjusted arthritis prevalences among veterans with employer or union-sponsored health insurance (women = 23.5%; men = 21.2%) were significantly lower than those among veterans with Medicare and Medigap (private insurance plans sold to supplement Medicare) (women = 37.0%; men = 38.1%), Medicaid/other state-sponsored insurance (women = 39.9%; men = 27.5%), and TRICARE/Veterans Health Administration/Military insurance (women = 34.7%; men = 31.1% [p<0.001]).

Geographically, the age-adjusted prevalence of arthritis among male veterans ranged from 18.1% in DC to 35.8% in West Virginia (male veteran state median = 25.5%) (Table 2). The age-adjusted prevalence of arthritis among female veterans ranged from 21.8% in Hawaii to 39.3% in Arkansas (female veteran state median = 31.2%). Generally, the highest age-adjusted arthritis prevalence quartile among veterans, for both men and women, includes U.S. states in the southern and Appalachian regions (Figure). Eight states were in the highest quartile for state-specific arthritis prevalence among male and female veterans (Alabama, Arkansas, Kentucky, Michigan, Oklahoma, Rhode Island, Tennessee, and West Virginia).

Discussion

In this study, approximately one third of veterans reported diagnosed arthritis. This report indicates that associations between sex, age, and disability status and arthritis prevalence reported for the general population (*3*) are also evident among veterans. Among veterans, the prevalence of arthritis was higher among women than men, and higher among veterans

§ The median combined landline- and cell phone–weighted American Association for Public Opinion Research response rate formula #4 for 2017–2021 were the following ranges: 2017: 45.9% (30.6%–64.1%); 2018: 49.9% (38.8%–67.2%); 2019: 49.4% (37.3–73.1); 2020: 47.9% (34.5%–67.2%); and 2021: 44.0% (23.5%–60.5%). https://www.cdc.gov/brfss/annual_data/annual_data.htm

¶ The overall sample size represents all persons with complete data for both the veteran and arthritis questions. Sample size for subgroup analyses might be smaller, because data for the items assessing the subgroup were missing.

** Age-standardized to the 2000 projected U.S. Census Bureau population with three age groups (18–44, 45–64, and ≥65 years). https://www.cdc.gov/nchs/data/statnt/statnt20.pdf

†† The sexual orientation and gender identity module was optional; 28, 29, 31, 33, and 32 U.S. states and territories contributed data in 2017, 2018, 2019, 2020, and 2021, respectively.

§§ In 2017, respondents were asked the question, "Do you consider yourself to be …" with the following response options: straight, lesbian or gay, bisexual, other, and don't know/not sure. During 2018–2021, sexual orientation was assessed using the question, "Which of the following best represents how you think of yourself?" with the following response options: gay, straight (that is, not gay), bisexual, something else, and I don't know. Proportions for the response categories were similar across years.

¶¶ Persons self-identifying as non-Hispanic American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, other race, or multiracial were combined into "other, non-Hispanic."

*** Responses to the question, "What is the highest grade or year of school you completed?" were combined into the following groups: 1) less than high school graduate: never attended school or attended only kindergarten, grades 1–8, or grades 9–11; 2) high school graduate or equivalent: grade 12 or general educational development certificate; 3) technical school degree or some college: college 1–3 years; and 4) college degree or more: college ≥4 years.

††† The calculated variables for income were harmonized across years to create four groups. For 2021 data, the following responses were combined into the "≥$50,000" category: $50,000 to <$100,000, $100,000 to <$200,000, and ≥$200,000.

§§§ The health care access module was optional; five, eight, 11, and seven U.S. states and territories contributed data in 2017, 2018, 2019, and 2020, respectively. In 2021, the following responses were harmonized with 2017–2020 health insurance/health care categories: 1) Medicare and Medigap, 2) Medicaid and state-sponsored programs, and 3) other government programs and Indian Health Service. Persons reporting that Children's Health Insurance Program was their primary source of health care insurance or who did not know or refused were excluded from analysis.

¶¶¶ The calculated variable for body mass index [weight (kg) / (height [m^2])] was used to create the following four categories: underweight/healthy weight (<25.0), overweight (25.0 to <30.0), obesity I (30 to <35.0), and obesity II (≥35.0).

**** Responses to the question, "Would you say that in general your health is…" were combined into the following categories: 1) excellent/very good, 2) good, and 3) fair/poor.

†††† Respondents were categorized as having a disability if they answered "yes" to any of the six questions assessing the following disability types: vision, hearing, cognitive, mobility, self-care, or independent living.

§§§§ 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.

TABLE 1. Crude, age-standardized,* and age-specific prevalence of diagnosed arthritis† among veterans§ and nonveterans, stratified by sex and by selected demographic characteristics — Behavioral Risk Factor Surveillance System, United States, 2017–2021

Characteristic	Prevalence, % (95% CI)			
	Men n = 947,180		Women n = 1,139,254	
	Nonveterans	Veterans	Nonveterans	Veterans
Crude	17.7 (17.5–17.9)	34.7 (34.3–35.1)¶	28.8 (28.6–29.0)	31.9 (30.8–33.1)**
Age-standardized	18.3 (18.1–18.4)	25.2 (24.8–25.7)¶	25.3 (25.2–25.5)	30.5 (29.4–31.5)**
Age group, yrs				
18–44	6.2 (6.0–6.3)	12.7 (12.0–13.4)¶	9.5 (9.3–9.7)	15.1 (13.8–16.5)**
45–64	26.2 (25.9–26.5)	34.9 (34.1–35.7)¶	35.8 (35.5–36.1)	43.0 (41.1–44.8)**
≥65	42.0 (41.4–42.6)	47.2 (46.7–47.8)¶	56.1 (55.7–56.5)	56.4 (53.7–59.0)
Race and ethnicity††				
Black or African American	18.5 (17.9–19.0)	25.6 (24.0–27.2)¶	26.9 (26.4–27.4)	29.3 (26.9–31.8)
White	20.3 (20.2–20.5)	25.5 (25.0–26.0)¶	27.1 (27.0–27.3)	32.7 (31.5–34.0)**
Hispanic or Latino	12.7 (12.2–13.3)	22.1 (20.4–23.9)¶	21.1 (20.6–21.6)	28.7 (25.1–32.6)**
Other	14.2 (13.5–14.9)	26.5 (24.6–28.4)¶	19.8 (19.1–20.5)	22.6 (19.0–26.8)
Highest educational attainment§§				
Less than HS graduate	20.2 (19.7–20.7)	32.1 (28.0–36.5)¶	29.3 (28.8–29.9)	35.0 (28.0–42.8)
HS graduate or equivalent	19.7 (19.4–20.0)	23.7 (23.0–24.4)¶	26.7 (26.4–27.0)	29.1 (26.9–31.4)**
Technical school degree or some college	19.8 (19.5–20.2)	27.3 (26.5–28.1)¶	27.4 (27.1–27.7)	33.3 (31.5–35.1)**
College degree or more	14.6 (14.4–14.8)	23.2 (22.4–23.9)¶	20.3 (20.1–20.5)	28.2 (26.8–29.6)**
Annual household income¶¶				
<$15,000	23.4 (22.7–24.1)	33.3 (30.7–35.9)¶	34.3 (33.7–34.9)	41.5 (35.5–47.8)**
$15,000 to <$25,000	21.3 (20.8–21.8)	28.6 (27.3–30.0)¶	30.5 (30.0–30.9)	35.7 (32.9–38.6)**
$25,000 to <$50,000	18.9 (18.5–19.3)	26.1 (25.2–27.0)¶	26.8 (26.5–27.2)	35.2 (33.0–37.4)**
≥$50,000	16.8 (16.6–17.1)	24.2 (23.5–24.8)¶	21.8 (21.6–22.0)	27.8 (26.4–29.3)**
BMI (kg/m²)* **				
Underweight/Healthy weight (<25)	14.4 (14.1–14.7)	20.0 (19.2–20.9)¶	19.7 (19.4–19.9)	25.0 (23.3–26.7)**
Overweight (25 to <30)	16.7 (16.4–16.9)	23.1 (22.4–23.7)¶	24.4 (24.1–24.7)	30.5 (28.7–32.4)**
Obesity I (30 to <35)	21.9 (21.5–22.3)	30.0 (28.9–31.2)**	30.1 (29.7–30.5)	36.6 (33.9–39.3)**
Obesity II (≥35)	28.9 (28.3–29.5)	36.7 (34.9–38.4)**	38.2 (37.8–38.7)	44.2 (40.8–47.7)**
Health insurance type†††				
Employer- or union-sponsored	16.6 (16.1–17.2)	21.2 (19.9–22.6)	22.1 (21.5–22.6)	23.5 (20.2–27.0)
Medicare and Medigap	26.9 (25.8–28.0)	38.1 (32.4–44.0)§§§	37.3 (36.2–38.5)	37.0 (30.7–43.8)¶¶¶
Medicaid or other state program	22.7 (21.5–23.9)	27.5 (22.4–33.2)§§§	31.2 (30.1–32.3)	39.9 (33.3–46.8)¶¶¶
Self-insured (purchased by self or family member)	16.7 (15.7–17.8)	19.7 (17.3–22.3)	22.1 (21.3–22.9)	26.9 (14.9–43.5)
TRICARE (formerly CHAMPUS), VA, or military	20.2 (15.1–26.5)	31.1 (29.6–32.6)§§§	27.8 (25.2–30.4)	34.7 (31.4–38.1)¶¶¶
Other health insurance	19.1 (17.4–21.0)	26.1 (21.4–31.6)	27.4 (25.6–29.3)	36.6 (26.8–47.7)¶¶¶
None	11.1 (9.6–12.7)	22.4 (16.4–29.9)	16.6 (15.0–18.5)	—****
Sexual orientation††††,§§§§				
Bisexual	19.7 (17.9–21.8)	27.1 (23.3–31.2)¶	30.7 (29.3–32.1)	33.5 (26.8–41.0)
Gay or lesbian	19.7 (18.2–21.3)	24.5 (20.2–29.4)	29.4 (27.5–31.4)	31.1 (24.7–38.2)
Straight or heterosexual	18.6 (18.4–18.8)	25.4 (24.7–26.0)¶	25.5 (25.2–25.7)	31.4 (29.9–33.0)**
Something else or don't know	14.4 (13.1–15.8)	27.8 (22.5–34.0)¶	20.8 (19.6–22.0)	31.6 (24.5–39.7)**
Self-rated health¶¶¶¶				
Excellent/Very good	13.0 (12.8–13.2)	17.7 (17.2–18.3)¶	17.0 (16.9–17.2)	20.9 (19.8–22.1)**
Good	19.4 (19.1–19.7)	28.3 (27.4–29.2)¶	27.2 (26.9–27.5)	34.4 (32.3–36.4)**
Fair/Poor	30.9 (30.4–31.4)	44.7 (42.8–46.6)¶	44.7 (44.2–45.2)	55.3 (51.3–59.2)**
Hearing disability*****				
Yes	32.2 (31.2–33.2)	42.4 (40.4–44.4)¶	42.2 (41.0–43.4)	51.2 (44.9–57.5)**
No	17.4 (17.2–17.5)	23.2 (22.8–23.7)¶	24.7 (24.6–24.9)	29.6 (28.6–30.7)**

See table footnotes on the next page.

with disabilities than veterans without disabilities. Among men aged 18–44 years, the arthritis prevalence among veterans was double that among nonveterans, and among women aged 18–44 years, the arthritis prevalence among veterans was 60% higher than among nonveterans. This suggests that younger veterans might be living longer with arthritis and arthritis-attributable outcomes relative to nonveterans, which might result in higher rates and longer periods of work disability and lost wages (*6*,*7*). An analysis conducted using 2013 data estimated that among adults aged 18–64 years, adults with arthritis earned 9% ($3,361) less per year, compared with adults without arthritis (*6*). Therefore, younger veterans

TABLE 1. (*Continued*) Crude, age-standardized,* and age-specific prevalence of diagnosed arthritis† among veterans§ and nonveterans, stratified by sex and by selected demographic characteristics — Behavioral Risk Factor Surveillance System, United States, 2017–2021

Characteristic	Prevalence, % (95% CI)			
	Men n = 947,180		Women n = 1,139,254	
	Nonveterans	Veterans	Nonveterans	Veterans
Vision disability*****				
Yes	29.6 (28.6–30.6)	40.4 (37.4–43.5)¶	40.2 (39.3–41.2)	51.4 (43.8–59.0)**
No	17.8 (17.6–17.9)	24.7 (24.2–25.1)¶	24.6 (24.4–24.7)	29.7 (28.7–30.8)**
Cognitive disability*****				
Yes	32.6 (31.9–33.3)	47.2 (45.4–49.0)¶	43.6 (43.1–44.2)	55.0 (51.8–58.2)**
No	16.8 (16.6–17.0)	22.1 (21.7–22.6)¶	22.7 (22.5–22.9)	26.3 (25.3–27.4)
Mobility disability*****				
Yes	46.6 (45.6–47.6)	58.0 (55.4–60.5)¶	61.8 (61.0–62.6)	68.6 (64.4–72.6)**
No	15.1 (14.9–15.2)	20.6 (20.1–21.0)¶	20.0 (19.8–20.1)	23.9 (22.9–24.9)**
Self-care disability*****				
Yes	48.0 (46.4–49.6)	63.5 (59.8–67.0)¶	65.9 (64.4–67.3)	72.5 (65.0–78.9)
No	17.3 (17.2–17.5)	23.6 (23.2–24.1)¶	24.0 (23.9–24.2)	28.8 (27.8–29.8)**
Independent living disability*****				
Yes	39.0 (38.1–40.0)	52.4 (49.8–55.0)¶	51.2 (50.4–51.9)	63.7 (59.4–67.8)**
No	17.2 (17.1–17.4)	23.3 (22.9–23.8)¶	23.1 (23.0–23.3)	27.3 (26.3–28.4)**

Abbreviations: BMI = body mass index; HS = high school; VA = Veterans Health Administration.

* Age-standardized to the 2000 U.S. Census Bureau projected adult population, using three age groups: 18–44, 45–64, and ≥65 years. https://www.cdc.gov/nchs/data/statnt/statnt20.pdf

† Responded "yes" to the question, "Have you ever been told by a doctor or other health professional that you had some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?"

§ Veterans were defined as respondents who answered "yes" to the question, "Have you ever served on active duty in the United States Armed Forces, either in the regular military or in a National Guard or military reserve unit?"

¶ Statistically significant (p≤0.05) difference between male veterans and male nonveterans (reference group).

** Statistically significant (p≤0.05) difference between female veterans and female nonveterans (reference group).

†† Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic. Persons self-identifying as American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, other race, or multiracial were combined into "Other."

§§ Responses to the question, "What is the highest grade or year of school you completed?" were combined into the following groups: 1) less than HS graduate: never attended school or attended only kindergarten, grades 1–8, or grades 9–11; 2) HS graduate or equivalent: grade 12 or general educational development certificate; 3) technical school degree or some college: college 1–3 years; and 4) college degree or more: college ≥4 years.

¶¶ The calculated variables for income were harmonized across years to create four groups. For 2021 data, the following responses were combined into the "≥$50,000" category: $50,000 to <$100,000, $100,000 to <$200,000, and ≥$200,000.

*** The calculated variable for BMI [weight (kg) / (height [m^2])] was used to create the following four categories: underweight/healthy weight (<25.0), overweight (25.0 to <30.0), obesity I (30.0 to <35.0), and obesity II (≥35.0).

††† The health care access module was optional; five, eight, 11, and seven U.S. states and territories contributed data in 2017, 2018, 2019, and 2020, respectively. In 2021, the following responses were harmonized with 2017–2020 health insurance/health care categories: 1) Medicare and Medigap (private health insurance plans sold to supplement Medicare), 2) Medicaid and state-sponsored programs, 3) other government programs and Indian Health Service. Persons reporting that Children's Health Insurance Program was their primary source of health care insurance or who did not know or refused were excluded from analysis.

§§§ Statistically significant difference (p≤0.05) for health insurance type among male veterans. Employer- or union-sponsored is the reference group.

¶¶¶ Statistically significant difference (p≤0.05) for health insurance type among female veterans. Employer- or union-sponsored is the reference group.

**** Estimates are not included because they might be unreliable when the number of respondents is <50 or absolute CI width is >30%.

†††† The sexual orientation and gender identity module was optional; 28, 29, 31, 33, and 32 U.S. states and territories contributed data in 2017, 2018, 2019, 2020, and 2021, respectively.

§§§§ In 2017, sexual orientation was assessed using the question, "Do you consider yourself to be..." with the following response options: straight, lesbian or gay, bisexual, other, and don't know/not sure. During 2018–2021, sexual orientation was assessed using the question, "Which of the following best represents how you think of yourself?" and response options: gay, straight (that is, not gay), bisexual, something else, and I don't know.

¶¶¶¶ Self-rated health was assessed using the question, "Would you say that in general your health is" with the following response options: excellent, very good, good, fair, and poor. These were then combined into the following three categories: excellent/very good, good, and fair/poor.

***** Persons were categorized as having a disability if they answered "yes" to any of the six questions assessing the following disability types: vision, hearing, cognitive, mobility, self-care, or independent living.

might be a prime population for prevention and interventions to help alleviate their symptoms and improve health outcomes. This report also describes geographic differences in arthritis prevalence among veterans, which can help to guide resource allocation and partnership development for the promotion or delivery of arthritis-appropriate interventions.

Limitations

The findings in this report are subject to at least six limitations. First, BRFSS data are self-reported, which can result in recall and social desirability biases. Second, the data are cross-sectional; therefore, a causative relationship between military service and the development of arthritis cannot be inferred. Third, the BRFSS survey does not collect information on

TABLE 2. Jurisdiction-specific age-standardized* estimated prevalence of diagnosed arthritis† among veterans,§ by sex — Behavioral Risk Factor Surveillance System, United States, 2017–2021

	Men		Women	
State	**Estimated no.¶**	**Age-standardized % (95% CI)**	**Estimated no.¶**	**Age-standardized % (95% CI)**
Alabama	174,000	31.0 (28.6–33.4)	21,000	34.2 (29.8–38.9)
Alaska	23,000	24.8 (22.4–27.5)	4,000	28.4 (23.0–34.6)
Arizona	198,000	25.0 (23.2–27.0)	25,000	30.7 (26.1–35.7)
Arkansas	92,000	27.1 (24.3–30.1)	11,000	39.3 (32.0–47.2)
California	667,000	22.8 (20.7–25.1)	66,000	23.3 (18.3–29.2)
Colorado	138,000	23.6 (22.1–25.1)	17,000	28.4 (24.8–32.3)
Connecticut	75,000	22.7 (20.5–25.0)	6,000	25.9 (20.8–31.9)
Delaware	26,000	21.8 (19.1–24.7)	4,000	28.0 (22.3–34.5)
District of Columbia	7,000	18.1 (15.9–20.4)	1,000	24.0 (18.4–30.7)
Florida	530,000	24.7 (22.5–26.9)	69,000	32.8 (28.0–37.9)
Georgia	275,000	26.4 (24.4–28.6)	41,000	29.9 (25.8–34.4)
Hawaii	37,000	20.6 (19.0–22.4)	4,000	21.8 (18.0–26.1)
Idaho	48,000	23.8 (21.3–26.5)	6,000	32.6 (26.4–39.5)
Illinois	230,000	22.9 (20.3–25.8)	24,000	30.8 (24.1–38.5)
Indiana	170,000	26.0 (24.1–27.9)	16,000	30.3 (25.2–36.0)
Iowa	76,000	24.7 (23.0–26.5)	6,000	28.3 (22.8–34.6)
Kansas	74,000	25.6 (24.2–27.1)	8,000	33.3 (29.6–37.2)
Kentucky	127,000	30.5 (27.8–33.3)	14,000	33.7 (27.6–40.3)
Louisiana	110,000	25.5 (23.4–27.8)	13,000	31.8 (26.8–37.1)
Maine	48,000	28.9 (26.4–31.4)	5,000	32.8 (27.9–38.2)
Maryland	147,000	25.4 (23.7–27.1)	23,000	31.3 (27.6–35.3)
Massachusetts	131,000	27.9 (24.6–31.4)	13,000	29.0 (23.4–35.3)
Michigan	264,000	28.1 (25.8–30.4)	25,000	36.9 (31.0–43.3)
Minnesota	117,000	22.1 (20.6–23.7)	9,000	25.0 (21.5–28.8)
Mississippi	83,000	28.4 (25.6–31.4)	11,000	32.9 (26.7–39.8)
Missouri	181,000	25.8 (24.0–27.7)	22,000	35.4 (30.5–40.5)
Montana	38,000	27.3 (25.2–29.4)	4,000	31.2 (26.2–36.6)
Nebraska	48,000	23.6 (21.9–25.3)	5,000	32.4 (28.2–37.0)
Nevada	81,000	24.6 (20.9–28.7)	13,000	35.9 (28.0–44.7)
New Hampshire	40,000	24.5 (21.9–27.4)	3,000	25.6 (20.5–31.5)
New Jersey	117,000	23.1 (19.8–26.8)	12,000	29.2 (21.2–38.6)
New Mexico	54,000	25.0 (22.5–27.7)	7,000	34.8 (28.5–41.6)
New York	287,000	22.7 (20.9–24.6)	33,000	29.0 (24.9–33.4)
North Carolina	294,000	26.0 (24.0–28.1)	40,000	31.2 (26.2–36.8)
North Dakota	20,000	25.5 (23.4–27.8)	2,000	27.8 (22.4–34.0)
Ohio	314,000	27.8 (25.9–29.8)	32,000	31.9 (27.7–36.4)
Oklahoma	122,000	29.1 (26.9–31.4)	17,000	36.1 (31.1–41.3)
Oregon	121,000	25.8 (23.7–28.1)	15,000	30.4 (25.6–35.6)
Pennsylvania	331,000	25.9 (23.5–28.4)	39,000	35.5 (28.5–43.2)
Rhode Island	29,000	27.7 (24.3–31.3)	3,000	37.9 (31.2–45.2)
South Carolina	172,000	28.5 (26.2–30.8)	21,000	31.0 (27.0–35.3)
South Dakota	25,000	25.5 (22.5–28.8)	3,000	23.8 (18.7–29.7)
Tennessee	203,000	27.8 (25.4–30.4)	29,000	38.8 (32.6–45.4)
Texas	610,000	23.3 (21.2–25.5)	90,000	28.4 (24.5–32.6)
Utah	56,000	26.2 (24.4–28.2)	5,000	31.7 (26.7–37.2)
Vermont	17,000	23.1 (21.2–25.2)	2,000	27.6 (22.3–33.6)
Virginia	260,000	25.9 (24.4–27.5)	5,000	29.0 (26.0–32.2)
Washington	204,000	23.6 (22.2–25.0)	30,000	35.7 (31.8–39.7)
West Virginia	73,000	35.8 (33.1–38.5)	5,000	35.3 (29.0–42.2)
Wisconsin	146,000	24.4 (21.9–27.2)	13,000	32.2 (25.6–39.5)
Wyoming	17,000	25.6 (23.2–28.2)	2,000	24.0 (19.3–29.3)
Median	—	25.5	—	31.2
U.S. territory				
Guam	3,000	23.9 (21.4–26.7)	<1,000	16.2 (11.9–21.7)
Puerto Rico	27,000	19.4 (16.4–22.9)	4,000	29.3 (21.4–38.5)
U.S. Virgin Islands	<1,000	13.8 (6.2–27.9)	<1,000	25.0 (16.3–36.4)

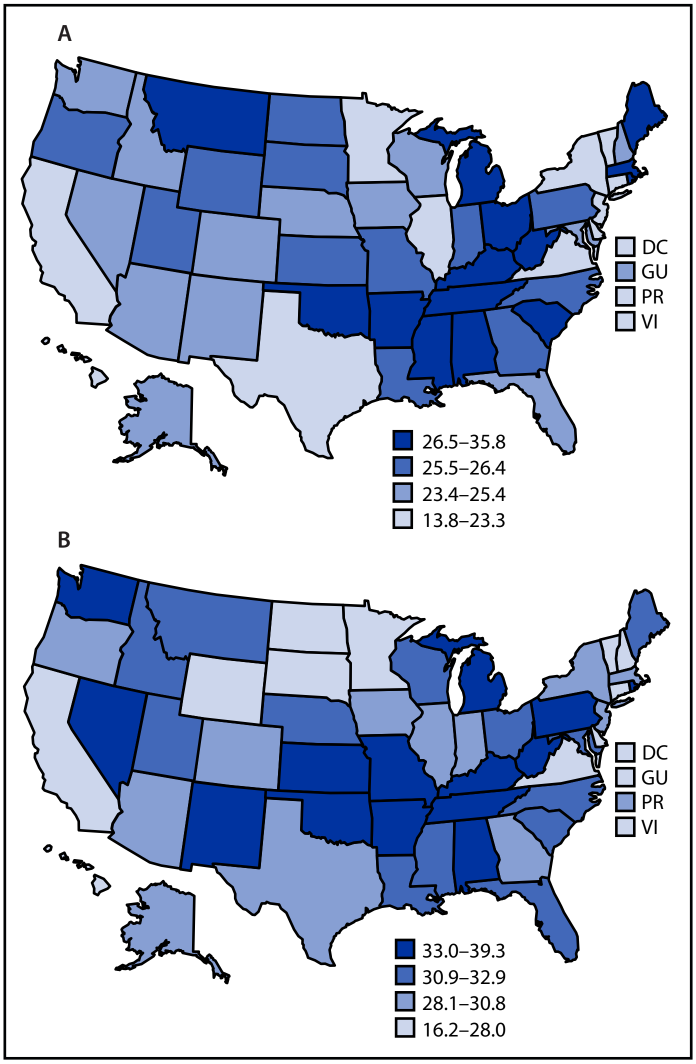
* Age-standardized to the 2000 U.S. Census Bureau projected adult population, using three age groups: 18–44, 45–64, and ≥65 years. https://www.cdc.gov/nchs/data/statnt/statnt20.pdf

† Responded "yes" to the question, "Have you ever been told by a doctor or other health professional that you had some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?"

§ Veterans were defined as respondents who answered "yes" to the question, "Have you ever served on active duty in the United States Armed Forces, either in the regular military or in a National Guard or military reserve unit?"

¶ Represents the estimated number of veterans with diagnosed arthritis, weighted to the noninstitutionalized U.S. civilian population using sampling weights provided in the Behavioral Risk Factor Surveillance System data.

FIGURE. Jurisdiction-specific, age-standardized estimated arthritis prevalence (quartiles) among male veterans (A) and female veterans (B) — Behavioral Risk Factor Surveillance System, United States, 2017–2021



Abbreviations: DC = District of Columbia; GU = Guam; PR = Puerto Rico; VI = U.S. Virgin Islands.

duration of military service or occupation type or activities while serving; therefore, arthritis prevalence across these characteristics could not be assessed. Fourth, these findings are not generalizable to U.S. adults without access to a landline or cell phone (e.g., persons experiencing homelessness or incarceration). Fifth, the current analyses did not examine confounding effects related to underlying differences in the distribution of age, sex, or race and ethnicity within the veteran population; future analyses might benefit from multivariable effect modification analyses. Finally, low response rates for individual states could result in nonresponse bias; however, the application of sampling weights helps address this bias.

Summary

What is already known about this topic?

Arthritis is a chronic inflammatory condition that can lead to chronic pain and disability. U.S. veterans experience higher rates of diagnosed arthritis than nonveterans.

What is added by this report?

Approximately one third of U.S. veterans reported diagnosed arthritis during 2017–2021. Among men aged 18–44 years, the arthritis prevalence among veterans was double that among nonveterans, and among women aged 18–44 years, the arthritis prevalence among veterans was 60% higher than among nonveterans.

What are the implications for public health practice?

Multisectoral partnerships among public health departments, community-based organizations, veteran-serving organizations, health care providers, and payors can help achieve equitable access to arthritis-appropriate, evidence-based programs for veterans to prevent or limit progression of arthritis, particularly among disproportionately affected groups and relatively younger veterans who might have been living longer with arthritis.

Implications for Public Health Practice

Arthritis prevalence among veterans is higher than among nonveterans, especially among male and female veterans aged <45 years and those with disabilities, providing rationale for prioritizing these subgroups for secondary and tertiary prevention efforts. These efforts might include dissemination of CDC-recognized arthritis-appropriate evidence-based interventions (AAEBIs), which are no- or low-cost physical activity and chronic disease self-management programs offered through community-based settings known to improve arthritis outcomes (*8*). Although veterans of all ages might benefit from AAEBIs to manage arthritis symptoms, younger veterans might have longer years of life lived with arthritis-attributable pain or disability, and therefore might receive additional benefit from AAEBIs to prevent or delay disease progression, disability, and functional limitations that might occur over time.

State-specific age-standardized prevalences of arthritis among male and female veterans can be used to guide state-level partnership development and resource allocation for addressing arthritis among veterans. Multisectoral partnerships among public health departments, community-based organizations, veteran-serving organizations, health care providers and payors (e.g., the Department of Veterans Affairs [VA], Medicare, and Medicaid) might help achieve equitable access to AAEBIs for all veterans. As one of the largest integrated health care systems serving an estimated 9 million veterans per year (*9*), the VA is particularly well-positioned to reach veterans with arthritis to provide interventions that might prevent or limit progression of the disease.

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Coverage with Selected Vaccines and Exemption from School Vaccine Requirements Among Children in Kindergarten — United States, 2022–23 School Year

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Abstract

U.S. states and local jurisdictions set vaccination requirements for school attendance and conditions and procedures for exemptions from these requirements. States annually report data to CDC on the number of children in kindergarten who meet, are exempt from, or are in the process of meeting requirements. National- and state-level estimates for complete vaccination with measles, mumps, and rubella vaccine (MMR); diphtheria, tetanus, and acellular pertussis vaccine (DTaP); poliovirus vaccine (polio); and varicella vaccine (VAR); exemptions from vaccination; and legally allowed kindergarten attendance while meeting requirements were based on data reported by 49 states and the District of Columbia (DC) for the 2022–23 school year. This kindergarten class became age-eligible to complete most state-required vaccinations during the COVID-19 pandemic. National coverage remained near 93% for all vaccines; exemptions were low but increased to 3%, compared with those during the 2021–22 school year (2.6%). At the state level, coverage with MMR, DTaP, polio, and VAR decreased in 29, 31, 28, and 25 states, respectively, compared with coverage during the 2021–22 school year. Exemptions increased in 40 states and DC, with 10 states reporting an exemption from at least one vaccine for >5% of kindergartners. Schools and providers should work to ensure that students are vaccinated before school entry, such as during the enrollment process, which is often several months before school starts. State and local provisional enrollment periods that allow students to attend school while on a catch-up schedule also provide the opportunity to fully vaccinate students and to prevent nonmedical exemptions resulting from lingering undervaccination due to COVID-19 pandemic–related barriers to vaccination, such as reduced access to vaccination appointments.

Introduction

State and local school vaccination requirements promote vaccination to protect students, schools, and communities against vaccine-preventable diseases (*1*). After 10 years of near 95% nationwide vaccination coverage, measles, mumps, and rubella vaccine (MMR)*; diphtheria, tetanus, and acellular pertussis vaccine (DTaP)†; poliovirus vaccine (polio)§; and varicella vaccine (VAR)¶ coverage declined approximately 1 percentage point during the 2020–21 school year and fell an additional percentage point during the 2021–22 school year, to approximately 93% (*2*). For both the 2020–21 and 2021–22 school years, states reported impacts of the COVID-19 pandemic and response for both vaccine administration and data collection (*3*,*4*). This analysis summarizes data collected and reported by state and local immunization programs** on vaccination coverage and exemptions to vaccination among kindergartners

* All states except Wyoming require 2 doses of a measles-containing vaccine. Seven states (Alaska, Georgia, New Jersey, New York, North Carolina, Oregon, and Virginia) require only 1 dose of rubella vaccine. Alaska, New Jersey, and Oregon require only 1 dose of mumps vaccine; mumps vaccine is not required in Iowa. Wyoming requires 1 dose of MMR for kindergarten entry, allowing students until the day before their seventh birthday to receive their second dose, but reported kindergarten coverage with 2 doses of MMR at the time of the assessment.

† Nebraska requires 3 doses of DTaP; Maryland and Wisconsin require 4 doses; Wyoming requires 4 doses of DTaP for kindergarten entry, allowing students until the day before their seventh birthday to receive their fifth dose; all other states require 5 doses, unless dose 4 was administered on or after the fourth birthday. The reported coverage estimates represent the percentage of kindergartners with the state-required number of DTaP doses, except for Kentucky, which requires 5 doses of DTaP by age 5 years, but reported 4-dose coverage for kindergartners, and Wyoming, which reported kindergarten coverage with 5 doses of DTaP at the time of the assessment.

§ Two states (Maryland and Nebraska) require only 3 doses of polio; Wyoming requires 3 doses of polio for kindergarten entry, allowing students until the day before their seventh birthday to receive their fourth dose; all other states require 4 doses unless the last dose was given on or after the fourth birthday. The reported coverage estimates represent the percentage of kindergartners with the state-required number of polio doses, except for Kentucky, which requires ≥4 but reports ≥3 doses of polio, and Wyoming, which reported kindergarten coverage with 4 doses of polio at the time of the assessment.

¶ Five states require 1 dose of VAR; 44 states and DC require 2 doses. Wyoming requires 1 dose of VAR for kindergarten entry, allowing students until the day before their seventh birthday to receive their second dose, but reported kindergarten coverage with 2 doses of VAR at the time of the assessment.

** Federally funded immunization programs are in 50 states and DC, five cities, and eight U.S. territories and freely associated states. Two cities (Houston and New York City) reported data to CDC, which were also included in data submitted by their state. State-level data were used to calculate national estimates and medians. Immunization programs in U.S. territories reported vaccination coverage and exemptions; however, these data were not included in national calculations.

in 49 states[††] and the District of Columbia (DC), and provisional enrollment or grace period status for kindergartners in 28 states[§§] for the 2022–23 school year.

Methods

Data Collection and Reporting

As mandated by state and local school entry requirements, either parents provide children's vaccination or exemption documentation to schools, or schools obtain records from state immunization information systems. Federally funded immunization programs work with departments of education, local health departments, school nurses, and other school personnel to assess the vaccination and exemption status of children enrolled in public and private kindergartens and to report unweighted counts, aggregated by school type, to CDC via a questionnaire in the Secure Access Management System, a federal, web-based platform that provides authorized personnel with secure access to public health applications operated by CDC. CDC uses these data to produce state- and national-level estimates of vaccination coverage among children in kindergarten. During the 2022–23 school year, 49 states and DC reported coverage with all state-required vaccines and exemption data for public school kindergartners; 48 states and DC reported coverage with all state-required vaccines and exemption data for private school kindergartners.[¶¶] Data from cities were included with their state data. State-level, national, and median coverage with the state-required number of DTaP, MMR, polio, and VAR doses are reported. Hepatitis B vaccination coverage is not included in this report but is available at SchoolVaxView (*2*). Twenty-eight states reported the number of kindergartners who were attending school under a grace period (attendance without proof of complete vaccination or exemption during a set number of days) or provisional enrollment (school attendance while completing a catch-up vaccination schedule). All counts were current as of the time of the assessment by the state immunization program.[***]

Data Analyses

National estimates, medians, and summary measures include only U.S. states and DC. Vaccination coverage and exemption estimates were adjusted on the basis of survey type and response rate.[†††] National estimates measure coverage and exemptions among all kindergartners, whereas medians indicate the midpoint of state-level coverage, irrespective of population size. During the 2022–23 school year, immunization programs reported 3,832,381 children enrolled in kindergarten in 49 states and DC.[§§§] Reported estimates are based on 3,559,366 (92.9%) children who were surveyed for vaccination coverage, 3,711,948 (96.9%) surveyed for exemptions, and 2,683,880 (70.0%) surveyed for grace period and provisional enrollment status. Potentially achievable coverage with MMR (the sum of the percentage of children who were up to date with 2 doses of MMR and those not up to date but nonexempt) was calculated for each state. Nonexempt students (those who do not have medical or nonmedical exemptions and who are not up to date) include those who were provisionally enrolled in kindergarten, in a grace period, or otherwise without documentation of complete vaccination. Vaccination assessments varied by state because of differences in required vaccines and required numbers of doses, vaccines assessed, methods of data collection, and data reported (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/134738). Kindergartners were considered up to date with a given vaccine if they received all doses for that vaccine required for school entry, except in nine states[¶¶¶] that reported kindergartners as up to date for any vaccine only if they had received all doses of all vaccines required for school entry. All but four states reported the number of kindergartners with an exemption for least one vaccine.[****] SAS software (version 9.4; SAS Institute)

[††] Montana did not report school vaccination data. Utah changed the way data were reported between the 2021–22 and 2022–23 school years and is excluded from year-to-year comparisons.

[§§] Arkansas, California, Colorado, Florida, Georgia, Hawaii, Idaho, Iowa, Michigan, Mississippi, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Washington, Wisconsin, and Wyoming reported data on the number of students within a grace period or provisionally enrolled at the time of assessment.

[¶¶] Twelve states reported coverage and exemption data for at least some homeschooled kindergartners, either separately, or included with data from public or private schools.

[***] Assessment date varied by state and area. Three states assessed schools on the first day of school; nine states assessed schools by December 31; 17 states and DC assessed schools by some other date, ranging from October 1, 2022, to May 15, 2023; and 20 states assessed schools on a rolling basis.

[†††] Immunization programs that used census or voluntary response provided CDC with data aggregated at the state or local (city or territory) level. Estimates based on these data were adjusted for nonresponse using the inverse of the response rate, stratified by school type (public, private, and homeschool, where available). Programs that used complex sample surveys provided CDC with data aggregated at the school or county level for weighted analyses. Weights were calculated to account for sample design and adjusted for nonresponse.

[§§§] These totals are the sums of the kindergartners surveyed among programs reporting data for coverage, exemptions, grace periods, and provisional enrollment. Data from cities and territories were not included in these totals.

[¶¶¶] Alabama, Florida, Georgia, Iowa, Mississippi, New Hampshire, New Jersey, and West Virginia considered kindergartners up to date only if they had received all doses of all vaccines required for school entry. In Kentucky, public schools reported numbers of children up to date with specific vaccines, and most private schools reported numbers of children who received all doses of all vaccines required for school entry.

[****] Colorado, Illinois, Minnesota, and Missouri did not report the number of kindergartners with an exemption but instead reported the number of exemptions for each vaccine, which could have counted some children more than once. For these states, the percentage of kindergartners exempt from the vaccine with the highest number of exemptions by exemption type (the lower bound of the potential range of exemptions) was included in the national and median exemption rates.

was used for all analyses. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.[††††]

Results

Vaccination Coverage

Nationally, 2-dose MMR coverage was 93.1% (range = 81.3% [Idaho] to ≥98.4% [Mississippi]), with coverage of ≥95% reported by 13 states and <90% by 12 states and DC (Table). DTaP coverage was 92.7% (range = 81.0% [Idaho] to ≥98.4% [Mississippi]); ≥95% coverage was reported by 11 states and <90% by 14 states and DC. Polio coverage was 93.1% (range = 81.8% [Idaho] to ≥98.4% [Mississippi]), with ≥95% coverage reported by 13 states and <90% by 12 states and DC. VAR coverage was 92.9% (range = 80.7% [Idaho] to ≥98.4% [Mississippi]), with 11 states reporting ≥95% coverage and 12 states and DC reporting <90% coverage. Coverage during the 2022–23 school year decreased in most states for all vaccines compared with the 2021–22 school year. (Supplementary Figure, https://stacks.cdc.gov/view/cdc/134740).

Vaccination Exemptions, Grace Period, and Provisional Enrollment

Overall, 3.0% of kindergartners had an exemption (0.2% medical and 2.8% nonmedical[§§§§]) from one or more required vaccines (not limited to MMR, DTaP, polio, and VAR) during 2022–23 (range = <0.1% [West Virginia] to 12.1% [Idaho]), compared with 2.6% reported during the 2021–22 school year (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/134739). Exemptions from receipt of one or more vaccines increased in 40 states and DC and increased by at least 1 percentage point in seven states (Figure 1). Nonmedical exemptions account for >90% of reported exemptions, and approximately 100% of the increase in the national exemption rate. Provisional enrollment or grace period attendance in kindergarten was 2.5% among 28 states reporting these data (range = 0.5% [Georgia and Hawaii] to 9.2% [Arkansas]). Nationwide, 3.9% of kindergarten students were not fully vaccinated with MMR and nonexempt. Among the 36 states and DC with MMR coverage <95% during the 2022–23 school year, 10 states reported that >5% of kindergartners were exempt. All but these 10 states could potentially achieve ≥95% MMR coverage if all nonexempt, not up-to-date children were vaccinated, compared with all but four states during the 2021–22 school year (Figure 2).

Discussion

During the 2022–23 school year, nationwide vaccination coverage among kindergarten children remained approximately 93% for MMR, DTaP, polio, and VAR, similar to that in the 2021–22 school year, lower than the 94% coverage in the 2020–21 school year, and lower still than the 95% coverage during the 2019–20 school year, when children were vaccinated before the COVID-19 public health emergency (*2*–*4*). National MMR coverage among kindergarten students remained below the Healthy People 2030 target of 95% (*5*) for the third consecutive year. Coverage with all four vaccines declined in a majority of states. To address pandemic-related declines in routine immunization coverage across the lifespan, CDC launched the Let's RISE[¶¶¶¶] initiative earlier in 2023 and is providing a broad range of communication and enhanced technical assistance, including back-to-school campaigns, to jurisdictions to get routine vaccination coverage back to prepandemic levels as quickly and equitably as possible.

The overall percentage of children with an exemption increased from 2.6% during the 2021–22 school year to 3.0% during the 2022–23 school year, the highest exemption rate ever reported in the United States (*2*). The percentage of children with an exemption increased in 40 states and DC. To achieve the Healthy People 2030 target of 95% MMR coverage, exemptions cannot exceed 5%. State-level exemption rates in excess of 5% prevent 10 states from potentially achieving ≥95% MMR coverage even if all nonexempt kindergartners in 2022–23 were vaccinated, up from four states in 2021–22. National MMR coverage of 93.1% during the 2022–23 school year translates to approximately 250,000 kindergartners who are at risk for measles infection.

Limitations

The findings in this report are subject to at least four limitations. First, comparisons among states are limited because of variation in state requirements: which vaccines are required, the number of doses required, the date required, the type of documentation accepted, data collection methods, allowable exemptions, definitions of grace period, and provisional enrollment. Second, representativeness might be negatively affected by data collection methods that assess vaccination status at different times, or miss some schools or students (e.g., homeschooled students). Third, vaccination coverage, exemption rates, grace

†††† 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.

§§§§ Washington was unable to deduplicate data for students with both religious and philosophical exemptions; therefore, the nonmedical exemption type with the highest number of kindergartners (the lower bound of the potential range of nonmedical exemptions) was included in the national and median exemption rates for nonmedical exemptions.

¶¶¶¶ https://www.cdc.gov/vaccines/partners/routine-immunizations-lets-rise.html

TABLE. Estimated[*] coverage[†] with measles, mumps, and rubella; diphtheria, tetanus, and acellular pertussis; poliovirus; and varicella vaccines; grace period or provisional enrollment[§]; and any exemption[¶,] among kindergartners, by immunization program — United States,[††] 2022–23 school year**

Immunization program	Kindergarten population[§§]	Percentage: Surveyed[¶¶]	Percentage: 2 doses of MMR[***]	Percentage: 5 doses of DTaP[†††]	Percentage: 4 doses of polio[§§§]	Percentage: 2 doses of VAR[¶¶¶]	Percentage: Grace period or provisional enrollment	Percentage: Any exemption	PP change in any exemption from 2021–22 school year
National estimate[****]	**3,832,381**	**92.9**	**93.1**	**92.7**	**93.1**	**92.9**	**2.5**	**3.0**	**0.4**
Median[****]	**—**	**—**	**92.1**	**91.9**	**92.2**	**92.7**	**2.0**	**3.3**	**0.6**
U.S. state/Jurisdiction									
Alabama[††††,§§§§]	59,113	100.0	≥93.9	≥93.9	≥93.9	≥93.9	NP	2.0	0.3
Alaska[§§§§,¶¶¶¶]	9,650	88.8	83.6	83.8	84.4	81.8	NR	5.7	1.1
Arizona[*****]	80,814	97.7	89.9	89.6	90.3	94.1	NR	7.4	0.6
Arkansas	38,358	95.8	91.9	90.6	90.7	91.1	9.2	3.1	0.6
California[§§§§,*****,†††††]	541,132	>99.9	96.5	95.6	96.3	96.1	1.5	0.2	−0.1
Colorado	65,576	97.2	87.0	87.2	87.0	85.9	≥0.6	≥4.3	1.1
Connecticut[††††,§§§§]	35,580	100.0	97.3	97.3	97.3	97.0	NP	0.8	−1.5
Delaware[§§§§,†††††]	10,674	9.7	95.1	93.8	94.0	94.0	NR	2.1	0.9
District of Columbia[††††,§§§§]	8,064	100.0	87.5	85.0	87.8	86.8	NR	1.3	0.8
Florida[§§§§]	230,309	97.7	≥90.6	≥90.6	≥90.6	≥90.6	4.7	4.5	0.6
Georgia[††††,§§§§]	123,771	100.0	≥88.1	≥88.1	≥88.1	≥88.1	0.5	3.8	−0.9
Hawaii[§§§§]	13,195	8.1	86.4	87.0	87.0	84.4	0.5	6.4	3.0
Idaho	23,721	99.3	81.3	81.0	81.8	80.7	1.9	12.1	2.3
Illinois[††††,§§§§]	135,332	100.0	91.7	91.5	91.4	91.3	NR	≥2.1	0.4
Indiana[§§§§,§§§§§]	81,307	87.5	92.0	83.0	88.8	91.6	NR	2.8	0.4
Iowa[††††,§§§§]	39,178	100.0	≥89.9	≥89.9	≥89.9	≥89.9	5.3	3.0	0.6
Kansas[§§§§,†††††,§§§§§,¶¶¶¶¶]	35,543	30.8	91.6	90.5	92.2	90.8	NP	2.9	0.6
Kentucky[§§§§,†††††,§§§§§]	54,742	96.9	≥90.1	≥90.6	≥91.2	≥89.8	NR	1.7	0.4
Louisiana[††††]	54,314	100.0	92.2	93.1	98.3	93.6	NP	2.3	1.2
Maine	12,403	93.9	96.8	96.6	96.8	96.6	NR	0.9	−0.9
Maryland[††††,§§§§,†††††]	59,684	100.0	96.7	96.9	97.2	96.6	NR	1.9	0.4
Massachusetts[††††,§§§§,†††††]	66,041	100.0	96.5	96.2	96.3	96.0	NP	1.4	0.4
Michigan[††††]	113,678	100.0	92.9	93.1	93.7	92.9	1.0	5.4	0.9
Minnesota	68,152	97.9	87.6	88.3	88.6	87.9	NR	≥4.5	0.8
Mississippi[††††,§§§§,*****]	36,048	100.0	≥98.4	≥98.4	≥98.4	≥98.4	1.0	0.2	0.1
Missouri[††††,§§§§]	69,126	100.0	91.3	91.1	91.5	90.8	NR	≥3.8	0.8
Montana	NR	NR	NR	NR	NR	NR	NR	NR	NA
Nebraska[††††,§§§§,†††††]	23,176	100.0	95.1	95.7	97.0	94.9	2.6	2.6	0.1
Nevada[§§§§]	34,333	89.1	92.8	92.2	92.8	92.6	1.7	5.6	0.8
New Hampshire [††††,§§§§,§§§§§]	11,332	100.0	≥89.4	≥89.4	≥89.4	≥89.4	4.5	3.4	0
New Jersey[††††,§§§§,§§§§§]	104,468	100.0	≥94.3	≥94.3	≥94.3	≥94.3	1.1	3.2	0.6
New Mexico[††††,§§§§]	21,068	100.0	94.9	94.7	95.0	94.4	2.0	1.5	0.1
New York (including NYC) [§§§§,*****]	205,906	96.6	97.9	97.2	97.5	97.5	2.3	0.1	0
NYC[§§§§,*****]	85,379	97.6	97.3	96.3	96.6	96.7	2.3	0.1	0
North Carolina [§§§§,†††††,§§§§§]	125,679	83.1	93.8	93.7	93.9	93.6	1.6	2.4	0.5
North Dakota	10,554	99.4	92.0	91.8	91.9	91.4	NR	5.1	−0.2
Ohio	134,893	93.7	89.3	89.4	89.7	88.8	5.9	3.8	0.8
Oklahoma[†††††]	52,548	89.5	89.6	90.0	91.0	94.6	NR	4.7	1.2
Oregon[††††,†††††]	40,963	100.0	91.9	90.9	91.5	94.1	NR	8.2	1.2
Pennsylvania	137,259	97.2	94.0	94.3	94.1	93.7	2.3	3.8	0.5
Rhode Island[§§§§,†††††,§§§§§]	10,532	96.5	96.9	96.9	96.9	96.3	0.9	1.5	0.3
South Carolina[§§§§,¶¶¶¶¶]	58,878	28.1	93.2	92.1	92.4	92.8	4.7	4.1	0.7
South Dakota[††††,§§§§]	12,081	100.0	92.5	92.2	92.3	92.0	NR	4.1	0.6
Tennessee[††††,§§§§,§§§§§]	79,692	100.0	95.4	94.8	95.0	95.1	2.0	3.2	0.8
Texas (including Houston)[†††††,§§§§§]	381,680	98.0	94.2	93.8	94.1	93.7	1.9	3.5	0.6
Houston[†††††,§§§§§]	37,664	98.8	91.3	90.7	91.0	90.6	2.6	2.3	0.8
Utah[††††,******]	46,635	100.0	90.0	89.7	89.9	89.6	3.7	8.1	NA
Vermont[††††,§§§§]	5,816	100.0	93.1	92.8	92.8	92.6	6.3	3.6	0.3
Virginia[§§§§,¶¶¶¶¶]	93,271	1.6	95.8	97.8	94.2	95.6	NR	2.2	0.4
Washington[§§§§§]	86,284	97.9	91.4	90.1	90.2	90.1	1.6	4.0	0.3
West Virginia[§§§§,*****,§§§§§,†††††]	19,175	86.1	≥95.6	≥95.6	≥95.6	≥95.6	NR	<0.1	0
Wisconsin[†††††]	63,593	93.9	86.5	87.0	88.2	85.9	5.7	7.2	0.9
Wyoming[††††,§§§§]	7,060	100.0	90.8	89.4	90.1	90.5	2.4	4.8	0.9

See table footnotes on the next page.

TABLE. (*Continued*) Estimated* coverage† with measles, mumps, and rubella; diphtheria, tetanus, and acellular pertussis; poliovirus; and varicella vaccines; grace period or provisional enrollment§; and any exemption¶, among kindergartners, by immunization program — United States,†† 2022–23 school year**

		Percentage							PP change
Immunization program	Kindergarten population§§	Surveyed¶¶	2 doses of MMR***	5 doses of DTaP†††	4 doses of polio§§§	2 doses of VAR¶¶¶	Grace period or provisional enrollment	Any exemption	in any exemption from 2021–22 school year
Territories and freely associated states									
American Samoa††††	NR	NR	NR	NR	NR	NR	NR	NR	NA
Federated States of Micronesia††††	1,595	100.0	92.2	77.6	82.7	NReq	NR	NR	NA
Guam††††,§§§§	2,079	100.0	91.0	86.0	89.1	NReq	NR	NR	NA
Marshall Islands††††, §§§§,*****	860	100.0	98.1	89.2	90.3	NReq	NR	NR	NA
Northern Mariana Islands††††	791	100.0	93.4	98.0	97.5	91.8	NR	0	0
Palau††††	261	100.0	≥81.2	≥81.2	≥81.2	NReq	NR	0	NA
Puerto Rico§§§§	21,255	9.3	92.8	95.2	96.7	92.9	NR	1.1	−0.7
U.S. Virgin Islands	NR	NR	NR	NR	NR	NR	NR	NR	NA

Abbreviations: DTaP = diphtheria, tetanus, and acellular pertussis vaccine; DTP = diphtheria and tetanus toxoids and pertussis vaccine; MMR = measles, mumps, and rubella vaccine; polio = poliovirus vaccine; NA = not available; NP = no grace period or provisional policy; NR = not reported to CDC; NReq = not required; NYC = New York City; PP = percentage point; VAR = varicella vaccine.

* Estimates adjusted for nonresponse and weighted for sampling where appropriate.

† Estimates based on a completed vaccination series (i.e., not vaccine specific) use the "≥" symbol. Coverage might include history of disease or laboratory evidence of immunity. In Kentucky, public schools reported numbers of children up to date with specific vaccines, and most private schools reported numbers of children who received all doses of all vaccines required for school entry.

§ A grace period is a set number of days during which a student can be enrolled and attend school without proof of complete vaccination or exemption. Provisional enrollment allows a student without complete vaccination or exemption to attend school while completing a catch-up vaccination schedule. In states with one or both of these policies, the estimates represent the number of kindergartners who were within a grace period, were provisionally enrolled, or were in a combination of these categories.

¶ Some programs did not report the number of children with exemptions, but instead reported the number of exemptions for each vaccine, which could count some children more than once. Lower bounds of the percentage of children with any exemptions were estimated using the individual vaccines with the highest number of exemptions. Estimates based on vaccine-specific exemptions use the "≥" symbol.

** Exemptions, grace period or provisional enrollment, and vaccine coverage status might not be mutually exclusive. Some children enrolled under a grace period or provisional enrollment might be exempt from one or more vaccinations, and children with exemptions might be fully vaccinated with one or more required vaccines.

†† Includes five territories and three freely associated states.

§§ The kindergarten population is an approximation provided by each program.

¶¶ The number surveyed represents the number surveyed for coverage. Exemption estimates are based on 30,224 kindergartners for Kansas, 58,878 for South Carolina, and 92,424 for Virginia.

*** Most states require 2 doses of MMR; Alaska, New Jersey, and Oregon require 2 doses of measles, 1 dose of mumps, and 1 dose of rubella vaccines. Georgia, New York, New York City, North Carolina, and Virginia require 2 doses of measles and mumps vaccines and 1 dose of rubella vaccine. Iowa requires 2 doses of measles vaccine and 2 doses of rubella vaccine. Wyoming requires 1 dose of MMR for kindergarten entry, allowing students until the day before their seventh birthday to receive their second dose, but reported kindergarten coverage with 2 doses of MMR at the time of the assessment.

††† Pertussis vaccination coverage might include some DTP doses if administered in another country or by a vaccination provider who continued to use DTP after 2000. Most states require 5 doses of DTaP for school entry, or 4 doses if the fourth dose was received on or after the fourth birthday; Maryland and Wisconsin require 4 doses; Nebraska requires 3 doses. The reported coverage estimates represent the percentage of kindergartners with the state-required number of DTaP doses, except for Kentucky, which requires ≥5 but reports ≥4 doses of DTaP. Wyoming requires 4 doses of DTaP for kindergarten entry, allowing students until the day before their seventh birthday to receive their fifth dose, but reported kindergarten coverage with 5 doses of DTaP at the time of the assessment.

§§§ Most states require 4 doses of polio vaccine for school entry, or 3 doses if the fourth dose was received on or after the fourth birthday; Maryland and Nebraska require 3 doses. The reported coverage estimates represent the percentage of kindergartners with the state-required number of polio doses, except for Kentucky, which requires ≥4 but reports ≥3 doses of polio. Wyoming requires 3 doses of polio for kindergarten entry, allowing students until the day before their seventh birthday to receive their fourth dose, but reported kindergarten coverage with 4 doses of polio at the time of the assessment.

¶¶¶ Most states require 2 doses of VAR for school entry; Alabama, Arizona, New Jersey, Oklahoma, and Oregon require 1 dose. Reporting of VAR status for kindergartners with a history of varicella disease varied within and among states; some kindergartners were reported as vaccinated against varicella and others as medically exempt. Wyoming requires 1 dose of VAR for kindergarten entry, allowing students until the day before their seventh birthday to receive their second dose, but reported kindergarten coverage with 2 doses of VAR at the time of the assessment.

**** National coverage and exemption estimates and medians were calculated using data from 49 states and the District of Columbia (i.e., did not include American Samoa, Federated States of Micronesia, Guam, Houston, Marshall Islands, Montana, Northern Mariana Islands, NYC, Palau, Puerto Rico, and the U.S. Virgin Islands). National grace period or provisional enrollment estimates and medians were calculated using data from the 28 states that have either a grace period or provisional enrollment policy and reported relevant data to CDC. Data reported from 3,559,366 kindergartners were assessed for coverage, 3,711,948 for exemptions, and 2,683,880 for grace period or provisional enrollment. Estimates represent rates for populations of coverage and exemptions (3,832,381), and grace period or provisional enrollment (2,763,250).

†††† The proportion surveyed is reported as 100% but might be <100% if based on incomplete information about the actual current enrollment.

§§§§ Philosophical exemptions were not allowed.

¶¶¶¶ Reported public school data only.

***** Religious exemptions were not allowed.

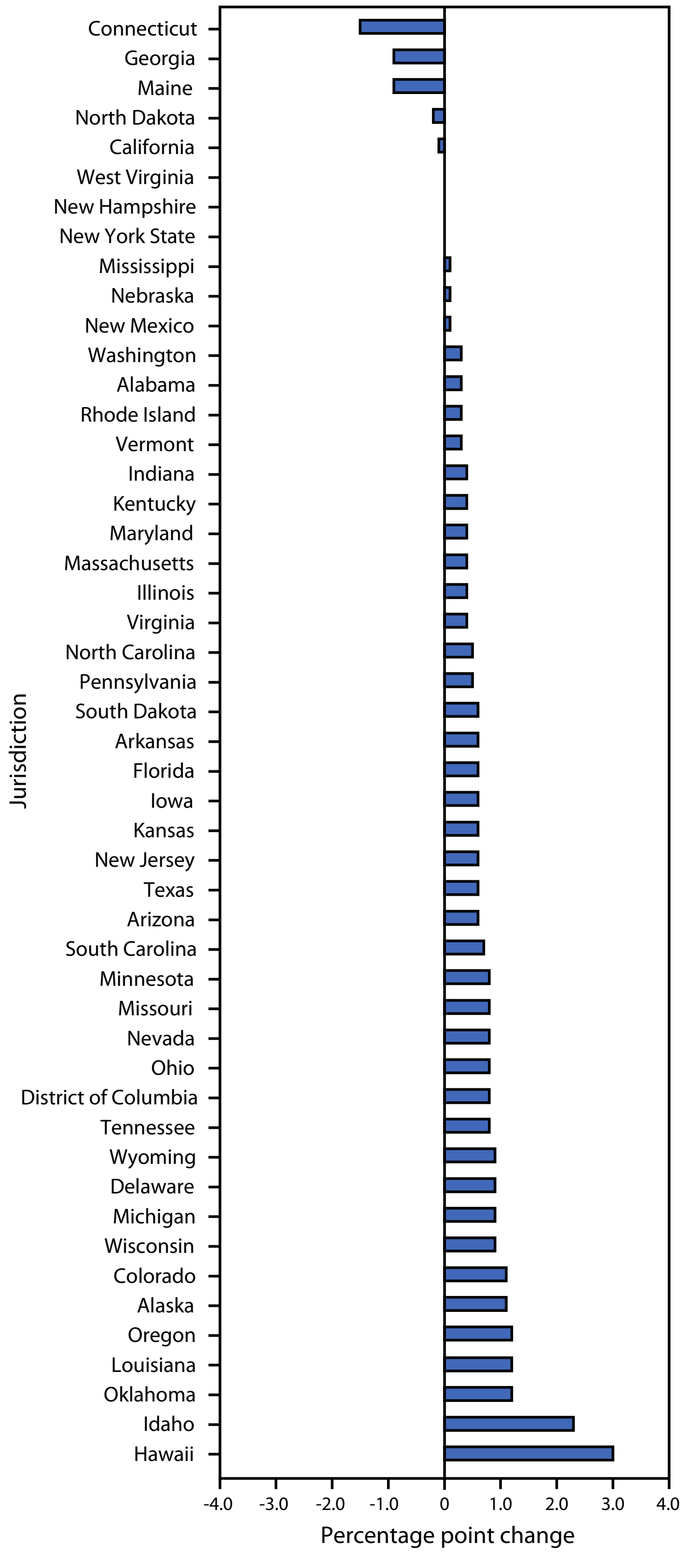
††††† Counted some or all vaccine doses received regardless of Advisory Committee on Immunization Practices–recommended age and time interval; vaccination coverage rates reported might be higher than those for valid doses.

§§§§§ Did not include certain types of schools, such as kindergartens in child care facilities, online schools, correctional facilities, or those located on military bases or tribal lands.

¶¶¶¶¶ Vaccination coverage data were collected from a sample of kindergartners; exemption data were collected from a census of kindergartners.

****** Utah changed the way data were reported between the 2021–22 and 2022–23 school years and is excluded from this analysis.

FIGURE 1. Change in percentage* of kindergartners exempt from one or more vaccinations, by jurisdiction — United States, 2021–22 and 2022–23 school years



* Montana did not report kindergarten vaccination coverage for the 2021–22 and 2022–23 school years and is excluded from this analysis. Utah changed the way data were reported between the 2021–22 and 2022–23 school years and is excluded from this analysis.

Summary

What is already known about this topic?

From the 2019–20 to the 2021–22 school year, national coverage with state-required vaccines among kindergartners declined from 95% to approximately 93%, ranging from 92.7% for diphtheria, tetanus, and acellular pertussis vaccine (DTaP) to 93.1% for polio.

What is added by this report?

During the 2022–23 school year, coverage remained near 93% for all reported vaccines, ranging from 92.7% for DTaP to 93.1% for measles, mumps, and rubella and polio. The exemption rate increased 0.4 percentage points to 3.0%. Exemptions increased in 41 states, exceeding 5% in 10 states.

What are the implications for public health practice?

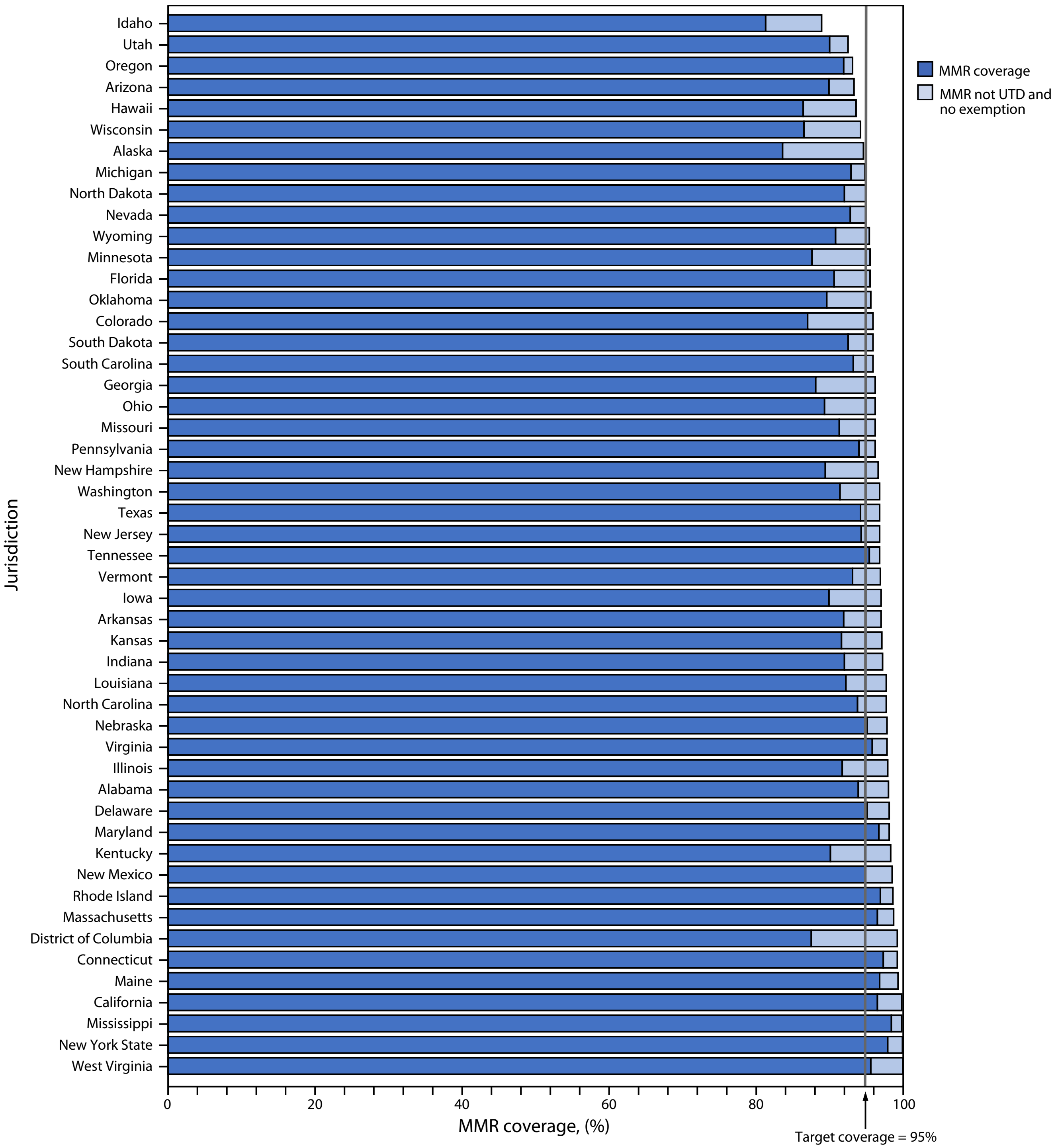
Exemptions >5% limit the level of achievable vaccination coverage, which increases the risk for outbreaks of vaccine-preventable diseases. Vaccination before school entry or during provisional enrollment periods could reduce exemptions resulting from barriers to vaccination during the COVID-19 pandemic.

period, or provisional enrollment might be under- or overestimated because of inaccurate or absent documentation. Finally, national coverage estimates for the 2022–23 school year include only 49 of 50 states and DC, and nine states use lower bound estimates; exemption estimates include 49 states and DC, and five states use lower bound estimates.

Implications for Public Health Practice

Nationwide vaccination coverage among kindergarten students remains below prepandemic levels, and exemptions have increased. Because clusters of undervaccinated children can lead to outbreaks (*6*–*8*), it is important for immunization programs, schools, and providers to make sure children are fully vaccinated before school entry, or before provisional enrollment periods expire. In previous years, nearly all states had the potential to achieve ≥95% coverage if all nonexempt students were vaccinated, but increases in state-level exemptions have reduced that number by 17%, from 48 in 2020–21 to 40 in 2022–23. Exemptions in excess of 5% limit the level of vaccination coverage that can be achieved, which increases the risk of outbreaks of vaccine-preventable diseases. It is not clear whether this reflects a true increase in opposition to vaccination, or if parents are opting for nonmedical exemptions because of barriers to vaccination or out of convenience. Whether because of an increase in hesitancy or barriers to vaccination, the COVID-19 pandemic affected childhood routine vaccination (*9*). Enforcement of school vaccination requirements, school-based vaccination clinics, reminder and recall systems, and follow-up with undervaccinated students

FIGURE 2. Potentially achievable coverage*,†,§ with measles, mumps, and rubella vaccine among kindergartners, by jurisdiction — United States, 2022–23 school year



Abbreviations: MMR = measles, mumps, and rubella vaccine; UTD = up to date.

* Jurisdictions are ranked from lowest to highest potentially achievable coverage. Potentially achievable coverage is estimated as the sum of the percentage of students with UTD MMR and the percentage of students without UTD MMR and without a documented vaccine exemption. Montana did not report kindergarten vaccination coverage for the 2021–22 and 2022–23 school years and is excluded from this analysis.

† The exemptions used to calculate the potential increase in MMR coverage for Alaska, Arizona, Arkansas, Colorado, Delaware, District of Columbia, Idaho, Illinois, Maine, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New York, North Carolina, Oklahoma, Oregon, Rhode Island, Texas, Utah, Vermont, Washington, Wisconsin, and Wyoming are the number of children with exemptions specifically for MMR. For all other jurisdictions, numbers are based on an exemption for any vaccine.

§ Potentially achievable coverage in Alaska, Arizona, Hawaii, Idaho, Michigan, Nevada, North Dakota, Oregon, Utah, and Wisconsin is <95%.

have already been shown to be effective in increasing vaccination coverage (*10*). A better understanding of the reasons behind nonmedical exemptions increasing in 40 states and DC, and their impact, could help develop policies that would complement those interventions, to bring higher vaccination coverage and protection against vaccine-preventable diseases within reach of more states.

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Strain of Multidrug-Resistant *Salmonella* Newport Remains Linked to Travel to Mexico and U.S. Beef Products — United States, 2021–2022

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Abstract

In 2016, CDC identified a multidrug-resistant (MDR) strain of *Salmonella enterica* serotype Newport that is now monitored as a persisting strain (REPJJP01). Isolates have been obtained from U.S. residents in all 50 states and the District of Columbia, linked to travel to Mexico, consumption of beef products obtained in the United States, or cheese obtained in Mexico. In 2021, the number of isolates of this strain approximately doubled compared with the 2018–2020 baseline and remained high in 2022. During January 1, 2021–December 31, 2022, a total of 1,308 isolates were obtained from patients, cattle, and sheep; 86% were MDR, most with decreased susceptibility to azithromycin. Approximately one half of patients were Hispanic or Latino; nearly one half reported travel to Mexico during the month preceding illness, and one third were hospitalized. Two multistate outbreak investigations implicated beef products obtained in the United States. This highly resistant strain might spread through travelers, animals, imported foods, domestic foods, or other sources. Isolates from domestic and imported cattle slaughtered in the United States suggests a possible source of contamination. Safe food and drink consumption practices while traveling and interventions across the food production chain to ensure beef safety are necessary in preventing illness.

Introduction

In 2016, CDC identified a multidrug-resistant (MDR) strain of *Salmonella enterica* serotype Newport that is now monitored as a persisting strain* named REPJJP01 and includes isolates from U.S. residents in all 50 states and the District of Columbia. A 2018–2019 investigation found that persons with these infections reported traveling to Mexico or consuming beef products obtained in the United States or cheese obtained in Mexico (*1*). During 2021, CDC's PulseNet database received an increase of REPJJP01 reports, which prompted this investigation. This report analyzed isolates identified during 2021–2022.

* This strain is monitored as a reoccurring, emerging, or persisting (REP) strain; "persisting" is defined as causing illness consistently during a long period. https://www.cdc.gov/ncezid/dfwed/outbreak-response/rep-strains.html

Methods

Isolate Sequencing and Determination of Antimicrobial Resistance

Salmonella isolates underwent whole genome sequencing at U.S. public health laboratories and federal agencies, and the resulting sequence data were uploaded to the PulseNet *Salmonella* National Database and analyzed by core genome multilocus sequence typing (cgMLST) (*2*). CDC defined REPJJP01 as a strain of *S.* Newport with a range of 0–21 allele differences by cgMLST. Isolate genomes were screened for resistance determinants and assigned predicted resistance patterns using ResFinder† drug keys as part of surveillance through the National Antimicrobial Resistance Monitoring System. Isolates were defined as MDR if they contained resistance determinants for three or more antimicrobial classes.

Data Analyses

Public health officials obtained travel and food exposure information from interviews and medical records of patients with the REPJJP01 strain isolated; some data were not available for all patients. Characteristics of patients with illness onset dates§ and food and animal samples with collection dates during January 1, 2021–December 31, 2022, were summarized, and proportions were compared using chi-square tests; $p<0.05$ was considered statistically significant. R statistical software (version 4.2.3 R Foundation) was used to conduct these analyses. CDC investigated multistate outbreaks among nontravelers with support from local and state health departments and the U.S. Department of Agriculture's Food Safety and Inspection Service. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.¶

† https://github.com/tseemann/shovill; https://github.com/phac-nml/staramr; https://github.com/StaPH-B/resistanceDetectionCDC

§ If illness onset date was unknown, it was presumptively calculated as the isolation date minus 3 days.

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

Results

Trends in Isolate Detection

In 2021, the total number of human isolates (641) approximately doubled from the average annual baseline number of cases detected during 2018–2020** (315) and remained high in 2022 (641) (Figure). Nonhuman isolates included 25 from cattle (beef products and cecal†† samples) and one from a sheep (cecal sample) from 13 U.S. states.§§

Patient and Isolate Characteristics

The median patient was aged 37.5 years (IQR = 23–55 years), 52% were female, 56% were Hispanic or Latino (Hispanic), and 19% and 17% were California and Texas residents, respectively (Table). Among all patients with hospitalization data available (721), one third (247, 33%) were hospitalized, and two died (<1%). The percentage of Hispanic patients who were hospitalized (40%) was higher than that of non-Hispanic White patients (24%, p<0.001) or non-Hispanic patients of other races (22%, p = 0.03). Most patient isolates (1,141, 89%) were resistant or had decreased susceptibility to at least one antibiotic recommended for empiric or alternative treatment (*3*–*5*), and 1,110 (87%) were MDR. Most food and cecal isolates also had antimicrobial resistance; 65% of food and cecal isolates were MDR.

Travel to Mexico remained a risk factor for infection during 2021–2022. Among 721 patients with known travel history, nearly one half (344, 48%) reported traveling to Mexico in the month before illness onset. Compared with persons without a recent history of travel to Mexico, fewer travelers to Mexico were Hispanic (43% versus 64%, p<0.001) or were hospitalized (24% versus 37%, p<0.001). Reported travel to Mexico was more prevalent in 2022 (53%) than in 2021 (39%) (p<0.001). Eleven ill nontravelers reported eating foods, including queso fresco or dried beef, purchased in Mexico by family or friends.

Outbreak Investigations

A multistate 75-patient outbreak was investigated during fall 2021; 80% of patients in that outbreak were Hispanic, and beef, including dried beef, was the suspected vehicle. A second multistate outbreak that included 22 non-Hispanic patients was investigated during fall 2022. A strain of *S.* Newport indistinguishable from the clinical isolates was isolated in a sample of leftover ground beef from a patient. However, because the beef could not be traced back definitively to a common source, no regulatory action could be taken. Six subclusters of REPJJP01 isolates related within 0–2 allele differences during 2021–2022 contained at least one clinical and one beef isolate; however, these small clusters did not include sufficient cases to conduct an epidemiologic investigation that could implicate a product.

Discussion

During 2021–2022, a total of 1,282 U.S. residents had culture-confirmed infections caused by REPJJP01, an MDR strain of *S.* Newport. The total number of cases of illness is likely much larger: an additional 29 cases of *Salmonella* are estimated for each culture-confirmed case (*6*). Further, the sharp increase in cases of REPJJP01 during 2021 occurred despite an overall decrease in *Salmonella* reports during the COVID-19 pandemic (*7*). Patient exposures and outbreak sources resembled those identified in the 2018–2019 investigation (*1*), including travel to Mexico, consumption of beef and cheese products purchased in Mexico, and consumption of beef products obtained in the United States.

This strain might spread to the United States through returned travelers from Mexico, cattle born or raised in Mexico and slaughtered in the United States, or beef or cheese imported from Mexico. The increase in cases during 2021–2022 appears driven partially by travelers; the 48% of patients who reported travel to Mexico is high compared with the 9% of all patients with nontyphoidal *Salmonella* reporting any international travel.¶¶ In September 2022, CDC posted a Level 1 Travel Health Notice to alert travelers to Mexico about the risk for infection and to provide advice for prevention.*** Travelers should practice safe eating, drinking, cooking, and food handling habits to reduce their chance of becoming ill. Among nontravelers, the high proportion of Hispanic patients and patient reports of eating beef or cheese purchased by family or friends in Mexico suggests that beef or cheese imported from Mexico might be an important source of illness.†††

The REPJJP01 strain might also spread within the United States through animals or beef products. The strain has been isolated in samples collected in federally regulated slaughter and processing establishments throughout the United States and import establishments on the Southern border. The isolation of this strain from a beef product collected during a 2022 multistate outbreak investigation suggests cattle infected with *Salmonella* in the United States might serve as a potential source of contamination. During outbreaks, the source of implicated beef products is difficult to identify because patients report consuming beef products both inside and outside the home,

** The 3-year baseline is the average number of culture-confirmed isolates during 2018–2020.

†† https://www.fsis.usda.gov/sites/default/files/media_file/2020-07/NARMS-Salmonella-Cecal-Report-2014.pdf

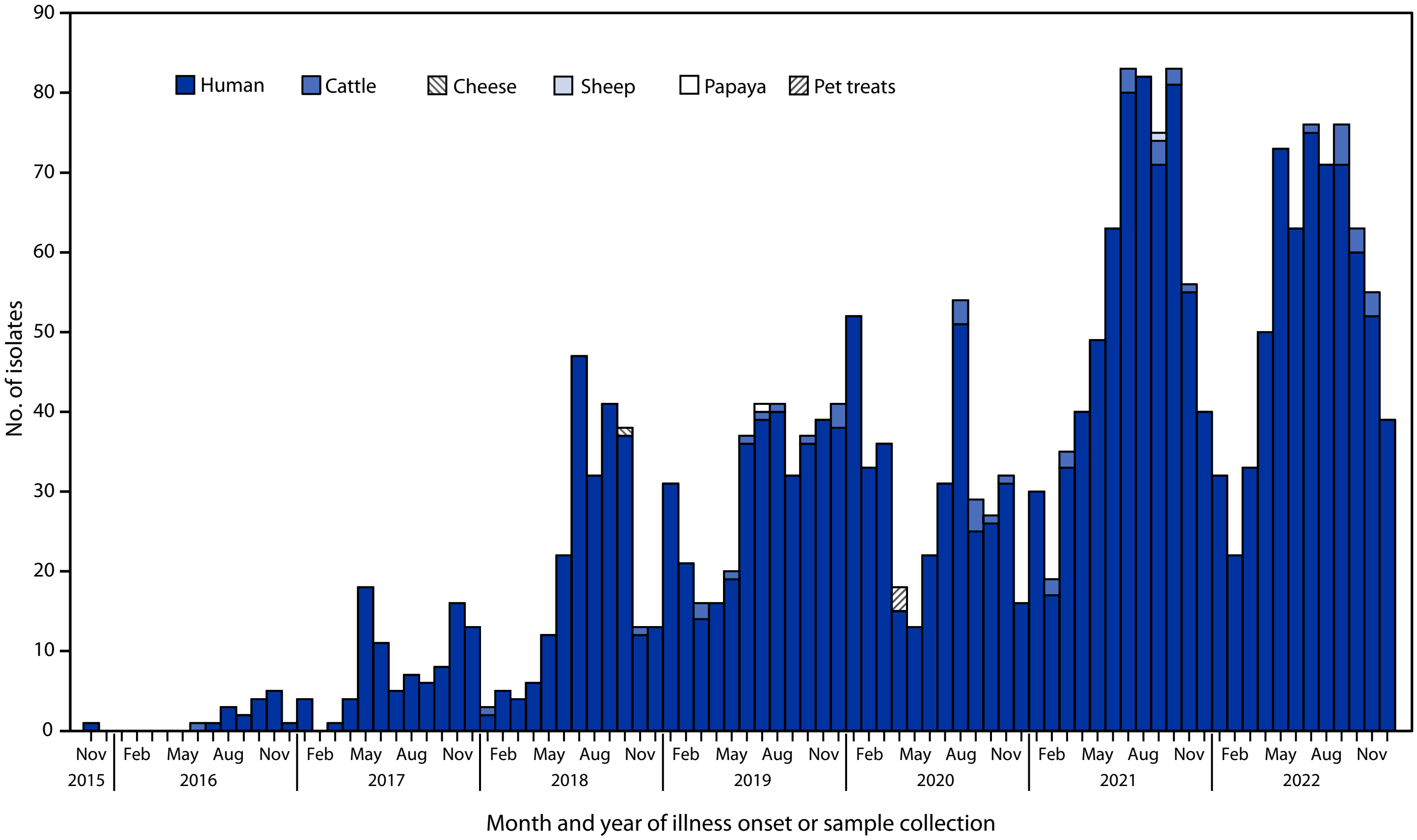
§§ No samples were imported during 2021–2022.

¶¶ https://wwwn.cdc.gov/foodnetfast

*** https://wwwnc.cdc.gov/travel/notices/watch/salmonella-newport-mexico

††† https://ask.usda.gov/s/article/Products-for-personal-consumption

FIGURE. Month and year of illness onset* or sample collection† and source type for isolates of multidrug resistant *Salmonella* Newport strain REPJJP01 — United States, 2016–2022



* Some illness onset dates for human cases have been estimated based on the isolation date.
† Nonhuman isolates.

shopper history records or receipts are often not available, and traceback is complex, with challenges including incomplete retail grinding logs and multiple products combined in retail products (*8*). Steps to prevent contamination of beef products might occur across the food production chain, including at preharvest (e.g., herd and biosecurity management), slaughter (e.g., appropriate sanitary dressing procedures and application of effective antimicrobial solutions), processing, and retail (*8*). Consumers should wash hands and surfaces after preparing raw meat at home and use a thermometer to ensure appropriate cooking temperatures are reached (*9*).

Some persons infected with REPJJP01 became seriously ill: 33% of all patients, 37% of non-travelers, and 40% of Hispanic patients were hospitalized, compared with 27% of all patients with nontyphoidal *Salmonella* infections reporting hospitalization in FoodNet data during 2021–2022. The high hospitalization rate is consistent with studies indicating that patients with antimicrobial-resistant *Salmonella* infections are

Summary

What is already known about this topic?

CDC monitors illness from a persisting, multidrug-resistant strain of *Salmonella* Newport linked to travel to Mexico, beef products obtained in the United States, and cheese obtained in Mexico.

What is added by this report?

The number of human infections with this strain doubled in 2021 from the 3-year baseline. Travel to Mexico remained a risk factor. Two multistate outbreaks were investigated; beef products obtained in the United States were the suspected vehicle in one outbreak and the confirmed vehicle in the other.

What are the implications for public health practice?

Safe food and drink consumption practices while traveling and at home, and interventions along the food production chain to ensure beef product safety might help prevent illness.

TABLE. Patient and clinical isolate characteristics of infections with multidrug-resistant *Salmonella* Newport strain REPJJP01 — United States, 2021–2022

Characteristic	Year No./Total no.* (%) 2021	2022	2021–2022
Patients, total no.	**641**	**641**	**1,282**
Sex			
Female	321/624 (51)	338/634 (53)	659/1,258 (52)
Male	303/624 (49)	296/634 (47)	599/1,258 (48)
Median age, yrs (IQR)	34 (20–52)	41 (26–58)	38 (23–55)
Race and ethnicity†			
Hispanic or Latino	228/349 (65)	195/407 (48)	423/756 (56)
White, non-Hispanic	100/349 (29)	176/407 (43)	276/756 (37)
Other or unknown race, non-Hispanic	21/349 (6)	36/407 (9)	57/756 (8)
Hospitalized			
Yes	123/346 (36)	124/412 (30)	247/758 (33)
No	223/346 (64)	288/412 (70)	511/758 (67)
Travel to Mexico			
Yes	112/287 (39)	232/434 (53)	344/721 (48)
No	175/287 (61)	202/434 (47)	377/721 (52)
Clinical isolates			
Source			
Stool	554/632 (88)	543/634 (86)	1,097/1,266 (87)
Urine	43/632 (7)	57/634 (9)	100/1,266 (8)
Blood	24/632 (4)	22/634 (3)	46/1,266 (4)
Other§	11/632 (2)	12/634 (2)	23/1,266 (2)
Antimicrobial resistance¶			
Ampicillin	493/640 (77)	449/641 (70)	942/1,281 (74)
Azithromycin**	562/640 (88)	536/641 (84)	1,098/1,281 (86)
Ceftriaxone	1/640 (<1)	0/641 (—)	1/1,281 (<1)
Ciprofloxacin††	514/640 (80)	475/641 (74)	989/1,281 (77)
Trimethoprim-sulfamethoxazole	572/640 (89)	534/641 (83)	1,106/1,281 (86)
Multidrug resistance	574/640 (90)	536/641 (84)	1,110/1,281 (87)
No resistance	46/640 (7)	94/641 (15)	140/1,281 (11)

* Denominators may not equal totals for each year due to missing data.
† Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.
§ Other source sites include abscess, fluid, iliac aneurysm, rectal swab, synovial fluid, tissue, or wound.
¶ Resistance was determined based on the results of antimicrobial susceptibility testing when available (37); otherwise, resistance was predicted based on whole genome sequencing. Isolates were considered to be resistant to an antimicrobial if the presence of at least one resistance mechanism known to confer resistance to that antimicrobial was present in the isolate's genome. One isolate in 2021 was not tested by antimicrobial susceptibility testing or analyzed for resistance determinants and is not included in the denominator.
** Interpretive criteria for azithromycin resistance have not been established for *Salmonella* serotypes other than serotype Typhi. Therefore, the presence of resistance determinants for azithromycin should not be used to predict clinical efficacy.
†† Includes isolates with interpretation of "intermediate" or isolates carrying a single quinolone resistance gene (878; 89%); a single gene might result in interpretation of "intermediate" for ciprofloxacin on antimicrobial susceptibility testing.

more likely to be hospitalized (*10*). The increase in infections from this MDR strain is concerning because it limits treatment options, has more severe outcomes, and creates opportunities for resistance genes to spread. Clinicians should be aware of the potential for multidrug resistance in recent travelers to Mexico with salmonellosis and should order susceptibility testing to guide antimicrobial selection when treatment is warranted.§§§

Limitations

The findings in this report are subject to at least three limitations. First, the number of illnesses recorded by the public health system is an underestimate of the total number of illnesses. Second, not all patients were able to be interviewed, limiting the ability to collect exposure information. Finally, the proportion of patients reporting travel might be an underestimate, because some patients were only asked about travel during the 4 or 7 days before illness onset.

Implications for Public Health Practice

CDC continues to work with local and state health departments and federal partners to investigate cases of this strain to identify sources of infection and prevent illness. Interventions along the food production chain to ensure beef safety (*8*) and prevention measures among producers, consumers, and

§§§ https://www.cdc.gov/salmonella/general/technical/newport.html travelers might help to reduce illness from this persisting MDR strain. Consumers should eat beef only if it is cooked thoroughly. Travelers to Mexico should follow food safety practices while abroad (https://wwwnc.cdc.gov/travel/page/food-water-safety); to reduce the chances of illness, travelers should avoid beef (including beef jerky or dried beef) and other foods that are prepared or sold by street vendors. Further research is needed to understand the consequences of decreased susceptibility to azithromycin on clinical outcomes for patients receiving this agent.

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Progress Toward Eradication of Dracunculiasis — Worldwide, January 2022–June 2023

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Abstract

The effort to eradicate *Dracunculus medinensis*, the etiologic agent of dracunculiasis, or Guinea worm disease, commenced at CDC in 1980. In 1986, with an estimated 3.5 million cases worldwide in 20 African and Asian countries, the World Health Assembly called for dracunculiasis elimination. The Guinea Worm Eradication Program (GWEP) was established to help countries with endemic dracunculiasis reach this goal. GWEP is led by The Carter Center and supported by partners that include the World Health Organization, UNICEF, and CDC. In 2012, *D. medinensis* infections were unexpectedly confirmed in Chadian dogs, and since then, infections in dogs, cats, and baboons have posed a new challenge for GWEP, as have ongoing civil unrest and insecurity in some areas. By 2022, dracunculiasis was endemic in five countries (Angola, Chad, Ethiopia, Mali, and South Sudan), with only 13 human cases identified, the lowest yearly total ever reported. Animal infections, however, were not declining at the same rate: 686 animal infections were reported in 2022, including 606 (88%) in dogs in Chad. Despite these unanticipated challenges as well as the COVID-19 pandemic, countries appear close to reaching the eradication goal. GWEP will continue working with country programs to address animal infections, civil unrest, and insecurity, that challenge the eradication of Guinea worm.

Introduction

Dracunculiasis (Guinea worm disease), caused by the parasite *Dracunculus medinensis*, is acquired by drinking water containing small crustacean copepods (water fleas) infected with *D. medinensis* larvae (*1*). Recent evidence suggests that the parasite also might be transmitted by eating inadequately cooked fish or other aquatic animals (*2*). Typically, approximately 1 year after infection, the worm emerges through the skin (usually on the host's lower limb), causing pain and disability (*1*). No vaccine or medicine is available to prevent or treat dracunculiasis. Eradication relies on case containment* to prevent water contamination and other interventions to prevent infection, including health education, water filtration, treatment of unsafe water with temephos (an organophosphate larvicide), provision of safe drinking water, adequate cooking of aquatic animals intended for consumption, and safe disposal of fish entrails (*1*–*4*). CDC began worldwide eradication efforts in 1980, and in 1984, was designated by the World Health Organization (WHO) as the technical monitor of the Dracunculiasis Eradication Program (*1*). In 1986, with an estimated 3.5 million human cases† occurring annually in 20 African and Asian countries§ (*5*), the World Health Assembly called for dracunculiasis elimination. The Guinea Worm Eradication Program (GWEP),¶ led by The Carter Center and supported by partners that include WHO, UNICEF, and CDC, began assisting ministries of health in countries with endemic disease. Since 1986, WHO has certified 200 countries, areas, and territories as dracunculiasis-free. Five countries with ongoing endemic dracunculiasis (Angola, Chad, Ethiopia, Mali, and South Sudan), plus Sudan, which has not yet completed its dossier and follow-up visit by WHO, have not been certified by WHO.**

From 2012, a new challenge emerged, posed by animal infections, mostly in domestic dogs, some domestic cats, and in Ethiopia, a few baboons; animal infections have now surpassed human cases. Genetic studies confirmed that Guinea worms from animals and humans are *D. medinensis* (*6*). This report describes progress made during January 2022–June 2023 and updates previous reports (*3*,*7*).

Methods

Each country's GWEP provided data on *D. medinensis* infections in humans and animals collected during January 2022–June 2023. Programs receive monthly case

* Human cases are contained when all of the following criteria are met: 1) infected patients are identified ≤24 hours after worm emergence; 2) patients have not entered any water source since worm emergence; 3) a village volunteer or health care provider properly treats the lesion until all detectable worms are fully removed and educates the patient not to contaminate water sources; 4) the containment process is validated by a GWEP supervisor ≤7 days after worm emergence; and 5) all contaminated and potentially contaminated sources of drinking water are treated with temephos. The criteria for defining a contained case of dracunculiasis in a human also should be applied, as appropriate, to define containment for an animal with a Guinea worm infection.

† A dracunculiasis case is defined as an infection occurring in a person exhibiting a skin lesion or lesions with emergence of one or more worms that is laboratory-confirmed as *Dracunculus medinensis* at CDC. Because *D. medinensis* has a 10–14-month incubation period, each infected person is counted as having an infection only once during a calendar year.

§ Initially 20 countries, but the former country of Sudan officially separated into two countries (South Sudan and Sudan) on July 9, 2011, and Yemen discovered Guinea worm cases in 1994.

¶ https://www.who.int/activities/eradicating-dracunculiasis

** https://iris.who.int/bitstream/handle/10665/354570/WER9721-22-eng-fre.pdf?sequence=

reports from supervised volunteers in each village under active surveillance.[††] Supervisors review the reports of human and animal infections and verify case containment at regional and national levels, where epidemiologic investigation of all human cases and selected animal infections are also analyzed. Specimens requiring laboratory confirmation are sent to CDC's Laboratory of Parasitic Diseases and Malaria. Villages where endemic transmission has ended (i.e., zero human cases or animal infections reported for ≥12 consecutive months), are kept under active surveillance for 2 additional years. WHO certifies a country as dracunculiasis-free after adequate nationwide surveillance for ≥3 consecutive years with no indigenous human cases or animal infections.[§§] This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.[¶¶]

Results

Reported and Laboratory-Confirmed Human and Animal Dracunculiasis Cases Worldwide

During 2022, a total of 13 human dracunculiasis cases were identified worldwide, in Central African Republic, Chad, Ethiopia, and South Sudan; these cases represent a 13% decrease from the 15 cases reported in 2021 (Table 1). During January–June 2023, three human cases were identified (no change from the number reported during the same period in 2022). Angola, Cameroon, Chad, Ethiopia, Mali, and South Sudan reported 686 animal (mostly dog) infections in 2022, a 21% decrease compared with the 862 animal infections reported in 2021. However, the 315 animal infections reported during January–June 2023 represented a 3% increase over the 305 reported during January–June 2022 (Table 2). Epidemiologic investigations identified the probable sources of 85% (11 of 13) of the human cases in 2022 compared with 47% (seven of 15) of cases in 2021.

During January–June 2023, CDC received 15 specimens from humans, and only one (7%) was laboratory-confirmed as *D. medinensis*[***] (Table 3), compared with 20 specimens received and three (15%) laboratory-confirmed during January–June 2022. No human cases were reported for an unprecedented period of 6 consecutive months (November 1, 2022–April 30, 2023). During the first 6 months of 2023, CDC received 131 animal specimens, 114 (87%) of which were laboratory-confirmed as *D. medinensis*, compared with 10 (83%) confirmed among 12 specimens received during January–June 2022.

Country Reports

Angola. Angola first discovered Guinea worm cases in 2018 (*8*). Active community-based surveillance began in 54 villages in 2020 and expanded to 61 communities in 2022. Seven infected dogs were detected in 2022, and 32 during January–June 2023 (Table 2), all in the same province as previous infections. Genetic analysis has not linked Angola's Guinea worms to *D. medinensis* specimens from other countries (Elizabeth Thiele, PhD, Vassar College, personal communication, September 2023). Angola offers a cash reward equivalent to US$450 for reporting an infected human or animal. In 2023, the Angola program began proactively tethering dogs at risk for infection, (i.e., living in or adjacent to villages with endemic disease) and began using temephos in affected areas in June.

Chad. Chad reported seven human cases in 2022,[†††] compared with eight cases in 2021; during January–June 2023, two cases were reported, compared with three during January–June 2022. Chad reported 606 animal infections (521 dogs and 85 cats) in 2022, compared with 832 (767 dogs and 65 cats) in 2021. During January–June 2023, Chad reported 220 infected animals, 18% fewer than the 268 reported during January–June 2022. Transmission of *D. medinensis* in Chad is hypothesized to result from consumption of inadequately cooked aquatic animals including fish or other transport hosts or paratenic hosts[§§§] (*2*). The Carter Center helped Chad's GWEP implement village-based surveillance for animal and human infections in 2,434 villages at risk for Guinea worm exposure by December 2022 (Table 1). Active surveillance generated 41,135 rumors (a report of a possible case) about possible Guinea worm infections among humans or animals during January–June 2022; these reports increased 169%, to 110,784 rumors during January–June 2023.

Since 2010, Chad's Ministry of Health has offered a reward equivalent to US$100 for reporting a confirmed human dracunculiasis case, and since 2015 a US$20 reward equivalent for reporting an animal infection. Evaluations in areas with established active surveillance indicated that 72% and 57%

[††] Villages under active surveillance are those that have endemic dracunculiasis or are at high risk for importation. Active surveillance involves daily searches of households by village volunteers (supported by their supervisors) for persons or animals with signs of dracunculiasis.

[§§] An indigenous dracunculiasis human case or animal infection is defined as an infection consisting of a skin lesion or lesions with emergence of one or more Guinea worms in a person or animal who had no history of travel outside their residential locality during the preceding year.

[¶¶] 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.

[***] Specimens are laboratory-identified as *D. medinensis* at CDC by morphologic examination under a microscope or DNA sequencing assays. https://www.cdc.gov/dpdx/dxassistance.html

[†††] A human case detected in the Central African Republic near the border with Chad is believed to have been imported from Chad and is counted as a case in Chad.

[§§§] An intermediate host in which no parasite development occurs but which serves to maintain the viability of larval stages of a parasite.

TABLE 1. Reported dracunculiasis human cases and animal infections, surveillance, and status of local interventions in villages with endemic disease, by country — worldwide, 2022

Human cases/Surveillance/Intervention status	Country						
	Chad*	Ethiopia	Mali†	South Sudan	Angola	Cameroon	Total
Reported human cases							
No. of indigenous	7§	1	0	5	0	0	**13**
No. of imported	0	0	0	0	0	0	**0**
% Contained¶ (no./total no.)	43 (3/7)	100 (1/1)	NA	60 (3/5)	NA	NA	**54 (7/13)**
% Change in indigenous human cases in villages or localities under surveillance (no. in 2021 vs. 2022)	−13 (8 vs. 7)	0 (1 vs. 1)	−100 (2 vs. 0)	25 (4 vs. 5)	NA (0 vs. 0)	NA (0 vs. 0)	**−13 (15 vs. 13)**
Reported animal infections							
No. of indigenous	606	3	41	1	7	28	**682**
No. of imported	0	0	0	0	0	0	**0**
% Contained¶ (no./total no.)	70 (421/606)	33 (1/3)	63 (26/41)	100 (1/1)	0 (0/7)	100 (28/28)	**70 (477/682)**
% Change in indigenous animal infections in villages or localities under surveillance (no. in 2021 vs. 2022)	−27 (832 vs. 606)	0 (3 vs. 3)	141 (17 vs. 41)	NA (0 vs. 1)	NA (0 vs. 7)	180 (10 vs. 28)	**−21 (862 vs. 682)**
Villages under active surveillance, 2022							
No. (%) of villages reporting monthly	2,434 (98)	411 (100)	2,216 (100)	2,044 (91)	61 (100)	15 (100)	**7,181 (98)**
No. reporting one or more human case	5	1	0	3	0	0	**9**
No. reporting only imported human cases	0	0	0	1	0	0	**1**
No. reporting indigenous human cases	5	1	0	2	0	0	**8**
No. reporting one or more animal infections	265	3	23	1	3	10	**307**
No. reporting only imported animal infections	0	0	0	0	0	0	**0**
No. reporting indigenous animal infections	265	3	23	1	3	10	**307**
Status of interventions in villages with endemic human dracunculiasis, 2022							
No. (%) of villages reporting monthly with endemic human dracunculiasis, 2021–2022	14 (86)	2 (100)	1 (100)	7 (100)	0 (NA)	0 (NA)	**24 (92)**
% Filters in all households (no./total no.)	79 (11/14)	100 (2/2)	100 (1/1)	100 (7/7)	NA	NA	**88 (21/24)**
% Using temephos (no./total no.)	79 (11/14)	50 (1/2)	100 (1/1)	100 (7/7)	NA	NA	**83 (20/24)**
% One or more source of safe water (no./total no.)	43 (6/14)	100 (2/2)	100 (1/1)	100 (7/7)	NA	NA	**67 (16/24)**
% Provided health education (no./total no.)	100 (14/14)	100 (2/2)	100 (1/1)	100 (7/7)	NA	NA	**100 (24/24)**
Status of interventions in villages with endemic animal dracunculiasis, 2022							
No. of villages with endemic animal dracunculiasis, 2021–2022	509	4	37	1	3	10	**564**
% Reporting monthly (no./total no.)	94 (479/509)	100 (4/4)	100 (37/37)	100 (1/1)	100 (3/3)	100 (10/10)	**95 (534/564)**
% Using temephos (no./total no.)	78 (398/509)	100 (4/4)	100 (37/37)	100 (1/1)	0 (0/3)	100 (10/10)	**80 (450/564)**
% Provided health education (no./total no.)	100 (509/509)	100 (4/4)	100 (37/37)	100 (1/1)	0 (0/3)	100 (10/10)	**99 (561/564)**

Abbreviations: GWEP = Guinea Worm Eradication Program; NA = not applicable.

* Participants at the annual Chad GWEP review meeting in November 2014 adopted "1+ case village" as a new description for villages in Chad affected by human cases of Guinea worm disease and dogs infected with Guinea worms and defined it as "a village with one or more indigenous and imported cases of Guinea worm infections in humans, dogs, and/or cats in the current calendar year and/or previous year."

† Civil unrest and insecurity since a coup in 2012 continued to constrain GWEP operations (i.e., supervision, surveillance, and interventions) in Gao, Kidal, Mopti, Segou, and Timbuktu regions.

§ A total of six human cases were reported from Chad in 2022. One human case was reported from the Central African Republic in 2022 in a location along the border with Chad. This case is believed to have been acquired in Chad.

¶ Human cases are contained when all of the following criteria are met: 1) infected patients are identified ≤24 hours after worm emergence; 2) patients have not entered any water source since worm emergence; 3) a village volunteer or health care provider properly treats the lesion until all detectable worms are fully removed and educates the patient not to contaminate water sources; 4) the containment process is validated by a GWEP supervisor ≤7 days after worm emergence; and 5) all contaminated and potentially contaminated sources of drinking water are treated with temephos. The criteria for defining a contained case of dracunculiasis in a human also should be applied, as appropriate, to define containment for an animal with a Guinea worm infection.

of residents surveyed during 2022 and January–June 2023, respectively, were aware of the rewards.

Chad launched a nationwide campaign in 2013 to increase Guinea worm awareness and implemented educational interventions to prevent transmission through consumption of uncooked fish or fish entrails. Since June 2017, approximately 81% of households assessed monthly in at-risk communities were burying fish entrails to prevent consumption by dogs.

Chad's GWEP began tethering dogs with dracunculiasis-compatible signs in 2014; in March 2020, it began proactively tethering all dogs during the 4 months of peak dracunculiasis incidence in all villages with five or more dracunculiasis infections during the previous year, increasing to villages with three or more infections in 2021, and to all villages reporting one or more dog infections in the previous or current year in 2022. As a result, 64% and 75% of eligible dogs were tethered in 2022

TABLE 2. Number of reported indigenous human and animal dracunculiasis cases, by country — worldwide, January 2021–June 2023

Country	No. of cases (% contained)		% Change Jan–Dec 2021 to Jan–Dec 2022	No. of cases (% contained)		% Change Jan–Jun 2022 to Jan–Jun 2023
	Jan–Dec 2021	Jan–Dec 2022		Jan–Jun 2022	Jan–Jun 2023	
Human cases						
Chad*	8 (75)	7 (43)	−13	3 (33)	2 (100)	−33
Ethiopia	1 (100)	1 (100)	0	0 (—)	0 (—)	NA
Mali†	2 (50)	0 (—)	−100	0 (—)	0 (—)	NA
South Sudan	4 (25)	5 (60)	25	0 (—)	0 (—)	NA
Angola	0 (—)	0 (—)	NA	0 (—)	0 (—)	NA
Cameroon§	0 (—)	0 (—)	NA	0 (—)	1 (100)	NA
Total	**15 (60)**	**13 (54)**	**−13**	**3 (33)**	**3 (100)**	**0**
Animal infections¶						
Chad	832 (81)	606 (70)	−28	268 (75)	220 (75)	−18
Ethiopia	3 (67)	3 (33)	0	0 (—)	0 (—)	NA
Mali†	17 (59)	41 (63)	141	2 (100)	7 (100)	250
South Sudan	0 (—)	1 (100)	NA	0 (—)	0 (—)	NA
Angola	0 (—)	7 (0)	NA	7 (0)	32 (0)	357
Cameroon§	10 (100)	28 (100)	180	28 (100)	56 (91)	100
Total	**862 (80)**	**686 (70)**	**−21**	**305 (76)**	**315 (71)**	**3**

Abbreviation: NA = not applicable.
* Chad's human case count for January–December 2022 includes a human case detected in an area of the Central African Republic near the border with Chad.
† Civil unrest and insecurity since a coup in 2012 continued to constrain Guinea Worm Eradication Program operations (i.e., supervision, surveillance, and interventions) in Gao, Kidal, Mopti, Segou, and Timbuktu regions.
§ One human case and multiple infected animals detected in areas of Cameroon near the border with Chad might have been infected in Chad.
¶ Chad: primarily dogs, some cats; Ethiopia: dogs, cats, and baboons; Mali: dogs and cats; Angola: dogs; Cameroon: dogs and cats.

and January–June 2023, respectively. Water treatment with temephos reached 94% of 280 villages with dog or human infections by December 2022 and 91% of 125 villages by June 2023. In December 2022, 40% of villages reporting Guinea worm infections had at least one source of copepod-free drinking water (e.g., from a borehole well). In June 2023, Chad's minister of health visited an area with endemic disease to support the Guinea worm eradication program and advocate for eradication.

Cameroon. Cameroon reported 28 infected dogs in 2022 and one human infection and 56 confirmed infected dogs during January–June 2023 in villages <3 miles (<5 km) from the Chad-Cameroon border. These Guinea worm infections were likely contracted in Chad because the affected villages include families living on both sides of the border and dog owners take their dogs to Chad regularly. Cameroon expanded active surveillance to all villages of concern and began proactive tethering of dogs in the affected area in January 2022.

Ethiopia. Ethiopia reported one human case, two infected baboons, and one infected dog during 2022; and no infected humans or animals during January–June 2023 (Table 2). Ethiopia is the only country that has reported infected baboons. Almost all recent infections have occurred in western Ethiopia, in the Gog district of Gambella Region. With The Carter Center's assistance, Ethiopia's public health and wildlife authorities resumed trapping and examining baboons in December 2022 and June 2023. Since 2021, the Ethiopia Dracunculiasis Eradication Program has conducted active surveillance in 198 villages and 223 non-village areas (e.g., farms and fishing and hunting settlements). Surveillance from the examination of baboons found dead or killed by villagers, and from approximately 555 baboons tracked and trapped by researchers (since 2018) detected 20 infected baboons during 2013–2021, two in 2022, and zero in January–June 2023, in an area of about 50 x 25 miles (80 x 40 km) in Gog district and part of adjacent Abobo district.

The reward for reporting human dracunculiasis cases is equivalent to US$360 and for reporting and tethering infected animals is US$40. In 2022, 72% of persons surveyed in active surveillance areas knew of the rewards; in January–June 2023, 97% were aware.

Since April 2018, Ethiopia has supported villager-initiated constant tethering of approximately 1,900 dogs and cats in villages at highest risk, to prevent their exposure in adjacent forests where transmission apparently occurs. The program applies temephos monthly to nearly all water sources known to have been used by humans in the at-risk areas of Gog and adjacent Abobo districts. Beginning in 2022, remote sensing data from Maxar Technologies, a space technology and intelligence company (https://www.maxar.com), has been identifying new water sources that need to be treated. In May 2022, the minister of health visited areas with endemic dracunculiasis to advocate for Guinea worm eradication.

Mali. Mali reported no human dracunculiasis cases in January 2022–June 2023, compared with two cases in 2021 (Table 2). In 2022, a total of 41 infected animals were reported,

TABLE 3. Characteristics of specimens from humans and animals received at CDC for laboratory confirmation of *Dracunculus medinensis* — January 2022–June 2023

Characteristic	Surveillance period			
	2023	2022		
	Jan–Jun	Jan–Jun	Jul–Dec	Jan–Dec
Human specimens				
Country of origin, no. of positive specimens (patients)*				
Central African Republic	—[†]	—	1 (1)	1 (1)
Chad	1 (1)	3 (3)	5 (5)	8 (8)
Ethiopia	—	—	1 (1)	1 (1)
South Sudan	—	—	9 (6)	9 (6)
Total no. (%) of positive specimens	**1 (7)**	**3 (15)**	**16 (48)**	**19[§] (36)**
Negative specimens, no. (%) of laboratory identifications				
Free-living organism[¶]	1 (7)	1 (6)	3 (18)	4 (12)
Onchocerca sp.	2 (14)	6 (35)	5 (29)	11 (32)
Other parasitic helminth**	—	—	1 (6)	1(3)
Other parasitic nematode[††]	4 (29)	1 (6)	—	1 (3)
Plant material	—	2 (12)	1 (6)	3 (9)
Sparganum	3 (21)	3 (18)	1 (6)	4 (12)
Tissue (animal origin)	1 (7)	4 (24)	5 (29)	9 (26)
Unknown origin	3 (21)	—	1 (6)	1 (3)
Total no. (%) of negative specimens*	**14 (93)**	**17 (85)**	**17 (52)**	**34 (64)**
Total no. of human specimens	**15**	**20**	**33**	**53**
Animal specimens				
Positive specimens, country and species of origin, no. of specimens (no. of animals)*				
Angola				
Dog	32 (32)	6 (6)	1 (1)	7 (7)
Cameroon				
Dog	67 (65)	—	46 (28)	46 (28)
Chad				
Cat	—	2 (2)	2 (2)	4 (4)
Dog	8 (7)	—	1 (1)	1 (1)
Other animals (mustelid)	—	—	1 (1)	1 (1)
Ethiopia				
Baboon	—	—	2 (2)	2 (2)
Dog	—	—	1 (1)	1 (1)
Other animal (wildcat)	1 (1)	—	—	—
Mali				
Cat	—	—	2 (2)	2 (2)
Dog	6 (6)	2 (2)	43 (40)	45 (42)
South Sudan				
Dog	—	—	1 (1)	1 (1)
No. (%) of positive specimens*	**114 (87)**	**10 (83)**	**100 (88)**	**110 (88)**
Total no. (%) of negative specimens*	**17 (13)[§§]**	**2 (17)**	**13 (12)**	**15 (12)[¶¶]**
Total no. of animal specimens	**131**	**12**	**113**	**125**

* Positive specimens were confirmed as *D. medinensis*; negative specimens were ruled out as *D. medinensis.*
[†] Dashes indicate no specimens received.
[§] CDC received 19 specimens in 2022: one was from 2021 (Chad), and 18 were from 2022. The specimens from 2022 were from 13 human cases among which 10 had one specimen each, two had two specimens each, and one had three specimens.
[¶] Free-living organisms primarily included adult Mermithidae and other worms identified as belonging to nonparasitic taxa.
** Other parasitic helminths submitted in association with human cases belonging to the cestode class (flatworms).
[††] Other parasitic nematodes submitted in association with human cases belonging to the filarioidea or ascarididae families.
[§§] In 2023, the 17 *D. medinensis*-negative specimens were identified as follows: 10 were other parasitic nematodes from which five were filaroidea, three were *Setaria* sp., and one was *Hastopiculum* sp., and one strongyloidea; one other parasitic helminth was a cestode; two were free-living organisms (mermithids); one was animal tissue, likely from fish; and three samples were of unknown origin.
[¶¶] The 15 negative specimens from animals from 2022 were identified as follows: eight were other parasitic nematodes from which five were filaroidea, one was *Hastopiculum* sp., one was *Protospirura* sp., and one was nematode; one was another parasitic helminth (a cestode); two were spargana; two were free-living organisms (mermithids); and two were animal tissues (one tendon-like tissue and one case of possibly congealed mucus).

compared with 17 in 2021. During January–June 2023, seven confirmed infections in dogs were reported, all in Segou Region of central Mali, an increase from two reported during January–June 2022. Among the infected animals identified in 2022, 31 were in Segou Region; and 10 in adjacent Mopti Region, which is partly inaccessible because of civil unrest. Animals from Segou Region apparently became infected in Mopti Region. The infections of all seven dogs in January–June 2023 were reportedly contained.

In 2022, a total of 2,216 villages in Mali were under active surveillance (Table 1), with cash rewards equivalent to US$340 for reporting a human case and US$20 for reporting and tethering an infected animal. In areas under active surveillance in 2022, 82% of persons queried knew about the rewards for reporting an infected person or animal; in January–June 2023, 88% knew about the rewards. Proactive tethering of some dogs was introduced late in 2021, expanded during the June–September peak transmission season in 2022, and extended to include puppies in 2023.

South Sudan. South Sudan reported five human dracunculiasis cases in 2022, compared with four in 2021 (Table 2). No human cases or infected animals were reported during January 2022–June 2023. Only two infected dogs have ever been reported in South Sudan, the first in September 2015 and the second in August 2022. The high mobility of cattle herders and others in South Sudan poses a challenge to GWEP surveillance and interventions as does sporadic insecurity. By December 2022, a total of 2,044 villages in South Sudan were under active surveillance (Table 1). The reward for reporting a case of dracunculiasis or an infected animal is equivalent to about US$380. A 2022 survey found that 78% of respondents were aware of the reward for reporting an infected person. In April 2023, the minister of health visited an area with endemic dracunculiasis to advocate for Guinea worm eradication.

Discussion

The 13 human dracunculiasis cases identified in 2022 represented the lowest annual number of human cases ever reported, and no cases were reported for an unprecedented period of 6 consecutive months. Progress toward guinea worm eradication was reviewed at the 2022 and 2023 annual meetings of GWEP program managers, the 2022 meeting of WHO's International Commission for the Certification of Dracunculiasis Eradication, and an unofficial meeting during the 2023 World Health Assembly. Representatives from seven countries with current or former endemic dracunculiasis, the United Arab Emirates, The Carter Center, and WHO renewed their commitment to completing Guinea worm eradication at a Guinea Worm Summit in Abu Dhabi in March 2022.

Summary

What is already known about this topic?

Human cases of dracunculiasis (Guinea worm infection causing limb pain and disability in some Asian and African countries) have decreased from an estimated 3.5 million in 1986 to 15 in 2021. The emergence of Guinea worm infections in dogs in 2012 has complicated eradication efforts.

What is added by this report?

Thirteen human cases and 686 animal infections were reported in 2022. Three human cases and 315 animal infections were reported during January–June 2023. As of August 2023, dracunculiasis remained endemic in five countries (Angola, Chad, Ethiopia, Mali, and South Sudan).

What are the implications for public health practice?

With only 13 human cases identified in 2022 and three during January–June 2023, program efforts appear to be closer to reaching the goal of eradication. However, dog infections and impeded access because of civil unrest and insecurity in Mali and South Sudan continue to be the greatest challenges for the program.

Infections in Dogs

During January 2022–June 2023, Chad reported 82% (835 of 1,017) of the world's remaining *D. medinensis* human and animal infections, of which 88% (893 of 1,017) were in dogs. Chad reported Guinea worm infections in domestic dogs for the first time in 2012 (*9*), mostly from communities along the Chari River in a pattern that remains peculiar to Chad (i.e., many cases in dogs and few in humans) (*9*,*10*). Stopping transmission among dogs is now the GWEP's principal challenge.

Guinea worm infections in dogs declined by 24% between 2021 and 2022. The 5% increase in dog infections during January–June 2023 reflects substantial increases in reported dog infections in Angola and Cameroon after expanded active surveillance for dog infections in those countries in 2022. This finding underscores the need for active surveillance, appropriate control measures, and thorough investigations in both countries. In Chad, however, dog infections declined for the third and fourth consecutive years, by 32% from 767 in 2021 to 521 in 2022, and by 17%, from 264 during January–June 2022 to 220 during January–June 2023.

The challenge of animal infections, which occurs in limited geographic areas (except in Chad), is being addressed through innovative interventions and research supported by The Carter Center, WHO, and CDC. After being pioneered by Ethiopia in 2018, proactive tethering of dogs in at-risk villages has proven effective and has been adopted by GWEPs in Chad (2020), Mali (2022), Cameroon (2022), and Angola (2023). Multiple research institutions are working to understand the unusual epidemiology of dracunculiasis in the remaining affected countries and to develop new interventions.

Infections in Humans and Nonhuman Primates

Finding three confirmed human cases and seven infected dogs in Angola in 2018–2022 and two human cases, 43 infected dogs, and one infected cat in Cameroonian villages that border areas with endemic transmission in Chad during 2019–2022 suggests that the problem in those two countries is limited. Detection of a human case of dracunculiasis in Central African Republic bordering an area with endemic dog infections in Chad also highlights the risks for exportation and the need for ongoing active surveillance and appropriate control measures in neighboring countries. The trend of infections in baboons appears to be declining in Ethiopia because of intensive temephos treatments of water sources in the areas of concern.

Adequate security is critical to achieving eradication, especially in Mali and South Sudan. In 2020, Mali's GWEP began working with ministry of health, regional, and local leaders in a Peace-Health Initiative to reduce insecurity in one district with endemic dracunculiasis and expanded to four districts in 2022. If adequate security is maintained, South Sudan is poised to achieve zero-case status soon, thanks to strong technical leadership and political support, and no known endemicity in animals.

Limitations

The findings in this report are subject to at least two limitations. First, the number of Guinea worm infections in humans or animals could have been underestimated, because infections were either undiscovered, not reported, deliberately hidden, or because insecurity impeded program access to some areas. These risks were partially mitigated by wide knowledge of the cash reward for reporting cases and active surveillance by trained local personnel in all areas with known infections. Second, the extent of Guinea worm infection among baboons in Ethiopia, although better understood, is still being determined.

Implications for Public Health Practice

With only 13 human cases identified in 2022 and three during January–June 2023, programs appear to be closer to reaching the goal of eradication. However, infections in dogs and impeded access due to civil unrest and insecurity in parts of Mali and South Sudan continue to be the most important challenges for the eradication program.

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Influenza and Up-to-Date COVID-19 Vaccination Coverage Among Health Care Personnel — National Healthcare Safety Network, United States, 2022–23 Influenza Season

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Abstract

The Advisory Committee on Immunization Practices recommends that health care personnel (HCP) receive an annual influenza vaccine and that everyone aged ≥6 months stay up to date with recommended COVID-19 vaccination. Health care facilities report vaccination of HCP against influenza and COVID-19 to CDC's National Healthcare Safety Network (NHSN). During January–June 2023, NHSN defined up-to-date COVID-19 vaccination as receipt of a bivalent COVID-19 mRNA vaccine dose or completion of a primary series within the preceding 2 months. This analysis describes influenza and up-to-date COVID-19 vaccination coverage among HCP working in acute care hospitals and nursing homes during the 2022–23 influenza season (October 1, 2022–March 31, 2023). Influenza vaccination coverage was 81.0% among HCP at acute care hospitals and 47.1% among those working at nursing homes. Up-to-date COVID-19 vaccination coverage was 17.2% among HCP working at acute care hospitals and 22.8% among those working at nursing homes. There is a need to promote evidence-based strategies to improve vaccination coverage among HCP. Tailored strategies might also be useful to reach all HCP with recommended vaccines and protect them and their patients from vaccine-preventable respiratory diseases.

Introduction

Vaccination of health care personnel (HCP) is a critical strategy to minimize transmission of infection in health care settings (*1*,*2*). HCP are at high risk for work-related exposure to viruses such as influenza and SARS-CoV-2 but are less likely to transmit these infections when they are vaccinated (*3*). The Advisory Committee on Immunization Practices (ACIP) recommends that HCP receive an annual influenza vaccine (*4*). ACIP also recommends that persons aged ≥6 months stay up to date with recommended COVID-19 vaccination.[†] The Centers for Medicare & Medicaid Services (CMS) monitors the implementation of these recommendations by requiring health care facilities such as nursing homes and acute care hospitals to report influenza[§] and COVID-19[¶] vaccination coverage among HCP[**] to CDC's National Healthcare Safety Network (NHSN). This study examined influenza and up-to-date COVID-19 vaccination coverage among HCP working in acute care hospitals and nursing homes during the 2022–23 influenza season.

Methods

Data Collection

Acute care hospitals and nursing homes report data to NHSN according to surveillance protocols for influenza and COVID-19 vaccination. Acute care hospitals and nursing homes began reporting COVID-19 vaccination among HCP in 2021; nursing homes were required to report influenza vaccination among HCP for the first time during the 2022–23 influenza season.[††] To assess influenza vaccination coverage, facilities are required to report an annual count of HCP working in the facility for ≥1 day during an influenza season (October 1–March 31)[§§] and the number of HCP who 1) received influenza vaccination, 2) had a medical contraindication to influenza vaccination, 3) declined vaccination, and 4) had unknown vaccination status. The protocol for COVID-19 vaccination coverage includes parallel data fields for COVID-19; however, data collection occurs at a different cadence. Nursing homes and acute care facilities report on schedules mandated by their respective regulatory programs at CMS. Nursing homes submit COVID-19 vaccination coverage weekly[¶¶]; acute care facilities submit ≥1 week of data per

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† https://www.cdc.gov/coronavirus/2019-ncov/vaccines/stay-up-to-date.html

§ https://www.cdc.gov/nhsn/faqs/vaccination/faq-influenza-vaccination-summary-reporting.html

¶ https://www.cdc.gov/nhsn/pdfs/hps/covidvax/protocol-hcp-508.pdf

** https://www.cdc.gov/nhsn/forms/instr/COVIDVax.Staff_.Revised.TOI_.MAY2022-508.pdf

†† https://www.federalregister.gov/documents/2022/08/03/2022-16457/medicare-program-prospective-payment-system-and-consolidated-billing-for-skilled-nursing-facilities

§§ https://www.govinfo.gov/content/pkg/FR-2011-08-18/pdf/2011-19719.pdf

¶¶ https://www.federalregister.gov/documents/2021/05/13/2021-10122/medicare-and-medicaid-programs-covid-19-vaccine-requirements-for-long-term-care-ltc-facilities-and month.*** Both types of facilities report COVID-19 vaccination coverage data among HCP who were eligible to work in the facility ≥1 day during the reporting week.

Data Analysis

To assess HCP vaccination coverage during the 2022–23 influenza season, analyses were conducted using influenza and up-to-date COVID-19 coverage data (specifically, up-to-date COVID-19 coverage data from the week ending March 26, 2023, or the last submitted week of data) reported to NHSN. NHSN defined up-to-date COVID-19 vaccination as the receipt of a bivalent booster dose or completion of a primary series within the previous 2 months (i.e., not yet eligible to receive a bivalent vaccine).††† Facilities reporting data for both vaccine types and employing at least five HCP were included in the analysis. Pooled mean influenza and up-to-date COVID-19 vaccination coverage rates were calculated as the number of HCP who had received each recommended vaccine or vaccination series divided by the number of HCP working in all facilities. HCP reported to have a medical contraindication to COVID-19 vaccination were subtracted from the denominator of the up-to-date COVID-19 vaccination coverage calculation, to align with the measure adopted by CMS's quality reporting programs.§§§ Coverage with each vaccine was calculated for HCP working at each facility type (nursing home or acute care hospital). Results were further stratified by employment category (employee, licensed practitioner, and student or volunteer); rural-urban classification (rural or urban)¶¶¶; county-level social vulnerability index (SVI) tertile****; facility size tertile††††; state; and U.S. region.§§§§ Counties in a lower SVI tertile are less socially vulnerable than are those in an upper SVI tertile. All analyses were conducted using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.¶¶¶¶

Results

Influenza Vaccination Coverage

Among approximately 8.4 million HCP working in 4,057 acute care hospitals, influenza vaccination coverage was 81.0% overall (Table 1); coverage was lowest (67.2%) among nonemployee licensed practitioners and was substantially higher among employees (83.1%) and nonemployee students and volunteers (85.2%). Among HCP working in acute care hospitals, influenza vaccination coverage was highest in the Midwest (84.7%) and lowest in the Pacific region (74.4%).

Among approximately 2.0 million HCP working in 13,794 nursing homes, influenza vaccination coverage was 47.1% overall; coverage was lowest among employees (46.1%) and substantially higher among nonemployee licensed practitioners (55.3%) and nonemployee students and volunteers (57.7%). Among HCP working in nursing homes, influenza vaccination coverage was highest in the Pacific region (61.1%) and lowest in the South (39.7%). Influenza vaccination coverage among HCP was similar across facility size, urban-rural status, and SVI for both nursing homes and acute care hospitals. Nursing homes in six states reported influenza vaccination coverage of ≥75% among HCP, whereas this level of coverage was reported in acute care hospitals in 40 states (Figure) (Supplementary Table, https://stacks.cdc.gov/view/cdc/134928).

Up-to-Date COVID-19 Vaccination Coverage

Among approximately 7.7 million HCP working in 4,057 acute care hospitals, up-to-date COVID-19 vaccination coverage was 17.2% overall (Table 2) and was highest in the Pacific region (28.9%) and lowest in the Mountain region (9.1%). No substantial differences by staff member type or urbanicity were observed.

Among approximately 1.6 million HCP working at 13,794 nursing homes, up-to-date COVID-19 vaccination coverage was 22.8% overall; coverage was highest among nonemployee licensed practitioners (28.2%) and lowest among employees (22.4%). Among HCP working in nursing homes, up-to-date COVID-19 vaccination coverage was highest among those working in the Pacific region (40.7%) and lowest among those working in the South (17.5%). Up-to-date COVID-19 vaccination was also substantially higher among HCP working at nursing homes in urban (24.2%) than in rural (17.5%) areas.

*** https://www.federalregister.gov/documents/2021/08/13/2021-16519/medicare-program-hospital-inpatient-prospective-payment-systems-for-acute-care-hospitals-and-the?form

††† NHSN defines up-to-date vaccination for surveillance purposes at the start of each quarter; the definition has been updated since the study was conducted. Bivalent COVID-19 vaccines are no longer recommended or available. https://www.cdc.gov/nhsn/pdfs/hps/covidvax/UpToDateGuidance-508.pdf

§§§ https://www.cdc.gov/nhsn/pdfs/nqf/covid-vax-hcpcoverage-rev-2023-508.pdf

¶¶¶ https://www.cdc.gov/nchs/data_access/urban_rural.htm

**** https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

†††† Facility size was calculated separately for acute care hospitals and nursing homes and was based on the tertile distribution of the total number of staff members per facility.

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

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

TABLE 1. Pooled mean influenza vaccination coverage among health care personnel working at acute care hospitals and nursing homes, by facility type — National Healthcare Safety Network, United States, October 1, 2022–March 31, 2023*

	Influenza vaccination coverage							
	Nursing homes				Acute care hospitals			
Characteristic	No. of facilities	No. of vaccinated HCP	No. of HCP	Coverage, %	No. of facilities	No. of vaccinated HCP	No. of HCP	Coverage, %
Total	**13,794**	**956,149**	**2,030,770**	**47.1**	**4,057**	**6,854,771**	**8,465,804**	**81.0**
Staff member type								
Employee	13,794	844,380	1,832,394	46.1	4,054	5,245,329	6,315,763	83.1
Nonemployee licensed practitioner	11,365	61,060	110,432	55.3	3,695	828,669	1,234,011	67.2
Nonemployee student or volunteer	4,500	50,709	87,944	57.7	3,447	780,773	916,030	85.2
Facility size†								
Small	4,573	156,855	327,271	47.9	1,352	351,836	455,343	77.3
Medium	4,614	269,800	585,075	46.1	1,352	1,268,677	1,648,273	77.0
Large	4,607	529,494	1,118,424	47.3	1,353	5,234,258	6,362,188	82.3
Urbanicity§								
Rural	3,817	191,508	426,368	44.9	1,173	659,881	824,714	80.0
Urban	9,977	764,641	1,604,402	47.7	2,884	6,194,890	7,641,090	81.1
Social vulnerability index¶								
Low	4,724	333,282	660,593	50.5	1,228	2,030,870	2,437,031	83.3
Medium	4,605	332,622	725,843	45.8	1,341	2,463,062	3,086,676	79.8
High	4,463	290,129	644,194	45.0	1,487	2,360,245	2,941,443	80.2
Region**								
Midwest	4,476	247,750	584,925	42.4	1,034	1,747,029	2,061,455	84.7
Mountain	484	38,160	64,260	59.4	200	330,765	398,865	82.9
Northeast	2,291	250,904	436,621	57.5	573	1,333,833	1,620,573	82.3
Pacific	1,421	126,090	206,518	61.1	471	854,017	1,148,524	74.4
South	5,122	293,245	738,446	39.7	1,779	2,589,127	3,236,387	80.0

Abbreviation: HCP = health care personnel.

* Each facility reported summary influenza vaccination data among HCP working in the facility for ≥1 day during October 1, 2022–March 31, 2023. Up-to-date COVID-19 vaccination coverage was reported to National Healthcare Safety Network each week; data from the week ending March 26, 2023, or the last submitted week of data, were used for analysis.

† Facility size was calculated separately for acute care hospitals and nursing homes and was based on the tertile distribution of the total number of staff members per facility.

§ https://www.cdc.gov/nchs/data_access/urban_rural.htm

¶ https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

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

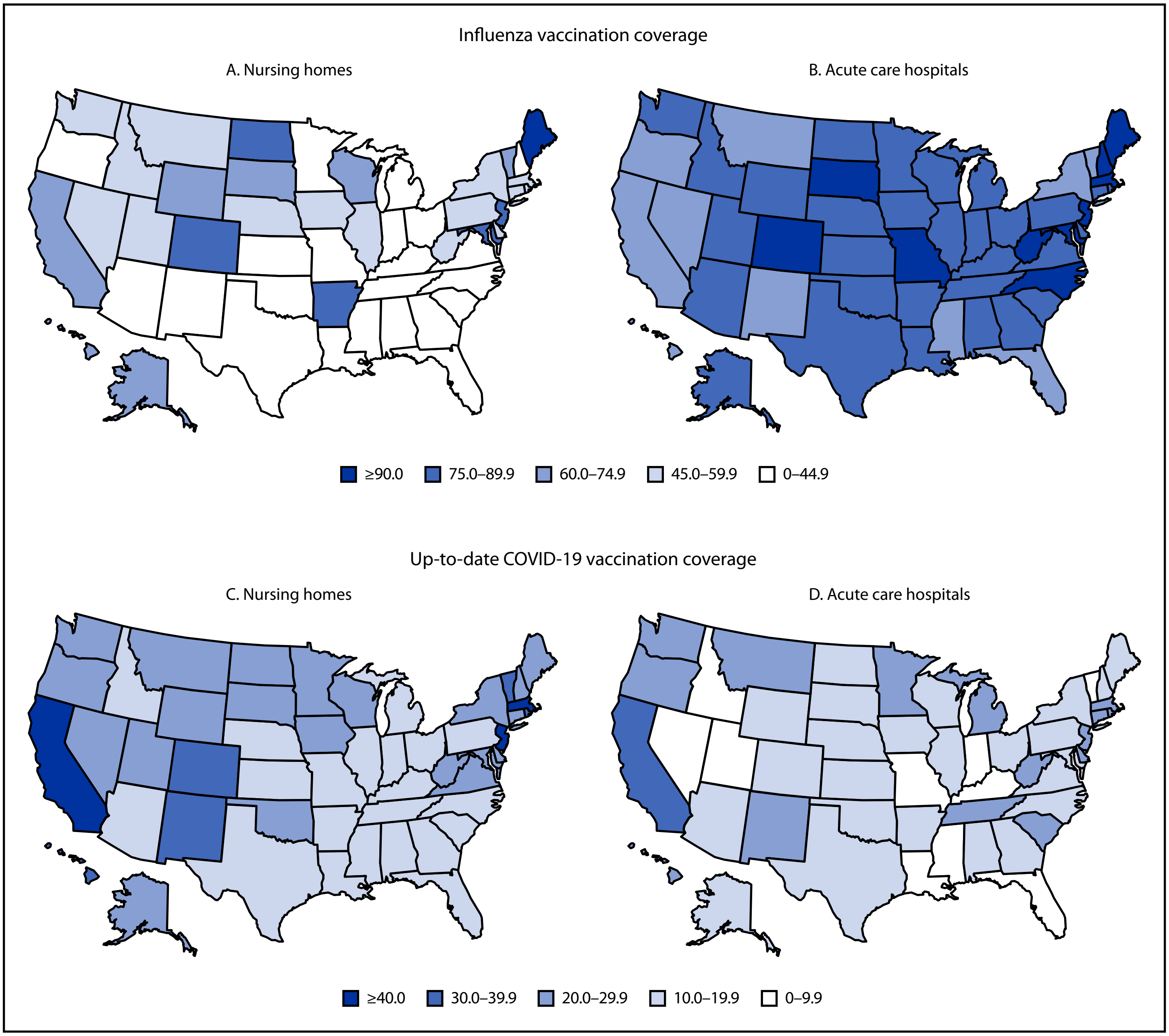
No substantial differences in COVID-19 vaccination coverage among HCP by facility staff size or SVI were observed at either facility type. Up-to-date COVID-19 vaccination coverage was ≥20% among HCP working in nursing homes in 30 states but among HCP in acute care hospitals, approximately one half as many states (16) achieved this level of coverage (Supplementary Table, https://stacks.cdc.gov/view/cdc/134928).

Discussion

During the 2022–23 influenza season, fewer than one quarter of HCP working in acute care hospitals and nursing homes were up to date with recommended COVID-19 vaccination, and fewer than one half of HCP working in nursing homes had received influenza vaccine. Coverage varied by geographic region, health care facility type, employment category, and urbanicity. Recent reports indicate that influenza and COVID-19 vaccination coverage among HCP has declined during the COVID-19 pandemic (*5*). During the 2017–18 and 2018–19 influenza seasons, influenza vaccination coverage among HCP in acute care hospitals was 88.6% and 90.0%, respectively (*6*). From November 2021 to June 2023, CMS required all HCP at CMS-certified facilities to be vaccinated for COVID-19*****; this requirement likely contributed to COVID-19 primary series vaccination coverage reaching 94.3% among HCP in nursing homes (*7*) and 91.2% among those at acute care hospitals (*5*). The current findings suggest that factors associated with low vaccination coverage might have been exacerbated by the COVID-19 pandemic and compounded by emerging concerns such as vaccine fatigue (*8*) and other as yet unidentified factors.

***** https://www.cms.gov/files/document/qso-23-02-all-expired.pdf

FIGURE. Percentage of pooled mean influenza vaccination coverage (A and B) and up-to-date COVID-19 vaccination*,† coverage (C and D) among health care personnel working at nursing homes (A and C) and acute care hospitals (B and D), by facility type and U.S. state — National Healthcare Safety Network, United States, October 1, 2022–March 31, 2023



* Up-to-date COVID-19 vaccination coverage was defined by the National Healthcare Safety Network during the study period as the receipt of a bivalent booster dose, completion of a primary series, or receipt of a monovalent booster dose within the previous 2 months.

† Each facility reported summary influenza vaccination data among health care personnel working in the facility for ≥1 day during October 1, 2022–March 31, 2023. Up-to-date COVID-19 vaccination coverage was reported to the National Healthcare Safety Network each week; data from the week ending March 26, 2023, or the last week of submitted data, were used for analysis.

TABLE 2. Pooled mean up-to-date COVID-19 vaccination coverage* among health care personnel working at nursing homes and acute care hospitals, by facility type — National Healthcare Safety Network, United States, October 1, 2022–March 31, 2023†

	Up-to-date COVID-19 vaccination coverage							
	Nursing homes				Acute care hospitals			
Characteristic	No. of facilities	No. of vaccinated HCP	Total no. of HCP	Coverage, %	No. of facilities	No. of vaccinated HCP	Total no. of HCP	Coverage, %
Total	**13,794**	**376,837**	**1,652,744**	**22.8**	**4,057**	**1,328,820**	**7,725,167**	**17.2**
Staff member type								
Employee	13,794	341,672	1,523,365	22.4	4,051	1,029,896	5,879,220	17.5
Nonemployee licensed practitioner	10,006	25,372	89,975	28.2	3,496	199,869	1,203,932	16.6
Nonemployee student or volunteer	3,522	9,793	39,404	24.9	3,148	99,055	642,015	15.4
Facility size§								
Small	4,573	76,018	309,005	24.6	1,352	70,547	448,596	15.7
Medium	4,614	116,077	494,368	23.5	1,352	228,176	1,540,690	14.8
Large	4,607	184,742	849,371	21.8	1,353	1,030,097	5,735,881	18.0
Urbanicity¶								
Rural	3,817	60,121	343,954	17.5	1,173	109,089	745,548	14.6
Urban	9,977	316,716	1,308,790	24.2	2,884	1,219,731	6,979,619	17.5
Social vulnerability index**								
Low	4,724	125,753	544,753	23.1	1,228	415,883	2,247,508	18.5
Medium	4,605	130,598	591,079	22.1	1,341	472,906	2,816,438	16.8
High	4,463	120,463	516,798	23.3	1,487	439,848	2,660,648	16.5
Region††								
Midwest	4,476	91,258	475,948	19.2	1,034	291,758	1,811,254	16.1
Mountain	484	13,227	49,615	26.7	200	33,396	365,336	9.1
Northeast	2,291	101,633	381,642	26.6	573	289,194	1,515,844	19.1
Pacific	1,421	70,245	172,738	40.7	471	308,765	1,066,996	28.9
South	5,122	100,474	572,801	17.5	1,779	405,707	2,965,737	13.7

Abbreviations: HCP = health care personnel.

* COVID-19 up-to-date coverage was defined by National Healthcare Safety Network during the study period as the receipt of a bivalent booster dose or completion of a primary series or receipt of a monovalent booster dose within the previous 2 months.

† Each facility reported summary influenza vaccination data among HCP working in the facility for ≥1 day during October 1, 2022–March 31, 2023. Up-to-date COVID-19 vaccination coverage was reported to National Healthcare Safety Network each week; data from the week ending March 26, 2023, or the last submitted week of data, were used for analysis.

§ Facility size was calculated separately for acute care hospitals and nursing homes and was based on the tertile distribution of the total number of staff members per facility.

¶ https://www.cdc.gov/nchs/data_access/urban_rural.htm

** https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

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

In this analysis, up-to-date COVID-19 vaccination coverage was higher among HCP working in nursing homes than among those working in acute care hospitals. CMS requires nursing homes to report weekly up-to-date COVID-19 vaccination status among HCP and publishes weekly results on a public-facing website[†††††]; this might have resulted in higher coverage among HCP in nursing homes. CDC also worked with nursing homes to facilitate access to vaccination for both patients and staff members,[§§§§§] which might have also improved coverage.

††††† https://www.cms.gov/newsroom/news-alert/cms-makes-nursing-home-covid-19-booster-vaccination-data-available-online-increasing-transparency

§§§§§ https://archive.cdc.gov/www_cdc_gov/vaccines/covid-19/long-term-care/pharmacy-partnerships/jurisdictions.html#on-site

This report identified low up-to-date COVID-19 vaccination coverage among HCP in both acute care hospitals and nursing homes and low influenza vaccination coverage among HCP in nursing homes, both important threats to patient health and safety that need to be addressed. Implementation of vaccination recommendations for HCP has been a long-standing challenge for the public health and health care sectors. In an effort to improve vaccination coverage among HCP, health care facilities and federal and state governments have implemented interventions including jurisdiction-wide and facility-wide vaccination mandates (*7,9*). Mandates for HCP to receive influenza vaccination have been in place since before the COVID-19 pandemic and might contribute to the high vaccination rates reported to NHSN. However, such mandates might not be easily enforceable among nonemployee HCP in acute care hospitals, among whom coverage with both vaccines was lower than that among employees. Compared to influenza vaccines, COVID-19 vaccines are newer, and availability can be more sporadic; therefore, facilities do not have as much experience promoting vaccination and might not have the ability to conduct mass vaccination events. This might have contributed to lower COVID-19 vaccination coverage. Further, given the variations in vaccination coverage by region and urbanicity, campaign strategies tailored by region and focusing on rural areas might have the potential to increase vaccination coverage.

Limitations

The findings in this report are subject to at least four limitations. First, influenza vaccination and up-to-date COVID-19 vaccination coverage rates were reported separately using different definitions of total HCP working within the facility. Whether the same personnel are represented in seasonal influenza vaccination coverage counts and weekly COVID-19 vaccination counts is unknown. This nuance limits the direct comparability of coverage with the two vaccines; therefore, statistical comparisons of vaccination coverage were not conducted. Second, this report includes data reported by facilities on behalf of HCP, which could have resulted in underestimates of vaccination acquired outside the health care facility, particularly by HCP not employed directly by the reporting facility. Third, vaccination coverage could not be stratified by recent history of SARS-CoV-2 infection. CDC recommendations state that persons may consider delaying an updated vaccine by 3 months after infection. Therefore, some persons might not have considered themselves eligible for vaccination, leading to an underestimate of COVID-19 vaccination coverage. Finally, this analysis was conducted using aggregate data reported to NHSN at the facility level. Therefore, vaccination coverage could not be stratified by person-level covariates that might have enabled an assessment of potential differences, such as age, race, and ethnicity.

Implications for Public Health Practice

Closely monitoring influenza and up-to-date COVID-19 vaccination coverage among HCP might help facilitate evaluation of effective implementation of vaccination promotion strategies.¶¶¶¶¶ Studies are needed to identify additional factors associated with low vaccination coverage and approaches to improve coverage among HCP, with particular attention to geographic region, health care facility type, and employment category. Understanding these factors and promoting evidence-based strategies to increase vaccination coverage among HCP, such as making vaccines free and accessible at work (*10*), might allow for targeted interventions to improve coverage during future respiratory virus seasons. HCP should receive annual influenza vaccines and remain up to date with recommended COVID-19 vaccination to protect themselves and their patients from vaccine-preventable diseases.

¶¶¶¶¶ https://www.cdc.gov/infectioncontrol/guidelines/healthcare-personnel/immunization.html

Summary

What is already known about this topic?

CDC and the Advisory Committee on Immunization Practices recommend that health care personnel (HCP) receive an annual influenza vaccine and stay up to date with recommended COVID-19 vaccination.

What is added by this report?

During the 2022–23 influenza season, influenza vaccination coverage was 81% among HCP at acute care hospitals and 47% among those at nursing homes. Up-to-date COVID-19 vaccination coverage was 17% among HCP at acute care hospitals and 23% among those at nursing homes.

What are the implications for public health practice?

There is a need to promote evidence-based strategies to improve vaccination coverage among HCP. Tailored strategies might be useful to reach all HCP with recommended vaccines to protect them and their patients from vaccine-preventable respiratory diseases.

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Declines in Influenza Vaccination Coverage Among Health Care Personnel in Acute Care Hospitals During the COVID-19 Pandemic — United States, 2017–2023

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Abstract

Health care personnel (HCP) are recommended to receive annual vaccination against influenza to reduce influenza-related morbidity and mortality. Every year, acute care hospitals report receipt of influenza vaccination among HCP to CDC's National Healthcare Safety Network (NHSN). This analysis used NHSN data to describe changes in influenza vaccination coverage among HCP in acute care hospitals before and during the COVID-19 pandemic. Influenza vaccination among HCP increased during the prepandemic period from 88.6% during 2017–18 to 90.7% during 2019–20. During the COVID-19 pandemic, the percentage of HCP vaccinated against influenza decreased to 85.9% in 2020–21 and 81.1% in 2022–23. Additional efforts are needed to implement evidence-based strategies to increase vaccination coverage among HCP and to identify factors associated with recent declines in influenza vaccination coverage.

Introduction

Health care personnel (HCP), including those working in acute care hospitals, are at risk for becoming infected with influenza, missing work due to illness, and transmitting the virus to their patients and to other staff members (*1*). The Advisory Committee on Immunization Practices recommends that HCP receive an annual influenza vaccine to reduce influenza-associated morbidity and mortality (*2*). In 2013, the Centers for Medicare & Medicaid Services (CMS) began requiring acute care hospitals to report aggregate facility-level data on HCP influenza vaccination to CDC's National Healthcare Safety Network (NHSN) (*3*). This analysis used data reported to NHSN to assess annual variation in influenza vaccination coverage among HCP during six influenza seasons (2017–18 through 2022–23) to describe annual changes in influenza vaccination coverage among HCP before and during the COVID-19 pandemic.

Methods

Data Collection

Since 2013, every year, acute care hospitals report aggregate facility-level influenza vaccination data among HCP working in the facility for ≥1 day during October 1–March 31 to NHSN.* During the 2019–20 influenza season, CMS suspended the NHSN reporting requirement to reduce regulatory workload during the COVID-19 pandemic,† making reporting optional during this season. This report includes data submitted by acute care hospitals to NHSN for the six influenza seasons from 2017–18 to 2022–23.

Data Analysis

For each influenza season, both pooled HCP influenza vaccination coverage (calculated by dividing the number of HCP who received the annual influenza vaccine by the total number of HCP among all reporting facilities) and facility-level coverage (calculated by dividing the reported number of HCP who worked at a specific facility and received the annual influenza vaccine by the total number of HCP who worked at the facility) were examined. A logistic regression model with generalized estimating equations was developed to assess differences in influenza vaccination coverage before the COVID-19 pandemic (prepandemic) and during the pandemic, controlling for HCP type (employee [those receiving a paycheck directly from the health care facility], nonemployee licensed practitioner [physicians, advanced practice nurses, and physician assistants who are affiliated with the health care facility, but are not directly employed by it], and nonemployee students and volunteer [medical, nursing, or other health professional students, interns, medical residents, or volunteers aged ≥18 years who are affiliated with the health care facility but are not directly employed by it]),§ three levels of urbanicity

* https://www.cdc.gov/nhsn/pdfs/hps-manual/vaccination/hps-flu-vaccine-protocol-508.pdf

† https://www.cms.gov/files/document/guidance-memo-exceptions-and-extensions-quality-reporting-and-value-based-purchasing-programs.pdf

§ https://www.cdc.gov/nhsn/forms/instr/COVIDVax.Staff_.Revised.TOI_.MAY2022-508.pdf of the hospital location (urban, suburban, and rural),¶ and the six influenza seasons (2017–18 through 2022–23).

The prepandemic period included influenza seasons 2017–18 through 2019–20, and the pandemic period included seasons 2020–21 through 2022–23, with the 2017–18 season set as the reference season. The 2019–20 season was included with the prepandemic seasons because influenza vaccination is generally recommended by the end of October,** and most influenza vaccines are administered by January.†† Thus, because widespread community transmission of SARS-CoV-2 in the United States did not begin until March 2020 (*4*), the pandemic is unlikely to have affected influenza vaccination during that season. In considering job category, the reference group was set as employee; for urbanicity, the reference group was rural. Descriptive analyses were performed at the facility level, with median coverage levels and IQRs calculated by season. Pooled facility-level vaccination coverage was further stratified by each factor included in the generalized estimating equations model, and odds ratios (OR) and 95% CI were calculated. P-values <0.05 and 95% CI that excluded 1 were considered statistically significant. All analysis was conducted using SAS (version 9.4; SAS Institute). This activity was reviewed by the CDC, deemed not research, and conducted consistent with applicable federal law and CDC policy.§§

Results

During the 2017–18 through 2022–23 influenza seasons, 5,231 acute care hospitals reported HCP influenza vaccination data to NHSN (Table 1), including 2,908 (55.6%) hospitals during the 2019–20 season, when reporting was optional. During the six-season period, overall pooled influenza vaccination coverage among HCP was 85.8%. During the prepandemic influenza seasons (2017–18, 2018–19, and 2019–20), pooled annual influenza vaccination coverage was 88.6%, 90%, and 90.7%, respectively. After the emergence of SARS-CoV-2, coverage during the 2020–21, 2021–22, and 2022–23 seasons declined to 85.9%, 80.4%, and 81.1%, respectively.

When controlled for HCP type and urbanicity, HCP were significantly less likely to be vaccinated against influenza during the pandemic than they were during the 2017–18 season, (Table 2). Across all influenza seasons, compared with HCP employed by hospitals, influenza vaccination coverage was lower among licensed independent practitioners (OR = 0.35; 95% CI = 0.34–0.37) and student trainees and volunteers (OR = 0.98; 95% CI = 0.81–0.98). Compared with HCP working in rural areas, HCP working in suburban areas were more likely to be vaccinated (OR = 1.16; 95% CI = 1.05–1.28).

Discussion

This study of a large national surveillance system found that influenza vaccination coverage among HCP in acute care hospitals has declined since the COVID-19 pandemic. A recent study reported similar results from an Internet panel survey of HCP in which estimated influenza vaccination coverage based on self-reported receipt of influenza vaccine decreased between the 2019–20 and the 2020–21 seasons (*5*). These findings underscore the importance of investigating reasons for declines in vaccination coverage among HCP.

A combination of factors might have affected the decline in influenza vaccination coverage among HCP during the COVID-19 pandemic. Similar decreases in influenza vaccination observed among HCP in other countries have been attributed to COVID-19 vaccination campaigns leading to decreased emphasis on influenza vaccination and vaccine fatigue from having received multiple COVID-19 vaccines (*6*). Although the co-administration of COVID-19 and influenza vaccines is safe and effective,¶¶ individual hesitancy to receive both vaccines at once might also have contributed to lower influenza vaccination coverage during the pandemic. In the United States, facility-wide mask-wearing was recommended by CDC during the pandemic,*** and fewer influenza cases, hospitalizations, and deaths were reported during the 2020–21 and 2021–22 influenza seasons compared with previous years.††† These factors might have contributed to perceptions that the risk for acquiring influenza in the workplace was lower and that influenza vaccination was less important than it had been in previous years.

Similar to reports from previous influenza seasons, nonemployee licensed independent practitioners were consistently found to have lower vaccination coverage compared with employees.§§§ Personnel directly employed by a hospital might be more easily reached by strategies to increase vaccination, such as offering vaccination at no cost, eliminating an important barrier to access. In addition, facility-issued vaccine mandates have been found to improve HCP influenza

¶ Urbanicity categories are based on the National Center for Health Statistics' rural-urban classification scheme for counties. Urban areas include counties within metropolitan statistical areas of ≥1 million population, suburban areas include counties within metropolitan statistical areas of 50,000–999,999 population, and rural areas include counties outside of metropolitan statistical areas (including counties within and outside of micropolitan statistical areas). https://www.cdc.gov/nchs/data/data_acces_files/NCHSUrbruralFileDocumentationInternet2.pdf

** https://www.cdc.gov/flu/professionals/vaccination/vax-summary.htm

†† https://www.cdc.gov/flu/fluvaxview/interactive-general-population.htm

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

¶¶ https://www.cdc.gov/flu/prevent/coadministration.htm

*** https://www.cdc.gov/flu/about/burden/past-seasons.html

††† https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html

§§§ https://www.cdc.gov/flu/fluvaxview/interactive-health-care-personnel.htm

TABLE 1. Pooled and facility-level influenza vaccination coverage among health care personnel in acute care hospitals, by influenza season, employee type, and urbanicity* — National Healthcare Safety Network, United States, 2017–18 through 2022–23 influenza seasons

Season/HCP type/Urbanicity	Pooled coverage: No. of facilities	Pooled coverage: No. of HCP	Pooled coverage: No. of HCP vaccinated	Pooled coverage: Vaccination coverage, %	Facility-level coverage, %, median (IQR)
Total	**5,231**	**48,082,901**	**41,246,748**	**85.8**	**93.21 (76.00–98.87)**
Influenza season					
Prepandemic period					
2017–18	4,735	8,661,994	7,678,088	88.6	94.12 (80.64–98.89)
2018–19	4,655	8,715,667	7,840,603	90.0	95.20 (84.16–99.10)
2019–20	2,908	5,167,211	4,684,995	90.7	95.47 (85.23–99.26)
Pandemic period					
2020–21	4,469	8,217,159	7,059,341	85.9	93.86 (77.76–99.38)
2021–22	4,602	8,530,075	6,856,292	80.4	89.48 (64.44–98.27)
2022–23	4,759	8,790,795	7,127,429	81.1	88.23 (65.12–97.48)
HCP type					
Employee	5,231	35,633,277	31,364,746	88.0	92.06 (80.49–97.07)
Licensed independent practitioner	5,231	6,935,148	5,033,055	72.6	87.75 (57.98–98.25)
Student trainee or volunteer	5,231	5,514,476	4,848,947	87.9	98.22 (86.36–100.00)
Urbanicity*					
Rural	1,883	5,342,766	4,597,676	86.1	93.75 (76.33–99.83)
Suburban	1,439	16,285,637	14,141,350	86.8	93.45 (77.08–98.73)
Urban	1,869	26,294,322	22,369,551	85.1	92.61 (75.00–98.44)

Abbreviation: HCP = health care personnel.

* Urbanicity categories are based on the National Center for Health Statistics' rural-urban classification scheme for counties. Urban areas include counties within metropolitan statistical areas of ≥1 million population, suburban areas include counties within metropolitan statistical areas of 50,000–999,999 population, and rural areas include counties outside of metropolitan statistical areas (including counties within and outside of micropolitan statistical areas). https://www.cdc.gov/nchs/data/data_acces_files/NCHSUrbruralFileDocumentationInternet2.pdf

vaccination coverage (*7*). However, facility-level vaccination mandates might not be easily enforced among nonemployee licensed independent practitioners, potentially limiting the effectiveness of this strategy in this subpopulation of HCP.

Previous reports of HCP vaccination have found that HCP working in rural areas had lower vaccination coverage compared with those working in nonrural areas (*8*). This report found that, compared with influenza vaccination coverage among HCP working in rural areas, influenza vaccination coverage among those working in suburban areas was significantly higher. There was no difference in coverage among HCP working in urban and rural areas. This suggests that future studies of vaccination coverage might consider examining HCP working in suburban and urban areas as separate subgroups.

Limitations

The findings in this report are subject to at least four limitations. First, this report includes influenza vaccination data reported by facilities to NHSN on behalf of HCP, which could have resulted in an underestimate of influenza vaccination acquired by HCP outside the hospital, particularly among HCP not employed directly by the reporting hospital. Second, NHSN received aggregate facility-level data; therefore, vaccination coverage could not be stratified by person-level covariates including age, race, or ethnicity. Third, a reporting exception was granted for acute care hospitals for the 2019–2020 season, resulting in only a subset of facilities reporting and limiting the generalizability of the data reported that year. Finally, NHSN does not collect data about facility-level influenza vaccination mandates for HCP. Therefore, it was not possible to determine the impact that facility-level vaccination mandates or changes to mandates over time might have had on influenza vaccination coverage among HCP.

Implications for Public Health Practice

Receipt of an annual influenza vaccination by HCP working in acute care hospitals is important for protecting themselves and hospitalized patients from influenza infection and its associated complications. Acute care hospitals can use evidence-based strategies to increase vaccination coverage, including implementing mandatory immunization policies and offering on-site influenza vaccination at no cost to all employee and nonemployee staff members.¶¶¶ Understanding factors contributing to recent declines in influenza vaccination among HCP might facilitate targeted interventions to increase influenza vaccination coverage during future public health emergencies.

¶¶¶ https://www.cdc.gov/infectioncontrol/guidelines/healthcare-personnel/immunization.html

TABLE 2. Influenza vaccination coverage differences among health care personnel in acute care hospitals,* by influenza season, health care personnel type, and urbanicity† — National Healthcare Safety Network, United States, 2017–18 through 2022–23 influenza seasons

Influenza season	Odds ratio (95% CI)	p-value
Prepandemic period		
2017–18	Ref	—
2018–19	1.14 (1.10–1.19)	<0.01
2019–20	1.24 (1.17–1.31)	<0.01
Pandemic period		
2020–21	0.76 (0.72–0.80)	<0.01
2021–22	0.50 (0.47–0.53)	<0.01
2022–23	0.52 (0.49–0.55)	<0.01
HCP type		
Employee	Ref	—
Licensed independent practitioner	0.35 (0.34–0.37)	<0.01
Student trainee or volunteer	0.89 (0.81–0.98)	0.02
Urbanicity†		
Rural	Ref	—
Suburban	1.16 (1.05–1.28)	<0.01
Urban	1.03 (0.94–1.14)	0.45

Abbreviations: HCP = health care personnel; Ref = referent group.
* Based on a generalized estimating equations model, controlling for health care provider type and urbanicity.
† Urbanicity categories are based on the National Center for Health Statistics' rural-urban classification scheme for counties. Urban areas include counties within metropolitan statistical areas of ≥1 million population, suburban areas include counties within metropolitan statistical areas of 50,000–999,999 population, and rural areas include counties outside of metropolitan statistical areas (including counties within and outside of micropolitan statistical areas). https://www.cdc.gov/nchs/data/data_acces_files/NCHSUrbruralFileDocumentationInternet2.pdf

Summary

What is already known about this topic?

CDC and the Advisory Committee on Immunization Practices recommend that health care personnel (HCP) receive an annual influenza vaccination to reduce influenza-related morbidity and mortality.

What is added by this report?

HCP working in acute care hospitals during the 2017–2023 influenza seasons were less likely to be vaccinated against influenza during the COVID-19 pandemic (influenza seasons 2020–21 through 2022–23) than before the pandemic (influenza seasons 2017–18 through 2019–20).

What are the implications for public health practice?

Efforts are needed to implement evidence-based strategies to increase vaccination coverage among HCP. HCP should receive seasonal influenza vaccines to protect other HCP and patients from influenza-related morbidity and mortality.

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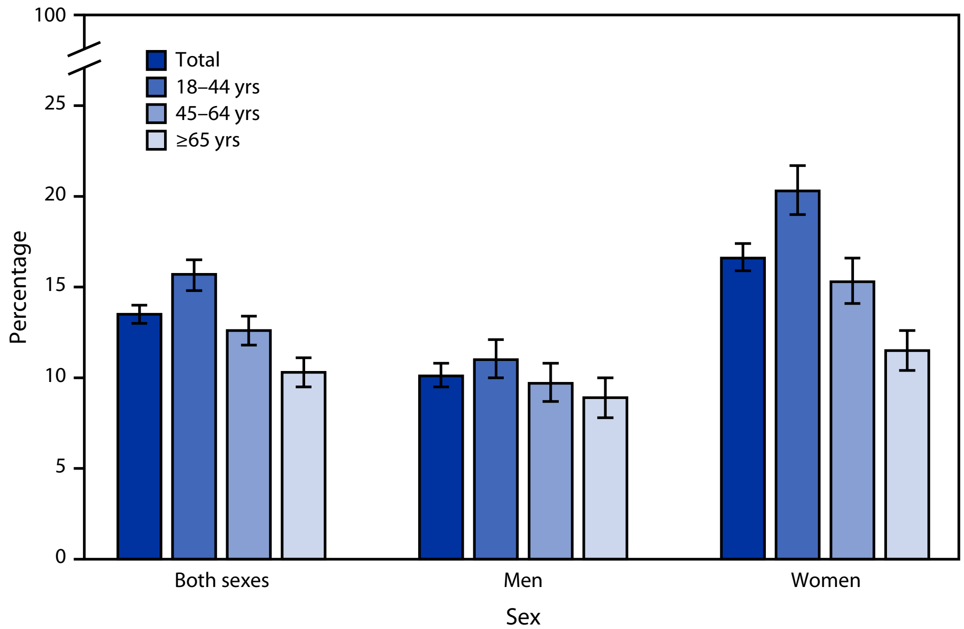
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥18 Years Who Felt Very Tired or Exhausted Most Days or Every Day in the Past 3 Months,† by Sex and Age Group — National Health Interview Survey,§ United States, 2022



* With 95% CIs indicated by error bars.
† Based on a response to the question, "In the past 3 months, how often did you feel very tired or exhausted? Would you say never, some days, most days, or every day?"
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

In 2022, 13.5% of adults aged ≥18 years felt very tired or exhausted most days or every day in the past 3 months, and this percentage declined with age. Among men, the percentage was highest among those aged 18–44 years (11.0%), followed by those aged 45–64 years (9.7%) and ≥65 years (8.9%). Among women, the decline in the percentage with age was steeper, decreasing from 20.3% (18–44 years), to 15.3% (45–64 years), to 11.5% (≥65 years). The percentage of adults who felt tired or exhausted most days or every day was higher for women compared with men in each age group.

Source: National Center for Health Statistics, National Health Interview Survey, 2022. https://www.cdc.gov/nchs/nhis/index.htm

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