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Tobacco Product Use Among Middle and High School Students — United States, 2022

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Tobacco use* is the leading cause of preventable disease, disability, and death among adults in the United States (*1*). Youth use of tobacco products in any form is unsafe, and nearly all tobacco use begins during youth and young adulthood (*2*). The Food and Drug Administration (FDA) and CDC analyzed data from the 2022 National Youth Tobacco Survey (NYTS) to estimate current (past 30-day) use of eight tobacco products among U.S. middle (grades 6–8) and high school (grades 9–12) students. In 2022, approximately 11.3% of all students (representing 3.08 million persons) reported currently using any tobacco product, including 16.5% of high school and 4.5% of middle school students (2.51 million and 530,000 persons, respectively). Electronic cigarettes (e-cigarettes) were the most commonly used tobacco product among high school (14.1%; 2.14 million) and middle school (3.3%; 380,000) students. Approximately 3.7% of all students (representing 1 million persons) reported currently smoking any combustible tobacco product. Current use of any tobacco product was higher among certain population groups, including 13.5% of non-Hispanic American Indian or Alaska Native (AI/AN)† students; 16.0% of students identifying as lesbian, gay, or bisexual (LGB); 16.6% of students identifying as transgender; 18.3% of students reporting severe psychological distress; 12.5% of students with low family affluence; and 27.2% of students with low academic achievement. Implementation of comprehensive evidence-based tobacco control strategies, combined with FDA regulation, is important for preventing and reducing youth tobacco product use (*1*,*2*).

NYTS is a cross-sectional, voluntary, school-based, self-administered survey of U.S. middle and high school students. A stratified, three-stage cluster sampling procedure generated a nationally representative sample of U.S. students attending public and private schools in grades 6–12. In 2022, the survey was administered during January 18–May 31, 2022. The 2022 NYTS was conducted using an online survey, with nearly all (99.3%) students completing it on a school campus. In total, 28,291 students (student participation rate = 76.1%) from 341 schools (school participation rate = 59.4%) participated, yielding an overall response rate of 45.2%. Because of changes in methodology, including differences in survey administration and data collection procedures, the ability to compare estimates from 2022 with those from previous NYTS waves is limited;

Continuing Education examination available at https://www.cdc.gov/mmwr/mmwr_continuingEducation.html

*The term "tobacco" as used in this report refers to commercial tobacco products and not to sacred and traditional use of tobacco by some American Indian communities.

†Respondents could select one or more races: AI/AN, Asian, Black, NH/OPI, or White. Respondents who indicated Hispanic, Latino, Latina, or Spanish origin were classified as Hispanic, irrespective of their race. Non-Hispanic respondents who selected more than one race were classified as multiracial.

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differences between estimates might result from changes in methodology, actual behavior, or both.[§] Detailed information about NYTS is available online.[¶]

Weighted prevalence estimates and population totals[**] of current use of eight tobacco products (e-cigarettes, cigars, cigarettes, smokeless tobacco,[††] hookahs, nicotine pouches,[§§] heated tobacco products, and pipe tobacco) and three composite measures (use of any tobacco product,[¶¶] any combustible tobacco product,[***] and multiple tobacco products[†††]) were reported among all students and by school level; current use was defined as use on ≥1 day during the past 30 days. In addition, estimates of current use of any tobacco product were reported by selected demographic characteristics[§§§] and indicators of social determinants of health.[¶¶¶] Estimates with

[§] The NYTS was conducted in schools using an electronic tablet in 2019 and 2020. Because of COVID-19 concerns, the 2021 NYTS was conducted using web-based data collection, with approximately one half (50.8%) of students completing the survey in school. The 2022 NYTS was also conducted using web-based data collection, with nearly all (99.3%) students completing the survey in school.

[¶] The 2022 NYTS included additional sampling to increase the sample size of AI/AN and Asian students for analyses. All respondents completing surveys were included in the final data set. https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/index.htm

[**] Data were weighted to account for the complex survey design and to adjust for nonresponse. Population estimates of current use were rounded down to the nearest 10,000 persons.

[††] Definition of smokeless tobacco includes chewing tobacco, snuff, and dip; snus; and dissolvable tobacco products. Use of individual smokeless tobacco products is not reported.

[§§] Questions assessing awareness, ever use, and current use of nicotine pouches were accompanied by a brief description, "The next section is about 'nicotine pouches' such as Zyn, on!, or Velo. These small, flavored pouches contain nicotine that comes from tobacco. Users place them in their mouth. Nicotine pouches are different from other smokeless tobacco products such as snus, dip, or chewing tobacco, because they do not contain any tobacco leaf."

[¶¶] Any tobacco product use was defined as current use of one or more of the following tobacco products on ≥1 day during the past 30 days: e-cigarettes, cigarettes, cigars, smokeless tobacco (chewing tobacco, snuff, and dip; snus; and dissolvable tobacco products), hookahs, heated tobacco products, nicotine pouches, pipe tobacco, or bidis (small brown cigarettes wrapped in a leaf).

[***] Any combustible tobacco product use is defined as current use of one or more of the following tobacco products on ≥1 day during the past 30 days: cigarettes, cigars, hookahs, pipe tobacco, or bidis.

[†††] Multiple tobacco product use was defined as current use of two or more of the following tobacco products on ≥1 day during the past 30 days: e-cigarettes, cigarettes, cigars, smokeless tobacco, hookahs, heated tobacco products, nicotine pouches, pipe tobacco, or bidis.

[§§§] Demographic characteristics included sex (female or male), race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian, non-Hispanic AI/AN, non-Hispanic NH/OPI, and non-Hispanic multiracial [two or more races]), sexual identity (heterosexual, LGB, or not sure), and transgender status (no, yes, not sure, or don't know what this question is asking). Race and ethnicity measure used in analyses allowed for multiple races, which is different from the measure used in previous NYTS publications that categorized respondents into single race and ethnicity groups.

[¶¶¶] Indicators of social determinants of health included grades in school (mostly As, Bs, Cs, Ds, or Fs), speaking a language other than English at home (yes or no), psychological distress (none, mild, moderate, or severe), and family affluence (low, medium, or high).

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a relative SE of >30% or an unweighted denominator of <50 were suppressed. Analyses were conducted using SAS-callable SUDAAN (version 11.0.4; RTI International). The 2022 NYTS was approved by the Office of Management and Budget, the contracted data collectors' institutional review board (IRB), and CDC's IRB.[****]

In 2022, among middle and high school students, 24.8% reported ever having used any tobacco product (Supplementary Table, https://stacks.cdc.gov/view/cdc/122048), and 11.3% reported current use of any tobacco product (Table 1). Overall, current use of any tobacco product was reported by 12.3% of female, 10.3% of male, 13.5% of AI/AN, 13.0% of non-Hispanic multiracial (multiracial), 12.4% of non-Hispanic White (White), 11.5% of non-Hispanic Black or African American (Black), 11.1% of Hispanic or Latino (Hispanic), and 3.1% of non-Hispanic Asian (Asian) students. Current use of any combustible tobacco product was reported by 5.7% of Black, 4.7% of multiracial, 4.6% of AI/AN, 3.9% of Hispanic, and 3.4% of White students. Notably, current use of any combustible tobacco product was highest among Black students, specifically for cigar (3.3%) and hookah (2.3%) use. Estimates among non-Hispanic Native Hawaiian or other Pacific Islander (NH/OPI) students, overall and by school level, were statistically unreliable for all current use measures and are not reported.

Tobacco use prevalence varied by certain demographic characteristics and indicators of social determinants of health. By sexual identity, current use of any tobacco product was 16.0% among middle and high school students identifying as LGB, 9.7% among those identifying as heterosexual, and 7.1% among those who were not sure. In addition, current use of any tobacco product was reported by 16.6% of students identifying as transgender, 14.5% of those who were not sure, and 10.2% of those identifying as not transgender (Table 2). Prevalence of current tobacco product use ranged from 7.2% among students reporting no psychological distress to 18.3% among those reporting severe distress.[††††] Current use of any tobacco product was reported by 12.5% of students whose families were categorized as having low affluence,[§§§§] and by 9.6% of those with medium or high family affluence. Current tobacco product use was inversely related to self-reported grades in school, ranging from 6.6% among those reporting "mostly As" to 27.2% among those reporting "mostly Fs." Current tobacco product use was higher among students who spoke English in the home (11.1%) compared with those who spoke another language at home (8.5%).

Among high school students, 16.5% reported current use of any tobacco product, 5.2% (31.5% of current users of any tobacco product) reported current use of any combustible tobacco product, and 5.0% (30.3% of any tobacco product users) reported current use of multiple tobacco products. E-cigarettes were the product type most commonly used (14.1%), followed by cigars (2.8%), cigarettes (2.0%), smokeless tobacco (1.6%), hookahs (1.5%), nicotine pouches (1.4%), heated tobacco products (1.1%), and pipe tobacco (0.7%).

Among middle school students, 4.5% reported current use of any tobacco product, 1.6% (35.6% of current users of any tobacco product) reported current use of any combustible tobacco product, and 1.5% (33.3% of any tobacco product users) reported current use of multiple tobacco products. By product type, e-cigarettes were most commonly used (3.3%), followed by cigarettes (1.0%), smokeless tobacco and heated tobacco products (both 0.7%), cigars (0.6%), hookahs and nicotine pouches (both 0.5%), and pipe tobacco (0.3%).

Discussion

An estimated 3.08 million U.S. middle and high school students reported current use of any tobacco product in 2022, representing approximately one in six high school students and one in 22 middle school students. Among all students who currently used any tobacco product, 31.0% reported using multiple tobacco products during the past 30 days. Multiple tobacco product use among youths is particularly concerning because it is associated with nicotine dependence, which increases the likelihood of sustained tobacco use in adulthood (*1*–*3*).

Similar to the previous year (*4*), indicators of social determinants of health were assessed in relation to tobacco product use, and in 2022, estimates for Asian, AI/AN, NH/OPI, and multiracial population groups were provided for the first time, allowing measurement of disparities affecting these groups.

[****] 45 C.F.R. part 46; 21 C.F.R. part 56.

[††††] Psychological distress was assessed with a composite scale comprised of four questions: "During the past two weeks, how often have you been bothered by any of the following problems?" 1) "Little interest or pleasure in doing things"; 2) "Feeling down, depressed, or hopeless"; 3) "Feeling nervous, anxious, or on edge"; and 4) "Not being able to stop or control worrying." Complete data from all four questions (n = 24,251) were summed (range = 0–12) and categorized.

[§§§§] Family affluence was assessed with a composite scale comprised of four questions: 1) "Does your family own a vehicle (such as a car, van, or truck)?"; 2) "Do you have your own bedroom?"; 3) "How many computers (including laptops and tablets, not including game consoles and smartphones) does your family own?"; and 4) "During the past 12 months, how many times did you travel on vacation with your family?" Complete data from all four questions (n = 24,972) were summed (range = 0–9) and categorized into approximate tertiles based on the sample's weighted distribution of scores.

TABLE 1. Percentage of middle and high school students who reported current (past 30-day) tobacco product use, by product,* overall and by school level, sex, and race and ethnicity — National Youth Tobacco Survey, United States, 2022

	Sex, % (95% CI)		Race and ethnicity,† % (95% CI)						Total	
Tobacco product	Female	Male	White, NH	Black or African American, NH	Hispanic	Asian, NH	AI/AN, NH	Multiracial, NH	% (95% CI)	Estimated no. of users§
Overall										
Any tobacco product¶	12.3 (10.7–14.1)	10.3 (8.6–12.4)	12.4 (10.2–14.8)	11.5 (9.2–14.3)	11.1 (9.7–12.8)	3.1 (1.9–4.9)	13.5 (9.9–18.2)	13.0 (10.3–16.2)	**11.3 (9.7–13.1)**	**3,080,000**
E-cigarettes	10.5 (8.9–12.3)	8.3 (6.7–10.3)	11.0 (8.9–13.5)	8.2 (6.3–10.6)	8.8 (7.6–10.1)	—**	9.6 (6.6–13.8)	10.6 (8.3–13.5)	**9.4 (8.0–11.1)**	**2,550,000**
Cigars	1.5 (1.1–1.9)	2.2 (1.6–3.0)	1.8 (1.3–2.5)	3.3 (2.3–4.7)	1.7 (1.3–2.3)	—	—	2.2 (1.3–3.7)	**1.9 (1.4–2.4)**	**500,000**
Cigarettes	1.5 (1.2–2.0)	1.7 (1.3–2.2)	1.8 (1.4–2.3)	—	1.8 (1.3–2.5)	—	—	2.3 (1.4–3.9)	**1.6 (1.3–2.0)**	**440,000**
Smokeless tobacco (composite)††	0.8 (0.6–1.1)	1.7 (1.3–2.2)	1.5 (1.2–2.0)	—	1.2 (0.8–1.7)	—	—	—	**1.3 (1.0–1.6)**	**330,000**
Hookahs	1.1 (0.8–1.4)	1.1 (0.9–1.5)	0.7 (0.5–1.0)	2.3 (1.7–3.1)	1.5 (1.1–2.1)	—	—	1.0 (0.6–1.6)	**1.1 (0.9–1.4)**	**290,000**
Nicotine pouches	0.7 (0.5–1.0)	1.4 (1.0–2.0)	1.3 (0.9–1.9)	—	1.0 (0.7–1.5)	—	—	—	**1.1 (0.8–1.4)**	**280,000**
Heated tobacco products	0.9 (0.7–1.2)	1.0 (0.8–1.5)	0.8 (0.6–1.0)	0.8 (0.5–1.3)	1.4 (0.9–2.0)	—	—	—	**1.0 (0.8–1.2)**	**260,000**
Pipe tobacco	0.5 (0.3–0.7)	0.7 (0.5–1.0)	0.5 (0.3–0.7)	—	0.8 (0.5–1.3)	—	—	—	**0.6 (0.4–0.8)**	**150,000**
Any combustible tobacco product§§	3.5 (2.9–4.3)	3.9 (3.1–4.8)	3.4 (2.7–4.2)	5.7 (4.3–7.5)	3.9 (3.1–4.9)	—	4.6 (2.8–7.5)	4.7 (3.3–6.6)	**3.7 (3.1–4.5)**	**1,000,000**
Multiple tobacco products¶¶	3.1 (2.5–3.8)	3.9 (3.1–5.0)	3.8 (3.0–4.9)	3.7 (2.7–5.2)	3.5 (2.7–4.5)	—	3.5 (2.2–5.5)	3.9 (2.7–5.6)	**3.5 (2.9–4.4)**	**960,000**
High school (grades 9–12)										
Any tobacco product¶	17.6 (15.8–19.6)	15.3 (13.0–17.9)	18.6 (16.2–21.2)	15.2 (12.0–19.2)	14.9 (13.0–17.1)	—	20.0 (13.9–28.1)	17.8 (14.0–22.4)	**16.5 (14.6–18.5)**	**2,510,000**
E-cigarettes	15.4 (13.6–17.4)	12.8 (10.6–15.3)	16.9 (14.6–19.5)	11.1 (8.3–14.7)	12.2 (10.7–14.0)	—	14.6 (9.4–22.0)	14.3 (11.0–18.3)	**14.1 (12.4–16.0)**	**2,140,000**
Cigars	2.1 (1.5–2.8)	3.5 (2.6–4.6)	2.8 (2.1–3.8)	4.4 (2.9–6.8)	2.2 (1.7–2.9)	—	—	3.4 (2.0–5.7)	**2.8 (2.2–3.5)**	**410,000**
Cigarettes	1.8 (1.4–2.3)	2.3 (1.8–3.0)	2.4 (1.8–3.0)	—	2.0 (1.3–3.1)	—	—	3.6 (2.0–6.1)	**2.0 (1.7–2.5)**	**310,000**
Smokeless tobacco (composite)††	0.9 (0.6–1.3)	2.3 (1.7–3.1)	2.2 (1.7–3.0)	—	1.3 (0.9–1.9)	—	—	—	**1.6 (1.3–2.1)**	**240,000**
Hookahs	1.3 (1.0–1.9)	1.7 (1.3–2.3)	1.1 (0.8–1.6)	3.4 (2.5–4.5)	1.7 (1.2–2.5)	—	—	—	**1.5 (1.2–1.9)**	**220,000**
Nicotine pouches	0.8 (0.5–1.2)	2.1 (1.5–2.9)	2.0 (1.4–2.9)	—	1.1 (0.7–1.8)	—	—	—	**1.4 (1.1–2.0)**	**210,000**
Heated tobacco products	1.0 (0.7–1.4)	1.3 (0.9–1.8)	1.1 (0.8–1.5)	—	1.4 (0.8–2.4)	—	—	—	**1.1 (0.9–1.5)**	**160,000**
Pipe tobacco	0.5 (0.3–0.8)	0.9 (0.6–1.3)	0.6 (0.4–1.1)	—	0.8 (0.5–1.3)	—	—	—	**0.7 (0.5–1.0)**	**100,000**
Any combustible tobacco product§§	4.7 (3.8–5.7)	5.8 (4.8–7.0)	4.9 (3.9–6.0)	8.2 (6.1–10.9)	4.9 (3.8–6.2)	—	6.6 (3.7–11.5)	7.4 (5.4–10.1)	**5.2 (4.4–6.2)**	**790,000**
Multiple tobacco products¶¶	4.1 (3.4–5.0)	5.9 (4.6–7.4)	5.7 (4.5–7.1)	5.5 (3.8–7.8)	4.1 (3.1–5.4)	—	4.6 (2.6–8.1)	5.6 (3.7–8.3)	**5.0 (4.1–6.1)**	**760,000**

See table footnotes on the next page.

These findings suggested disparities in current tobacco product use among U.S. youths. Whereas AI/AN students reported the highest prevalence of current use of any tobacco product, current use of any combustible tobacco product, specifically cigar and hookah use, was highest among Black students. In addition, current use of any tobacco product was higher among those students identifying as LGB or transgender, those reporting severe psychological distress, those with low family affluence, and those with low academic achievement.

Cigarette smoking among U.S. youths has been steadily declining during the past 2 decades (*1*,*2*). Although the ability to compare results between 2022 and previous survey waves

TABLE 1. (*Continued*) Percentage of middle and high school students who reported current (past 30-day) tobacco product use, by product,* overall and by school level, sex, and race and ethnicity — National Youth Tobacco Survey, United States, 2022

	Sex, % (95% CI)		Race and ethnicity,† % (95% CI)						Total	
Tobacco Product	Female	Male	White, NH	Black or African American, NH	Hispanic	Asian, NH	AI/AN, NH	Multiracial, NH	% (95% CI)	Estimated no. of users§
Middle school (grades 6–8)										
Any tobacco product¶	5.3 (4.0–7.0)	3.8 (3.1–4.6)	3.7 (2.6–5.1)	6.2 (4.7–8.2)	5.7 (4.6–7.0)	1.3 (0.8–2.2)	6.2 (3.6–10.4)	6.8 (4.0–11.3)	**4.5 (3.7–5.5)**	**530,000**
E-cigarettes	4.1 (2.9–5.7)	2.5 (2.0–3.3)	2.8 (1.9–4.3)	4.1 (2.7–6.1)	4.2 (3.2–5.4)	—	—	6.0 (3.3–10.5)	**3.3 (2.6–4.2)**	**380,000**
Cigars	0.6 (0.4–1.0)	0.6 (0.4–0.9)	—	1.7 (1.0–2.7)	0.8 (0.5–1.4)	—	—	—	**0.6 (0.4–0.9)**	**70,000**
Cigarettes	1.1 (0.6–2.0)	0.8 (0.5–1.3)	—	—	1.2 (0.8–1.9)	—	—	—	**1.0 (0.6–1.5)**	**110,000**
Smokeless tobacco (composite)††	0.6 (0.4–0.9)	0.7 (0.5–1.1)	0.6 (0.3–0.9)	—	—	—	—	—	**0.7 (0.5–1.0)**	**80,000**
Hookahs	0.6 (0.4–0.8)	0.4 (0.2–0.6)	—	—	0.9 (0.6–1.4)	—	—	—	**0.5 (0.4–0.7)**	**50,000**
Nicotine pouches	—	0.4 (0.2–0.7)	—	—	0.6 (0.4–1.0)	—	—	—	**0.5 (0.3–0.8)**	**50,000**
Heated tobacco products	0.7 (0.4–1.3)	0.6 (0.4–0.9)	0.4 (0.2–0.7)	—	0.9 (0.5–1.5)	—	—	—	**0.7 (0.5–0.9)**	**70,000**
Pipe tobacco	—	0.3 (0.2–0.6)	—	—	—	—	—	—	**0.3 (0.2–0.4)**	**30,000**
Any combustible tobacco product§§	1.9 (1.2–2.8)	1.4 (1.0–1.9)	1.3 (0.7–2.3)	2.2 (1.4–3.3)	2.2 (1.6–3.0)	—	—	—	**1.6 (1.2–2.2)**	**190,000**
Multiple tobacco products¶¶	1.7 (1.1–2.7)	1.3 (0.9–1.7)	1.3 (0.7–2.3)	1.3 (0.8–2.3)	2.1 (1.5–2.9)	—	—	—	**1.5 (1.1–2.1)**	**170,000**

Abbreviations: AI/AN = American Indian or Alaska Native; NH = non-Hispanic; NH/OPI = Native Hawaiian or other Pacific Islander.

* Current use is defined as use on ≥1 day during the past 30 days for each product. Because of missing data on past 30-day use questions, denominators for each tobacco product might differ.

† The race and ethnicity measure used in analyses allowed for multiple races, which differs from the measure used in previous NYTS publications that categorized all respondents into single race and ethnicity groups. Hispanic persons could be of any race (White, Black or African American, Asian, AI/AN, NH/OPI, or multiracial). Estimates among NH NH/OPI students, overall and by school level, were statistically unreliable for all measures and are omitted.

§ Estimated weighted total number of current tobacco users was rounded down to the nearest 10,000 persons. Overall estimates were reported among 28,291 U.S. middle and high school students. School level was determined by self-reported grade level: high school (grades 9–12; n = 16,118) and middle school (grades 6–8; n = 12,041). Overall population estimates might not sum to corresponding subgroup population estimates because of rounding or inclusion of students who did not self-report sex, race and ethnicity, or grade level.

¶ Any tobacco product use is defined as current use of one or more of the following tobacco products on ≥1 day during the past 30 days: e-cigarettes, cigars, cigarettes, smokeless tobacco (chewing tobacco, snuff, and dip; snus; and dissolvable tobacco products), hookahs, nicotine pouches, heated tobacco products, pipe tobacco, or bidis (small brown cigarettes wrapped in a leaf).

** Dashes indicate that data were statistically unreliable because of an unweighted denominator <50 or a relative SE >30%.

†† Smokeless tobacco was defined as chewing tobacco, snuff, and dip; snus; and dissolvable tobacco products.

§§ Any combustible tobacco product use was defined as current use of one or more of the following tobacco products on ≥1 day during the past 30 days: cigars, cigarettes, hookahs, pipe tobacco, or bidis.

¶¶ Multiple tobacco product use was defined as current use of two or more of the following tobacco products on ≥1 day during the past 30 days: e-cigarettes, cigars, cigarettes, smokeless tobacco, hookahs, nicotine pouches, heated tobacco products, pipe tobacco, or bidis.

is limited because of methodological changes, approximately 3.7% of middle and high school students reported current use of any combustible tobacco product in 2022. Efforts are ongoing at the national, state, and local levels, such as enforcing the federal minimum age of sale of 21 years for all tobacco product types (*5*) and restricting the sale of flavored tobacco products in some states and communities.¶¶¶¶ In addition, efforts have been made to raise the price of tobacco products, prohibit public indoor use of tobacco products, and warn about the dangers of tobacco product use through media campaigns and other educational interventions (*6*). Furthermore, factors related to the ongoing COVID-19 pandemic could have possibly affected youth access to tobacco products and tobacco use (*7*).

The 2022 NYTS findings suggest ongoing disparities in tobacco product use, which, to a certain extent, might be attributed to higher volume of exposure to tobacco promotion and advertising and higher tobacco retail outlet density in racial and ethnic minority communities among other systemic environmental factors (*2*). Concerted efforts by parents,

¶¶¶¶ https://www.tobaccofreekids.org/assets/factsheets/0398.pdf

TABLE 2. Percentage of middle and high school students who reported current (past 30-day) use of any tobacco product,* overall† and by school level, selected demographic characteristics, and indicators of social determinants of health — National Youth Tobacco Survey, United States, 2022

Characteristic	Overall		High school (grades 9–12)		Middle school (grades 6–8)	
	% (95% CI)	Estimated no. of users§	% (95% CI)	Estimated no. of users§	% (95% CI)	Estimated no. of users§
Sexual identity						
Heterosexual	**9.7 (8.2–11.5)**	**1,750,000**	14.1 (12.2–16.2)	1,490,000	3.6 (2.9–4.4)	260,000
Gay, lesbian, or bisexual	**16.0 (13.8–18.4)**	**630,000**	21.5 (18.7–24.5)	500,000	7.6 (5.5–10.3)	120,000
Not sure	**7.1 (5.1–9.8)**	**170,000**	12.5 (9.1–16.9)	120,000	—¶	—
Transgender						
No, not transgender	**10.2 (8.6–12.0)**	**2,200,000**	14.8 (12.8–16.9)	1,860,000	3.8 (3.1–4.7)	340,000
Yes, transgender	**16.6 (13.0–21.0)**	**130,000**	20.5 (15.2–27.0)	90,000	9.1 (6.0–13.6)	30,000
Not sure	**14.5 (10.7–19.3)**	**120,000**	23.6 (16.7–32.4)	90,000	—	—
I don't know what this question is asking	**8.1 (5.9–10.9)**	**80,000**	13.8 (10.0–18.7)	50,000	4.0 (2.3–6.8)	20,000
Psychological distress**						
None	**7.2 (6.0–8.5)**	**900,000**	11.0 (9.5–12.8)	760,000	2.3 (1.8–3.0)	120,000
Mild	**10.9 (8.9–13.3)**	**510,000**	16.4 (13.9–19.3)	460,000	2.5 (1.7–3.8)	40,000
Moderate	**13.1 (10.4–16.3)**	**400,000**	18.1 (15.0–21.7)	340,000	5.3 (2.9–9.4)	60,000
Severe	**18.3 (15.7–21.4)**	**540,000**	23.5 (20.6–26.6)	410,000	10.6 (8.0–13.8)	120,000
Family Affluence Scale††						
Low	**12.5 (11.2–13.9)**	**680,000**	17.2 (15.5–19.0)	570,000	5.1 (4.0–6.5)	100,000
Medium	**9.6 (7.8–11.8)**	**870,000**	13.8 (11.3–16.7)	720,000	4.0 (3.3–4.9)	150,000
High	**9.6 (7.8–11.8)**	**900,000**	15.1 (12.9–17.6)	770,000	2.8 (2.0–4.0)	120,000
Grades in school						
Mostly As	**6.6 (5.2–8.2)**	**710,000**	10.1 (8.4–12.2)	580,000	2.4 (1.7–3.3)	110,000
Mostly Bs	**11.3 (9.4–13.6)**	**850,000**	16.4 (14.0–19.2)	750,000	3.3 (2.6–4.3)	90,000
Mostly Cs	**16.5 (13.8–19.6)**	**490,000**	21.1 (17.9–24.7)	410,000	7.7 (5.6–10.4)	70,000
Mostly Ds	**22.7 (18.7–27.3)**	**170,000**	28.9 (23.8–34.7)	140,000	11.5 (7.3–17.6)	30,000
Mostly Fs	**27.2 (22.0–33.2)**	**140,000**	30.6 (23.6–38.6)	100,000	19.2 (12.3–28.8)	30,000
Speak language other than English at home						
Yes	**8.5 (7.1–10.3)**	**640,000**	12.1 (10.2–14.2)	460,000	4.7 (3.4–6.3)	160,000
No	**11.1 (9.4–13.0)**	**1,890,000**	16.1 (14.1–18.4)	1,630,000	3.6 (2.8–4.5)	250,000

* Any tobacco product use is defined as current use of one or more of the following tobacco products on ≥1 day during the past 30 days: e-cigarettes, cigarettes, cigars, smokeless tobacco (chewing tobacco, snuff, and dip; snus; and dissolvable tobacco products), hookahs, heated tobacco products, nicotine pouches, pipe tobacco, or bidis (small brown cigarettes wrapped in a leaf).

† Overall estimates were reported among 28,291 U.S. middle and high school students. School level was determined by self-reported grade level: high school (grades 9–12; n = 16,118) and middle school (grades 6–8; n = 12,041).

§ Estimated weighted total numbers of current tobacco users were rounded down to the nearest 10,000 persons. Overall estimates might not sum to corresponding subgroup estimates by school level because of rounding or inclusion of students who did not self-report grade level.

¶ Dashes indicate that data were statistically unreliable because of an unweighted denominator <50 or a relative SE >30%.

** Psychological distress was assessed with a composite scale comprised of four questions: "During the past two weeks, how often have you been bothered by any of the following problems?" 1) "Little interest or pleasure in doing things"; 2) "Feeling down, depressed, or hopeless"; 3) "Feeling nervous, anxious, or on edge"; and 4) "Not being able to stop or control worrying." Complete data from all four questions (n = 24,251) were summed (range = 0–12) and categorized.

†† Family affluence was assessed with a composite scale comprised of four questions: 1) "Does your family own a vehicle (such as a car, van, or truck)?"; 2) "Do you have your own bedroom?"; 3) "How many computers (including laptops and tablets, not including game consoles and smartphones) does your family own?"; and 4) "During the past 12 months, how many times did you travel on vacation with your family?" Complete data from all four questions (n = 24,972) were summed (range = 0–9) and categorized into approximate tertiles based on the sample's weighted distribution of scores.

schools, and those who work with youths are necessary to reduce tobacco-related disparities by helping youths recognize and avoid the dangers of tobacco use. Furthermore, combined with regulation by FDA, efforts to address social and structural determinants of health disparities are warranted for advancing tobacco-related health equity and reducing and preventing all forms of tobacco product use among U.S. youths (*1*,*2*).

The findings in this report are subject to at least five limitations. First, data were self-reported and cross-sectional in nature; they might be subject to recall and response bias, and no causal inferences can be drawn. Second, data were collected only from middle and high school students who attended public or private schools; findings might not be generalizable to youths who are home-schooled, have dropped out of school, are in detention centers, or are enrolled in alternative schools. However, data from the Current Population Survey indicate that approximately 96% of U.S. youths aged 10–17 years were enrolled in a traditional school in 2020 (*8*). Third, the student participation rate in 2022 was lower than expected. However, weighting adjustments for nonresponse were applied

Summary

What is already known about this topic?

Commercial tobacco use is the leading cause of preventable disease and death in the United States. Youth use of tobacco products in any form is unsafe.

What is added by this report?

In 2022, nearly one in nine (11.3%) middle and high school students reported current tobacco product use, including 13.5% of non-Hispanic American Indian or Alaska Native students; 16.0% who identified as lesbian, gay, or bisexual; 16.6% who identified as transgender; 18.3% who reported severe psychological distress; 12.5% with low family affluence; and 27.2% with low academic achievement.

What are the implications for public health?

Continued surveillance, sustained implementation of population-based tobacco control strategies, and efforts to address disparities, combined with the Food and Drug Administration's regulation are warranted to prevent and reduce youth tobacco use.

to produce national weighted estimates.***** Fourth, because of small sample sizes, many estimates for racial and ethnic population groups were not reliable, especially for less prevalent tobacco products and among the NH/OPI population. Finally, the current definition of AI/AN excludes students indicating both AI/AN and another race and ethnicity, further reducing the sample size and statistical power for the AI/AN group assessed in these data.

Youth use of tobacco products in any form is unsafe. In 2022, nearly one in nine U.S. middle and high school students, or approximately 3.08 million youths overall, reported current use of any tobacco product. Continued surveillance efforts of all tobacco product types, including novel products, and sustained implementation of population-based tobacco control strategies, combined with regulation by FDA, are warranted to prevent and reduce youth tobacco product use.

***** The actual school and student participation rates in 2022 were lower than in previous years, possibly because of lower expected response rates being used in the sampling plan as a result of the COVID-19 pandemic and school policy. The assumed student participation rate used for the sampling plan was adjusted to account both for a growing number of ineligible students and parental refusal and for the new data collection methods (i.e., 100% virtually supported fielding methodology without in-person survey administrators). https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/index.htm

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Interim Recommendations from the Advisory Committee on Immunization Practices for the Use of Bivalent Booster Doses of COVID-19 Vaccines — United States, October 2022

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Four COVID-19 vaccines are currently approved for primary series vaccination in the United States under a Biologics License Application or authorized under an emergency use authorization (EUA) by the Food and Drug Administration (FDA), and recommended for primary series vaccination by the Advisory Committee on Immunization Practices (ACIP): 1) the 2- or 3-dose monovalent mRNA BNT162b2 (Pfizer-BioNTech, Comirnaty) COVID-19 vaccine; 2) the 2- or 3-dose monovalent mRNA mRNA-1273 (Moderna, Spikevax) COVID-19 vaccine; 3) the single-dose adenovirus vector-based Ad26.COV.S (Janssen [Johnson & Johnson]) COVID-19 vaccine; and 4) the 2-dose adjuvanted, protein subunit–based NVX-CoV2373 (Novavax) COVID-19 vaccine. The number of doses recommended is based on recipient age and immunocompromise status (*1*). For additional protection, FDA has amended EUAs to allow for COVID-19 booster doses in eligible persons (*1*). Because COVID-19 vaccines have demonstrated decreased effectiveness during the period when the Omicron variant (B.1.1.529) of SARS-CoV-2 predominated, bivalent booster doses (i.e., vaccine with equal components from the ancestral and Omicron strains) were considered for the express purpose of improving protection conferred by COVID-19 vaccine booster doses (*2*). During September–October 2022, FDA authorized bivalent mRNA vaccines for use as a booster dose in persons aged ≥5 years who completed any FDA-approved or FDA-authorized primary series and removed EUAs for monovalent COVID-19 booster doses (*1*). Pfizer-BioNTech and Moderna bivalent booster vaccines each contain equal amounts of spike mRNA from the ancestral and Omicron BA.4/BA.5 strains. After the EUA amendments, ACIP and CDC recommended that all persons aged ≥5 years receive 1 bivalent mRNA booster dose ≥2 months after completion of any FDA-approved or FDA-authorized monovalent primary series or monovalent booster doses.*

Since June 2020, ACIP has convened 33 public meetings to review data relevant to the potential use of COVID-19 vaccines.† The ACIP COVID-19 Vaccine Work Group (Work Group), comprising experts in adult and pediatric medicine, infectious diseases, vaccinology, vaccine safety, public health, and ethics, has met weekly to review COVID-19 surveillance data, evidence for vaccine efficacy, postauthorization effectiveness, safety, and implementation considerations for COVID-19 vaccines. To assess the certainty of evidence for benefits and harms of a bivalent booster dose and guide deliberations, ACIP used the Evidence to Recommendations (EtR) Framework.§ Within this framework, ACIP considered the importance of COVID-19 as a public health problem, including during the Omicron-predominant period, and issues of resource use, benefits and harms, patients' values and preferences, acceptability, feasibility, and equity for use of the vaccines.

Effectiveness of monovalent COVID-19 vaccines was high after vaccine introduction in late 2020. However, declines in vaccine effectiveness (VE) against infection and COVID-19–associated hospitalization have been observed because of waning protection over time and differences between the virus for which the initial vaccines were designed and currently circulating variants. The Omicron variant,

* On September 1, 2022, ACIP voted in favor of the following interim recommendations: 1) 13 to one in favor of a single dose of bivalent Pfizer-BioNTech COVID-19 vaccine for persons aged ≥12 years ≥2 months after receipt of a primary series or prior monovalent booster dose, under the EUA issued by FDA. ACIP repealed its previous recommendations for administration of monovalent Pfizer-BioNTech COVID-19 vaccine boosters for persons aged ≥12 years; 2) 13 to one in favor of recommending a single dose of bivalent Moderna COVID-19 vaccine for adults aged ≥18 years ≥2 months after receipt of a primary series or prior monovalent booster dose, under the EUA issued by FDA. ACIP repealed its previous recommendations for administration of monovalent Moderna COVID-19 vaccine boosters for adults aged ≥18 years. On October 12, 2022, FDA authorized bivalent booster doses from Pfizer-BioNTech for children aged 5–11 years, and CDC recommended expanding the recommendation for receipt of a single dose of bivalent Pfizer-BioNTech COVID-19 vaccine for persons aged ≥5 years.

† https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/covid-19.html

§ https://www.cdc.gov/vaccines/acip/recs/grade/downloads/acip-evidence-recs-framework.pdf

which emerged in November 2021, has increased immune evasion compared with that of earlier variants (*2*). During the Omicron-predominant period, monovalent mRNA primary series VE against SARS-CoV-2 infection and COVID-19–associated hospitalization was substantially lower and waned over time since vaccination (*3*). A third monovalent (booster) dose provided increased protection against infection and severe disease during the period of Omicron predominance, but VE of monovalent booster doses against COVID-19–associated hospitalization has also waned over time since receipt of the booster dose, especially during the recent BA.2/BA.2.12.1 and BA.4/BA.5 sublineage–predominant periods (*3*,*4*).

The goal of a bivalent booster vaccination is to expand the immune response to the currently circulating Omicron variant[¶] and improve protection conferred by COVID-19 vaccines against severe disease (*2*,*5*). Specifically, the bivalent booster vaccines authorized by FDA contain mRNA encoding the viral spike (S) glycoprotein of SARS-CoV-2 Wuhan-hu-1 strain (ancestral) and the identical S glycoprotein of SARS-CoV-2 Omicron variant BA.4 and BA.5 (Omicron BA.4/BA.5) sublineages (*1*).

At the September 1, 2022, ACIP meeting, committee members reviewed evidence demonstrating monovalent VE against COVID-19–associated hospitalization during the BA.4/BA.5 period among immunocompetent adults aged ≥18 years of 49% (95% CI = 20%–68%) at 14–149 days after dose 3 and 34% (95% CI = 25%–42%) ≥150 days after dose 3 (*5*). Among evidence reviewed for children aged 5–11 years, monovalent VE against emergency department and urgent care visits for COVID-19 was 51% (95% CI = 34%–64%) at 14–59 days after dose 2 and declined to 18% (95% CI = –4% to 35%) ≥150 days after dose 2; among adolescents aged 12–17 years, VE against emergency department and urgent care visits was 63% (95% CI = 48%–73%) ≥7 days after dose 3. These data indicate that VE has declined during a time when the vaccine and circulating variants are different from the version of the virus against which the vaccines were designed to protect; bivalent booster doses might have the potential to improve vaccine protection against newly circulating Omicron variants.

ACIP recommendations for a COVID-19 bivalent mRNA booster dose were also guided by data on immunogenicity and safety from clinical trials of the Moderna and Pfizer-BioNTech bivalent vaccines composed of ancestral and Omicron BA.1 strains (*5*). The Moderna and Pfizer-BioNTech clinical trials included 437 and 315 participants who received 50 μg Omicron BA.1–containing bivalent boosters and 30 μg Omicron BA.1–containing bivalent boosters, respectively.[**] Among adults aged ≥18 years, geometric mean ratios (GMRs) of neutralization titers 28 days after Moderna bivalent (ancestral and BA.1 variant) booster dose were 1.2-fold higher for ancestral SARS-CoV-2 antibodies and 1.8-fold higher for Omicron SARS-CoV-2 antibodies compared with titers in those receiving a Moderna monovalent booster dose, thereby meeting superiority criteria.[††] Among adults aged >55 years, GMRs of neutralization titers 1 month after a Pfizer-BioNTech bivalent (ancestral and BA.1 variant) booster dose were equivalent for ancestral SARS-CoV-2 antibodies and 1.6-fold higher for Omicron SARS-CoV-2 antibodies compared with titers in persons receiving a Pfizer-BioNTech monovalent booster dose, meeting noninferiority criteria[§§] against the ancestral strain and superiority criteria against Omicron.

In the clinical trials of the Moderna and Pfizer-BioNTech bivalent (ancestral and BA.1 variant) booster doses, rates of local or systemic adverse events occurred with similar or lower frequency after a bivalent booster dose than after the second dose of a primary series with the same vaccine (i.e., homologous monovalent booster dose). No serious adverse events related to the vaccine were reported for mRNA COVID-19 updated bivalent booster doses (*5*). A rare risk for myocarditis and pericarditis has been identified after mRNA COVID-19 vaccination, primarily in adolescent and young adult males (*5*). The risk after a bivalent booster dose is not known; however, the observed risk for myocarditis and pericarditis after monovalent mRNA COVID-19 booster doses is similar to or lower than the risk after dose 2 of the primary series. Regular review of safety data, including myocarditis and pericarditis risk after bivalent booster doses, will continue in national safety surveillance systems. Modeling scenarios reviewed during the ACIP meeting showed that, irrespective of the presence of a new variant, vaccination coverage in adults aged ≥18 years similar to coverage for influenza vaccine would lead to a reduction in hospitalizations and deaths of >20% and >15%, respectively, compared with a recommendation for adults aged ≥50 years only (*5*). In addition, absent a new variant, booster doses administered to adults aged ≥18 years in September 2022 were

[¶] https://covid.cdc.gov/covid-data-tracker/#variant-proportions (Accessed October 19, 2022).

[**] In the clinical trials, the Moderna booster contained 25 μg ancestral mRNA spike protein and 25 μg of Omicron BA.1 mRNA spike protein (total = 50 μg) and Pfizer-BioNTech contained 15 μg ancestral mRNA spike protein and 15 μg Omicron BA.1 mRNA (total = 30 μg).

[††] Superiority is considered met when the lower bound of the 97.5% CI of the GMR, the ratio of neutralization titers in the intervention versus the control group, is >1.

[§§] Noninferiority is considered met when the lower bound of the 97.5% CI of the GMR is ≥0.67.

projected to prevent 137,000 more hospitalizations and 9,700 more deaths compared with those prevented by booster doses administered in November 2022.¶¶

Data to guide the pediatric expansions (i.e., to include children aged ≥5 years) for bivalent mRNA COVID-19 vaccines included data on monovalent boosters in both the pediatric and adolescent populations and data on bivalent boosters in the adult population. Recommendations for monovalent booster doses of Pfizer-BioNTech were discussed at previous ACIP meetings and were based on 1) safety and immunogenicity of the booster dose, 2) postauthorization safety data after a primary series in children and adolescents and booster doses in adults, and 3) waning VE after a primary series during the Omicron-predominant period.*** Safety and immunogenicity data for monovalent Moderna COVID-19 booster dose vaccination in children aged 6–11 years and adolescents aged 12–17 years were also reviewed by CDC and FDA. Antibody levels obtained 28 days after a Moderna monovalent booster dose compared with titers 28 days after receiving a Moderna primary series in young adults aged 18–25 years demonstrated neutralization titers 4.2-fold and 5.1-fold higher in children aged 6–11 years and adolescents aged 12–17 years, respectively (*6*). Reactogenicity symptoms were similar to those observed after receipt of booster doses in adults (*6*).

ACIP also examined data pertaining to equity in consideration of each EtR domain, in line with the COVID-19 ACIP Work Group's approach to the EtR Framework through the lens of health equity (*3*). Data reviewed pertaining to health equity included 1) the disproportionate incidence of COVID-19 illness, hospitalization, and death among persons of racial and ethnic minority groups; 2) the demographic characteristics of clinical trial populations compared with those of the U.S. population; and 3) the evidence of persistent inequity in receipt of primary series and booster doses, with potential drivers including differences in access, differences in acceptability, and evidence of limitations to feasibility of booster dose implementation.

In its deliberations at the September 1, 2022, meeting, ACIP discussed the rationale for a bivalent booster vaccine for persons in all age groups previously recommended to receive monovalent booster doses. ACIP concluded that the evidence reviewed, including data and considerations from the EtR Framework, supported use of a dose of a bivalent booster dose of mRNA COVID-19 vaccine in eligible recipients of a COVID-19 primary vaccination series (Box). Since FDA removed the EUAs for mRNA monovalent COVID-19 vaccine booster doses, ACIP repealed its previous recommendations for administration of monovalent Pfizer-BioNTech and Moderna monovalent boosters for persons aged ≥12 years and adults aged ≥18 years, respectively. During this discussion, ACIP voting members and liaisons underscored the importance of extending the potential benefits of the Omicron BA.4/BA.5–targeting bivalent vaccines to pediatric populations. On October 12, 2022, FDA authorized and CDC recommended bivalent Pfizer-BioNTech booster doses for children aged 5–11 years. After the EUA amendments, ACIP and CDC recommended that all persons aged ≥5 years should receive 1 bivalent mRNA booster dose ≥2 months after completion of any FDA-approved or FDA-authorized monovalent primary series or monovalent booster dose (Table). The pediatric data described above were reviewed again at the ACIP meeting on October 19, 2022. In

BOX. Timeline of COVID-19 bivalent vaccine authorizations by Food and Drug Administration and CDC vaccination recommendations — United States, fall 2022

Authorizations and vaccine recommendations

August 2022

- FDA authorizes Pfizer-BioNTech and Moderna bivalent (ancestral and Omicron BA.4/BA.5 variant) COVID-19 vaccines for use as booster doses.

September 2022

- CDC recommends Pfizer-BioNTech and Moderna bivalent booster vaccines for persons aged ≥12 years (Pfizer-BioNTech) and adults aged ≥18 years (Moderna) ≥2 months after last primary series or booster dose.

October 2022

- FDA revises EUA to authorize a Pfizer-BioNTech bivalent booster dose for persons aged ≥5 years; CDC recommends bivalent boosters in children aged 5–11 years ≥2 months after last primary series or booster dose.
- FDA authorizes and CDC recommends a Moderna bivalent booster dose for children and adolescents aged 6–17 years ≥2 months after last primary series or booster dose.
- FDA authorizes and CDC recommends a monovalent Novavax booster dose for adults aged ≥18 years instead of a bivalent booster if they have completed the primary series vaccination but have not previously received a COVID-19 booster, and if they cannot or will not receive mRNA vaccines.

Abbreviations: EUA = emergency use authorization; FDA = Food and Drug Administration.

¶¶ https://covid19scenariomodelinghub.org/viz.html (Accessed August 18, 2022).
*** https://www.cdc.gov/vaccines/acip/meetings/index.html

TABLE. COVID-19 vaccines approved or authorized for emergency use by the Food and Drug Administration and recommended by the Advisory Committee on Immunization Practices for persons aged ≥6 months — United States, October 2022*

Age	Primary series (timing of vaccination)		Bivalent booster dose†
	For most persons	For moderately or severely immunocompromised persons	
6 mos–4 yrs	2-dose Moderna (0, 4–8 wks) or 3-dose Pfizer-BioNTech (0, 3–8, 11–16 wks)	3-dose Moderna (0, 4, 8 wks) or 3-dose Pfizer-BioNTech (0, 3, 11 wks)	No booster dose authorized
5 yrs	2-dose Moderna (0, 4–8 wks) or 2-dose Pfizer-BioNTech (0, 3–8 wks)	3-dose Moderna (0, 4, 8 wks) or 3-dose Pfizer-BioNTech (0, 3, 7 wks)	Pfizer-BioNTech
6–11 yrs	2-dose Moderna (0, 4–8 wks) or 2-dose Pfizer-BioNTech (0, 3–8 wks)	3-dose Moderna (0, 4, 8 wks) or 3-dose Pfizer-BioNTech (0, 3, 7 wks)	Moderna or Pfizer-BioNTech
12–17 yrs	2-dose Moderna (0, 4–8 wks) or 2-dose Novavax (0, 3–8 wks) or 2-dose Pfizer-BioNTech (0, 3–8 wks)	3-dose Moderna (0, 4, 8 wks) or 2-dose Novavax (0, 3 wks) or 3-dose Pfizer-BioNTech (0, 3, 7 wks)	Moderna or Pfizer-BioNTech
≥18 yrs§	2-dose Moderna (0, 4–8 wks) or 2-dose Novavax (0, 3–8 wks) or 2-dose Pfizer-BioNTech (0, 3–8 wks)	3-dose Moderna (0, 4, 8 wks) or 2-dose Novavax (0, 3 wks) or 3-dose Pfizer-BioNTech (0, 3, 7 wks)	Moderna or Pfizer-BioNTech Novavax monovalent booster may be used in limited situations¶

Abbreviation: FDA = Food and Drug Administration.

* https://www.cdc.gov/vaccines/covid-19/clinical-considerations/interim-considerations-us.html

† Bivalent booster doses are authorized ≥2 months after the last primary series or monovalent booster dose. The Novavax monovalent booster is authorized ≥6 months after the last primary series dose.

§ For primary series vaccination, Pfizer-BioNTech, Moderna, and Novavax COVID-19 vaccines are recommended. Janssen (Johnson & Johnson) should only be used in very limited situations because of the risk for thrombosis with thrombocytopenia syndrome after receipt of the vaccine. https://www.cdc.gov/mmwr/volumes/71/wr/mm7103a4.htm

¶ A monovalent Novavax booster dose (rather than a bivalent mRNA booster dose) may be used in limited situations in adults aged ≥18 years who completed any FDA-approved or FDA-authorized monovalent primary series, have not received any primary booster doses, and are unable to receive an mRNA vaccine (i.e., mRNA vaccine is contraindicated or not available) or are unwilling to receive an mRNA vaccine and would otherwise not receive a booster dose.

addition, persons who recently had a SARS-CoV-2 infection may consider delaying a primary series dose or booster dose by 3 months from symptom onset or a positive test result (if infected person was asymptomatic). Additional supporting evidence for the EtR Framework is available at https://www.cdc.gov/vaccines/acip/recs/grade/covid-19-bivalent-booster-etr.html and complete interim clinical considerations are available at https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html.

ACIP emphasized that achieving high and equitable coverage with a COVID-19 primary vaccination series remains the highest priority and is fundamental to reducing COVID-19–related morbidity and mortality, including in younger age groups with lower vaccination coverage. ACIP also stressed the importance of ensuring global equity in access to COVID-19 vaccines for the prevention of disease in vulnerable persons and mitigation of the emergence of SARS-CoV-2 variants.

After authorization by FDA on October 19, 2022, CDC recommended use of a monovalent Novavax booster dose (rather than a bivalent mRNA booster dose) in limited situations. These situations include use in adults aged ≥18 years who completed any FDA-approved or FDA-authorized monovalent primary COVID-19 vaccination series, have not received any previous booster doses, and are unable to receive an mRNA vaccine (i.e., mRNA vaccine is contraindicated or not available) or unwilling to receive an mRNA vaccine and would otherwise not receive a booster dose (*7*). Additional supporting evidence for the EtR is available at https://www.cdc.gov/vaccines/acip/recs/grade/covid-19-novavax-adult-booster-etr.html.

Before vaccination, providers should provide the EUA Fact Sheet for the vaccine being administered and counsel vaccine recipients about expected systemic and local reactogenicity. Additional clinical education materials are available at https://www.cdc.gov/vaccines/covid-19/index.html, including additional clinical considerations at https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html.

Summary

What is already known about this topic?

In the United States, COVID-19 monovalent booster vaccination was previously recommended, but related protection decreased after the emergence of Omicron subvariants.

What is added by this report?

In fall 2022, CDC recommended a bivalent mRNA COVID-19 vaccine booster dose for persons aged ≥5 years, administered ≥2 months after completing the primary series or after receipt of a monovalent booster dose.

What are the implications for public health practice?

Bivalent COVID-19 vaccine booster doses might improve protection against SARS-CoV-2 Omicron sublineages and, along with completion of a primary series in persons who remain unvaccinated, are important to protect against COVID-19, particularly among those persons who are at increased risk for severe illness and death.

These interim ACIP recommendations and clinical considerations are based on bivalent booster doses of COVID-19 vaccine and might change as more evidence becomes available. At the September meeting, existing recommendations for persons who are immunocompromised were highlighted, including preexposure prophylaxis with the medication Evusheld, a combination of two monoclonal antibodies (tixagevimab and cilgavimab) administered every 6 months to persons who are or become moderately or severely immunocompromised, to supplement vaccine-conferred protection (*5*).

Reporting of Vaccine Adverse Events

Adverse events occurring after receipt of any COVID-19 vaccine should be reported to the Vaccine Adverse Event Reporting System (VAERS) at https://vaers.hhs.gov or 1-800-822-7967. Vaccination providers are required under the provisions of the provider agreements for the CDC COVID-19 Vaccination Program and by FDA to report vaccine administration errors, serious adverse events, cases of multisystem inflammatory syndrome, cases of myocarditis, cases of pericarditis, and cases of COVID-19 that result in hospitalization or death after administration of COVID-19 vaccine under EUA. Health care providers are encouraged to report any clinically significant adverse event, even if it is unclear whether the vaccine caused the event. In addition, CDC has developed v-safe, a voluntary, smartphone-based active surveillance system that monitors adverse events occurring after COVID-19 vaccination. Reports to v-safe indicating a medically significant health impact are followed up by CDC's v-safe call center to collect additional information and complete a VAERS report, if indicated. Information on v-safe is available at https://www.cdc.gov/vsafe.

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COVID-19–Associated Hospitalizations Among U.S. Infants Aged <6 Months — COVID-NET, 13 States, June 2021–August 2022

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COVID-19–associated hospitalization rates are highest among adults aged ≥65 years (*1*); however, COVID-19 can and does cause severe and fatal outcomes in children, including infants (*2*,*3*). After the emergence of the SARS-CoV-2 B.1.1.529 (Omicron) BA.1 variant in December 2021, hospitalizations among children aged <5 years, who were ineligible for vaccination, increased more rapidly than did those in other age groups (*4*). On June 18, 2022, CDC recommended COVID-19 vaccination for infants and children aged ≥6 months (*5*). Data from the Coronavirus Disease 2019–Associated Hospitalization Surveillance Network (COVID-NET)* were analyzed to describe changes in the age distribution of COVID-19–associated hospitalizations since the Delta-predominant period (June 20–December 18, 2021)† with a focus on U.S. infants aged <6 months. During the Omicron BA.2/BA.5–predominant periods (March 20–August 31, 2022), weekly hospitalizations per 100,000 infants aged <6 months increased from a nadir of 2.2 (week ending April 9, 2022) to a peak of 26.0 (week ending July 23, 2022), and the average weekly hospitalization rate among these infants (13.7) was similar to that among adults aged 65–74 years (13.8). However, the prevalence of indicators of severe disease§ among hospitalized infants did not increase since the B.1.617.2 (Delta)-predominant period. To help protect infants too young to be vaccinated, prevention should focus on nonpharmaceutical interventions and vaccination of pregnant women, which might provide protection through transplacental transfer of antibodies (*6*).

COVID-NET conducts population-based surveillance for laboratory-confirmed COVID-19–associated hospitalizations among residents of predefined surveillance catchment areas.¶ COVID-19–associated hospitalizations are defined as receipt of a positive SARS-CoV-2 molecular or rapid antigen detection test result during hospitalization or during the 14 days preceding hospital admission. Demographic data were collected on all COVID-19–associated hospitalizations in 13 states and used to calculate age-stratified hospitalization rates.** Clinical data (signs and symptoms at admission,†† underlying medical conditions, and indicators of severe disease) were available for infants aged <6 months from 12 states.§§ Using previously described methods (*4*), clinical data were collected on all infant COVID-NET cases. Because of the surge in hospitalizations during December 2021 and January 2022, some sites abstracted clinical data on a representative sample of hospitalized infants.¶¶ A birth hospitalization was defined as the hospitalization during which the infant was born.

This analysis describes weekly COVID-19–associated hospitalization rates (hospitalizations per 100,000 population) and clinical characteristics of infants aged <6 months during June 20, 2021–August 31, 2022, which includes SARS-CoV-2 Delta (June 20–December 18, 2021), Omicron BA.1 (December 19, 2021–March 19, 2022), Omicron BA.2 (March 20–June 18, 2022), and Omicron BA.5 (June 19–August 31, 2022) variant–predominant periods. Hospitalization rates from the pre-Delta period and among all other age groups are included for comparison. Average weekly rates and demographic and clinical characteristics of infants aged <6 months were compared across variant-predominant periods. Unadjusted weekly COVID-19–associated hospitalization rates were calculated by dividing the total number of

* https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html

† A variant that accounted for >50% of sequenced isolates in all age groups was considered predominant. https://data.cdc.gov/Laboratory-Surveillance/SARS-CoV-2-Variant-Proportions/jr58-6ysp/data

§ Indicators of severe disease included hospital length of stay, intensive care unit admission, need for respiratory support, and in-hospital death.

¶ COVID-NET includes selected counties in California, Colorado, Connecticut, Georgia, Iowa, Maryland, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah. https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e3.htm

** Iowa did not collect demographic or clinical data for the full analysis period and was therefore excluded from all analyses.

†† Signs and symptoms included respiratory conditions (congestion/runny nose, cough, shortness of breath/respiratory distress, upper respiratory infection, wheezing, nausea/vomiting, rash, and seizures) and nonrespiratory conditions (conjunctivitis, diarrhea, fever, apnea, cyanosis, decreased vocalization/stridor, dehydration, hypothermia, inability to eat/poor feeding, and lethargy). Signs and symptoms were abstracted from medical charts and might be incomplete.

§§ Maryland provided demographic data for rate calculations but did not collect clinical data for the full analysis period.

¶¶ During December 2021–January 2022, sites sampled data for 12%–100% of pediatric patients. Random numbers (1–100) were automatically generated and assigned to each patient on entry into the surveillance database to produce random samples of hospitalized patients for medical record abstraction. Percentages were weighted to account for the probability of selection for sampled patients.

hospitalized patients by population estimates within each age group for the counties included in the surveillance catchment area.*** Because population estimates are available in 1-year age increments, population denominators for hospitalization rates among infants aged <6 months were calculated as one half the population estimate for infants aged <1 year. Three-week moving averages are presented for visualization purposes. Rate ratios (RRs) and 95% CIs were calculated. Demographic characteristics, clinical outcomes, and severity across SARS-CoV-2 variant-predominant periods were compared; the Omicron BA.2- and BA.5-predominant periods were combined in analyses because of small sample sizes. During the combined Omicron BA.2/BA.5-predominant period, the proportions of hospitalized infants with underlying medical conditions and symptoms on admission by age group (<1 month, 1–3 months, 4–5 months) were estimated. Wilcoxon rank-sum tests and chi-square tests were used to compare medians and proportions, respectively; p-values <0.05 were considered statistically significant. Percentages were weighted to account for the probability of selection for sampled cases, and further adjusted to account for nonresponse (i.e., an incomplete chart review). Data were analyzed using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and conducted consistent with applicable federal law and CDC policy.†††

During the Omicron BA.2/BA.5-predominant period, the weekly hospitalization rate among infants aged <6 months increased elevenfold (95% CI = 4.3–33.3) from a nadir of 2.2 (week ending April 9, 2022) to a peak of 26.0 (week ending July 23, 2022) and began to decline thereafter (Figure). The mean weekly hospitalization rate in this group was higher during the Omicron BA.2/BA.5 period (13.7) than during the Delta period (8.3) (RR = 1.6; 95% CI = 1.4–1.8). Compared with the Delta period, rates were also higher during the BA.2/BA.5 period among infants and children aged 6 months–4 years (RR = 1.9) and adults aged ≥75 years (RR = 1.4) but lower among children and adolescents aged 5–17 years (RR = 0.9), adults aged 18–64 years (RR = 0.5), and adults aged 65–74 years (RR = 0.8). The mean weekly hospitalization rate among infants aged <6 months during the Omicron BA.2/BA.5 period (13.7) was less than that of adults aged ≥75 years (39.4), similar to that of adults aged 65–74 years (13.8) and higher than rates in all other pediatric age groups (2.3 and 0.8 for children aged 6 months–4 years and 5–17 years, respectively) and in adults aged <65 years (4.6).

Complete clinical data were available for 1,116 infants aged <6 months hospitalized with laboratory-confirmed COVID-19, including 321, 322, and 473 infants hospitalized during the Delta, Omicron BA.1, and Omicron BA.2/BA.5 periods, respectively (Table 1). Differences during the three periods were small, and not all were statistically significant; however, indicators of severity, including length of hospital stay, and the proportion of hospitalizations that required intensive care unit admission, high-flow nasal cannula, mechanical ventilation, or bilevel positive airway pressure/continuous positive airway pressure (BiPAP/CPAP) were consistently lower during the Omicron BA.2/BA.5 period than during the Delta period, and in-hospital deaths were rare (<1%).

Among 473 infants aged <6 months hospitalized during the Omicron BA.2/BA.5 variant-predominant period, 397 (84%) had COVID-19–related symptoms. Among all 473 infants, 174 (38%) were aged <1 month; 69 (39%) of these were birth hospitalizations (Table 2). Among infants who received a positive SARS-CoV-2 test result during the birth hospitalization, 60 (87%) were asymptomatic. Excluding birth hospitalizations, similar proportions were hospitalized with COVID-19–related symptoms among infants aged <1 month (94%), 1–2 months (97%) and 3–5 months (96%). At least one underlying medical condition was present in 26% of hospitalized infants aged 1–2 months and 36% of those aged 3–5 months. Prematurity§§§ was the most frequently reported underlying condition (20% and 25% of infants aged 1–2 months and 3–5 months, respectively). Most infants aged 1–2 months (74%) and 3–5 months (68%) had fever on admission.

Discussion

Compared with the Delta variant–predominant period, COVID-19–associated hospitalization rates increased among infants aged <6 months during Omicron variant–predominant periods, but the proportion of hospitalized infants aged <6 months with indicators of the most severe illness did not increase. Among infants aged <6 months, the average weekly COVID-19–associated hospitalization rate during the SARS-CoV-2 Omicron BA.2/BA.5 variant–predominant period was similar to that among adults aged 65–74 years and higher than that in other pediatric age groups and younger adults. These findings underscore the continued risk for COVID-19–associated hospitalization among infants aged <6 months, who are ineligible for vaccination.

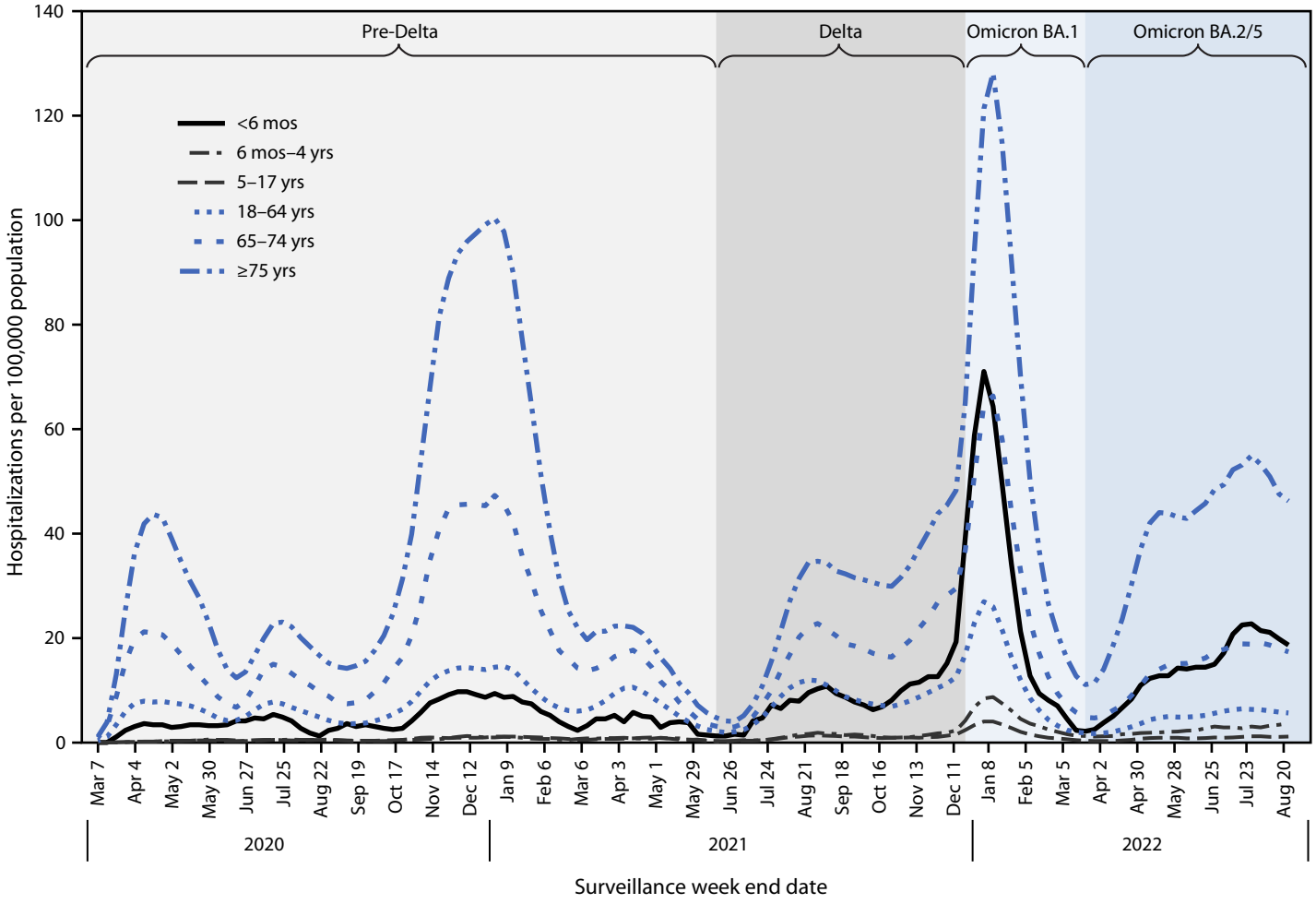
Multiple factors likely contributed to high COVID-19–associated hospitalization rates among young infants during the Omicron variant–predominant period, including the high

*** Rates are calculated using the National Center for Health Statistics' vintage 2020 bridged-race postcensal population estimates for the counties included in surveillance. https://www.cdc.gov/nchs/nvss/bridged_race.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.

§§§ Prematurity was defined as gestational age at birth of <37 weeks.

FIGURE. Weekly COVID-19–associated hospitalization rates,* by age group (3-week moving average) and period of SARS-CoV-2 variant predominance† — Coronavirus Disease 2019–Associated Hospitalization Surveillance Network, 13 states,§ March 2020–August 2022



* Number of patients with a laboratory-confirmed COVID-19–associated hospitalization per 100,000 population. Rates are calculated using the CDC National Center for Health Statistics' vintage 2020 bridged-race postcensal population estimates for the counties included in the surveillance area (https://www.cdc.gov/nchs/nvss/bridged_race.htm). Rates are subject to change as additional data are reported.

† Periods of SARS-CoV-2 variant predominance are defined as follows. Delta: June 20–December 18, 2021; Omicron BA.1: December 19, 2021–March 19, 2022; Omicron BA.2: March 20–June 18, 2022; and Omicron BA.5: June 19–August 31, 2022.

§ Data are collected in selected counties in California, Colorado, Connecticut, Georgia, Maryland, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah. A list of these counties is available at https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e3.htm. Additional information on surveillance methods is available at https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html.

infectivity and community transmission of the SARS-CoV-2 Omicron variant and the relatively low threshold for hospitalizing infants for signs and symptoms consistent with COVID-19 (e.g., fever) relative to that in older children (*7*).

High relative hospitalization rates in infants compared with older children, adolescents, and adults aged <65 years during the Omicron BA.2/BA.5 variant–predominant period also reflect lower rates of hospitalization in these other age groups compared with those during the Delta variant–predominant period, as immunity in older age groups has increased through vaccination,¶¶¶ previous infection, or both.****

Because infants are more likely to be immunologically naïve, and vaccines are not approved for infants aged <6 months (*8*), maternal COVID-19 vaccination during pregnancy might help to protect young infants. Maternal completion of a

¶¶¶ https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-total-admin-rate-total

**** https://covid.cdc.gov/covid-data-tracker/#nationwide-blood-donor-seroprevalence

TABLE 1. Demographic characteristics and clinical outcomes of hospitalized infants aged <6 months with laboratory-confirmed SARS-CoV-2 infections,* by period of SARS-CoV-2 variant predominance — Coronavirus Disease 2019–Associated Hospitalization Surveillance Network, 12 states,† June 20, 2021–August 31, 2022

	SARS-CoV-2 variant predominance period, no. (%) of hospitalizations				
		Delta	Omicron BA.1	Omicron BA.2/5	
Characteristic	Total	(Jun 20–Dec 18, 2021)	(Dec 19, 2021–Mar 19, 2022)	(Mar 20–Aug 31, 2022)	p-value§
Total	**1,116**	**321**	**322**	**473**	
Age, days, median (IQR)	**46.1 (18.1–100.7)**	41.1 (16.9–83.0)	48.6 (16.8–107.3)	47.5 (20.7–105.6)	0.04
Sex					
Male	**625 (56.2)**	168 (52.6)	189 (57.8)	268 (57.0)	0.17
Female	**491 (43.8)**	153 (47.4)	133 (42.2)	205 (43.0)	
Race and ethnicity¶					
Asian or Pacific Islander, NH	**65 (5.8)**	15 (4.5)	12 (3.4) **	38 (8.4)	0.10
Black or African American, NH	**234 (20.8)**	74 (22.9)	68 (21.3)	92 (19.1)	
Hispanic	**272 (25.0)**	80 (25.4)	79 (25.7)	113 (24.2)	
White, NH	**417 (36.8)**	118 (36.6)	123 (36.7)	176 (36.9)	
All other races**	**30 (2.7)**	9 (2.7)	11 (3.5)	10 (2.1)	
Unknown race or ethnicity	**98 (8.9)**	25 (7.7)	29 (9.3)	44 (9.3)	
Hospitalization intervention or outcome††					
Length of hospital stay, days, median (IQR)	**1.6 (0.9–2.8)**	1.7 (0.9–3.6)	1.6 (0.9–2.7)	1.5 (0.8–2.6)	<0.01
ICU admission	**234 (20.9)**	72 (22.5)	75 (23.2)	87 (18.0)	0.08
BiPAP/CPAP	**65 (5.7)**	28 (8.7)	16 (4.8)	21 (4.5)	<0.01
High-flow nasal cannula	**157 (13.5)**	51 (15.9)	49 (14.0)	57 (11.6)	0.02
Invasive mechanical ventilation	**53 (5.2)**	17 (5.4)	21 (7.4)	15 (3.2)	<0.01
In-hospital death	**6 (0.7)**	0 (—)	3 (1.3)§§	3 (0.6)§§	NA

Abbreviations: BiPAP/CPAP = bilevel positive airway pressure/continuous positive airway pressure; COVID-NET = Coronavirus Disease 2019–Associated Hospitalization Surveillance Network; ICU = intensive care unit; NA = not applicable; NH = non-Hispanic.

* Data are a weighted sample of hospitalized infants with completed medical record abstractions. Sample sizes presented are unweighted with weighted percentages.

† Includes infants admitted to a hospital with an admission date during June 20, 2021–August 31, 2022, in 12 states participating in COVID-NET: California, Colorado, Connecticut, Georgia, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah. https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e3.htm

§ Proportions between the Delta variant and Omicron BA.2/BA.5 variant periods of predominance were compared with chi-square tests, and medians were compared with the Wilcoxon rank-sum test, accounting for sampling weights.

¶ If ethnicity was unknown, NH ethnicity was assumed.

** Includes NH persons reported as other or multiple races and persons of Alaska Native and American Indian race.

†† Hospitalization outcomes are not mutually exclusive.

§§ Relative SE >30%.

2-dose primary monovalent mRNA COVID-19 vaccination series during pregnancy has been estimated to be 52% effective against COVID-19 hospitalization among infants aged <6 months. This suggests that young infants might receive protection through passive transplacental transfer of maternal antibodies acquired through maternal vaccination. Effectiveness of maternal vaccination in preventing disease in young infants was lower during the early Omicron variant–predominant period (38%) than during the Delta variant–predominant period (80%) (*9*). Surveillance data show that compared with earlier periods, during the recent Omicron variant–predominant periods, a larger proportion of pregnant women received a vaccination series before pregnancy (*9*,*10*). Because of immune evasion when novel variants have emerged and waning immunity as time since the last dose increases, infants born during the Omicron BA.5 variant–predominant period might have had less protection.

The findings in this report are subject to at least five limitations. First, population estimates for infants aged <6 months were not available; therefore, the assumption was that they accounted for one half of infants aged <1 year when calculating rates. This assumption does not account for seasonality in births,†††† which was affected by the pandemic; births typically peak in the summer, leading to potential small overestimates of rates during Omicron BA.2/BA.5 variant–predominant periods. Second, it was not possible to account for changes in public health policies and testing and treatment practices over time. Third, maternal vaccination or previous infection, which might confer some immunity to infants, was not assessed. Fourth, periods of variant predominance are based on national data and might not reflect regional differences in circulating variants. Finally, the COVID-NET catchment areas include approximately 10% of the U.S. population; these findings might not be nationally generalizable.

Although these findings do not suggest increased severity of COVID-19 among hospitalized infants, COVID-19–associated hospitalization rates in infants aged <6 months

†††† https://www.census.gov/library/stories/2021/09/united-states-births-declined-during-the-pandemic.html

TABLE 2. Clinical characteristics of hospitalized infants aged <6 months with laboratory-confirmed SARS-CoV-2 infections during the combined period of SARS-CoV-2 Omicron BA.2 and BA.5 variant predominance* — Coronavirus Disease 2019–Associated Hospitalization Surveillance Network, 12 states,† March 20–August 31, 2022

Characteristic	No. (%) of hospitalizations, by age group			
	All <6 mos	<1 mo	1–2 mos	3–5 mos
Total no. of hospitalized infants	**473**	**174**	**154**	**145**
Birth hospitalization§	69 (14.8)	69 (39.3)	0 (—)	0 (—)
Underlying medical conditions				
≥1 underlying medical condition¶	114 (23.5)	20 (11.8)	41 (26.1)	53 (35.6)
Prematurity	86 (17.7)	17 (10.0)	31 (19.6)	38 (25.2)
COVID-19–related symptoms on admission**				
Yes	397 (83.6)	108 (62.2)	149 (96.7)	140 (96.4)
Symptoms at admission††				
Fever	287 (60.6)	75 (43.3)	112 (73.5)	100 (68.3)
Congested/Runny nose	220 (45.9)	51 (29.3)	82 (52.7)	87 (59.3)
Cough	218 (45.5)	39 (22.6)	89 (57.4)	90 (61.2)
Inability to eat/Poor feeding	164 (33.9)	32 (18.3)	73 (47.5)	59 (38.9)
Shortness of breath/Respiratory distress	132 (27.6)	27 (15.7)	43 (27.7)	62 (42.5)
Nausea/Vomiting	91 (19.3)	18 (10.9)	36 (23.2)	37 (25.6)
Diarrhea	57 (12.2)	10 (5.8)	19 (12.5)	28 (19.8)
Lethargy	45 (9.5)	11 (6.2)	20 (13.5)	14 (9.2)
Rash	32 (6.6)	6 (3.5)§§	18 (11.2)	8 (5.4)§§
Apnea	31 (6.3)	9 (4.8)§§	13 (8.1)	9 (6.1)

Abbreviation: COVID-NET = Coronavirus Disease 2019–Associated Hospitalization Surveillance Network.

* Data are from a weighted sample of hospitalized infants with completed medical record abstractions. Sample sizes presented are unweighted with weighted percentages.

† Includes infants admitted to a hospital with an admission date during June 20, 2021–August 31, 2022, in 12 states participating in COVID-NET: California, Colorado, Connecticut, Georgia, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah. https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e3.htm

§ A birth hospitalization was defined as the hospitalization during which the infant was born.

¶ Defined as one or more of the following: prematurity, neurologic disorders, congenital heart disease, abnormality of airway, chronic metabolic disease, immunocompromised condition, chronic lung disease of prematurity/bronchopulmonary dysplasia, or asthma/reactive airway disease. Underlying conditions that occurred in fewer than five sampled cases in any stratum are not displayed.

** COVID-19–related signs and symptoms included respiratory conditions (congestion/runny nose, cough, shortness of breath/respiratory distress, upper respiratory infection, wheezing, nausea/vomiting, rash, and seizures) and nonrespiratory conditions (conjunctivitis, diarrhea, fever/chills, apnea, cyanosis, decreased vocalization/stridor, dehydration, hypothermia, inability to eat/poor feeding, and lethargy). Signs and symptoms were abstracted from medical charts and might be incomplete.

†† Symptoms that occurred in fewer than five sampled cases in any stratum are not displayed.

§§ Relative SE >30%

Summary

What is already known about this topic?

Infants aged <6 months, who are ineligible for vaccination, have high COVID-19–associated hospitalization rates compared with other pediatric age groups.

What is added by this report?

Although population-based COVID-19–associated hospitalization rates among infants aged <6 months increased in the Omicron variant–predominant periods compared with the Delta variant–predominant period, indicators of the most severe disease among hospitalized infants aged <6 months did not.

What are the implications for public health practice?

Pregnant women should stay up to date with COVID-19 vaccination to help protect themselves and infants too young to be vaccinated. Nonpharmaceutical measures should be used to help protect infants ineligible for vaccination.

were higher during the Omicron variant–predominant periods (December 2021–August 2022) than they were during previous periods. Maternal vaccination has been shown to provide protection to infants aged <6 months who are currently ineligible for vaccination (*9*), and both CDC and the American College of Obstetricians and Gynecologists recommend COVID-19 vaccination for women who are pregnant, breastfeeding, trying to get pregnant now, or might become pregnant in the future.§§§§

COVID-19 hospitalization rates in infants aged <6 months are higher than those of all other age groups except adults aged ≥65 years. To help protect both pregnant women and infants too young to be vaccinated, prevention should focus on ensuring that pregnant women stay up to date on COVID-19 vaccines¶¶¶¶ (including receiving a bivalent booster dose)*****

§§§§ https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/pregnancy.html; https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2020/12/covid-19-vaccination-considerations-for-obstetric-gynecologic-care

¶¶¶¶ https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/pregnancy.html

***** https://www.cdc.gov/vaccines/covid-19/clinical-considerations/interim-considerations-us.html

and implementing nonpharmaceutical interventions for COVID-19 prevention (*6*) and newborn care.†††††

†††††† https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/pregnancy-breastfeeding.html

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Please note: This report has been corrected. An erratum has been published.

Morbidity and Mortality Weekly Report

Epidemiologic Features of the Monkeypox Outbreak and the Public Health Response — United States, May 17–October 6, 2022

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On May 17, 2022, the Massachusetts Department of Health announced the first suspected case of monkeypox associated with the global outbreak in a U.S. resident. On May 23, 2022, CDC launched an emergency response (*1*,*2*). CDC's emergency response focused on surveillance, laboratory testing, medical countermeasures, and education. Medical countermeasures included rollout of a national JYNNEOS vaccination strategy, Food and Drug Administration (FDA) issuance of an emergency use authorization to allow for intradermal administration of JYNNEOS, and use of tecovirimat for patients with, or at risk for, severe monkeypox. During May 17–October 6, 2022, a total of 26,384 probable and confirmed* U.S. monkeypox cases were reported to CDC. Daily case counts peaked during mid-to-late August. Among 25,001 of 25,569 (98%) cases in adults with information on gender identity,† 23,683 (95%) occurred in cisgender men. Among 13,997 cisgender men with information on recent sexual or close intimate contact,§ 10,440 (75%) reported male-to-male sexual contact (MMSC) ≤21 days preceding symptom onset. Among 21,211 (80%) cases in persons with information on race and ethnicity,¶ 6,879 (32%), 6,628 (31%), and 6,330 (30%) occurred in non-Hispanic Black or African American (Black), Hispanic or Latino (Hispanic), and non-Hispanic White (White) persons, respectively. Among 5,017 (20%) cases in adults with information on HIV infection status, 2,876 (57%) had HIV infection. Prevention efforts, including vaccination, should be prioritized among persons at highest risk within groups most affected by the monkeypox outbreak, including gay, bisexual, and other men who have sex with men (MSM); transgender, nonbinary, and gender-diverse persons; racial and ethnic minority groups; and persons who are immunocompromised, including persons with advanced HIV infection or newly diagnosed HIV infection.

Epidemiology of Cases

On June 23, 2022, the Council of State and Territorial Epidemiologists approved designating monkeypox as a nationally notifiable disease. Data reported to CDC** by jurisdictions included patient demographic characteristics, history of possible exposure, diagnostic studies performed, and clinical signs and symptoms at onset. Characteristics of monkeypox cases reported during May 17–October 6, 2022, are described and compared before and after July 18, 2022, when five commercial laboratories began testing and substantially expanded capacity and access. This surveillance activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.††

During May 17–October 6, 2022, a total of 26,384 monkeypox cases were reported to CDC by all 50 states, the District of Columbia, and Puerto Rico. Daily case counts peaked during mid-to-late August (Figure 1). Among 25,678 (97%) persons with monkeypox for whom demographic data were available, the median age was 34 years (range = 0–89 years). From May 17–July 17 to July 18–October 6, the percentage of cases among persons aged 18–29 years increased from 20% to 27%; the percentage of cases among persons aged 30–39 years decreased from 45% to 41% (Table). Among 21,211 (80%) cases in persons with information on race and ethnicity, 6,879 (32%) identified as Black, 6,628 (31%) as Hispanic, and 6,330 (30%) as White. From May 17–July 17 to July 18–October 6, the percentage of cases among Black persons increased 67%, from 21% to 35%, whereas the percentage of cases among Hispanic persons decreased 6%, from 33% to 31%. Among White persons, the percentage of cases decreased 28%, from

* https://www.cdc.gov/poxvirus/monkeypox/clinicians/case-definition.html

† Persons whose reported sex differed from their gender or who reported being transgender were classified as transgender. Among cases with reported information on sex but not gender, sex was used to categorize persons as cisgender women or men. Among cases with reported information on gender but not sex, gender was used to categorize persons as cisgender women or men. Among 25,001 adults with information on sex or gender, 3,589 (14%) only had information on sex, and 6,142 (25%) only had information on gender.

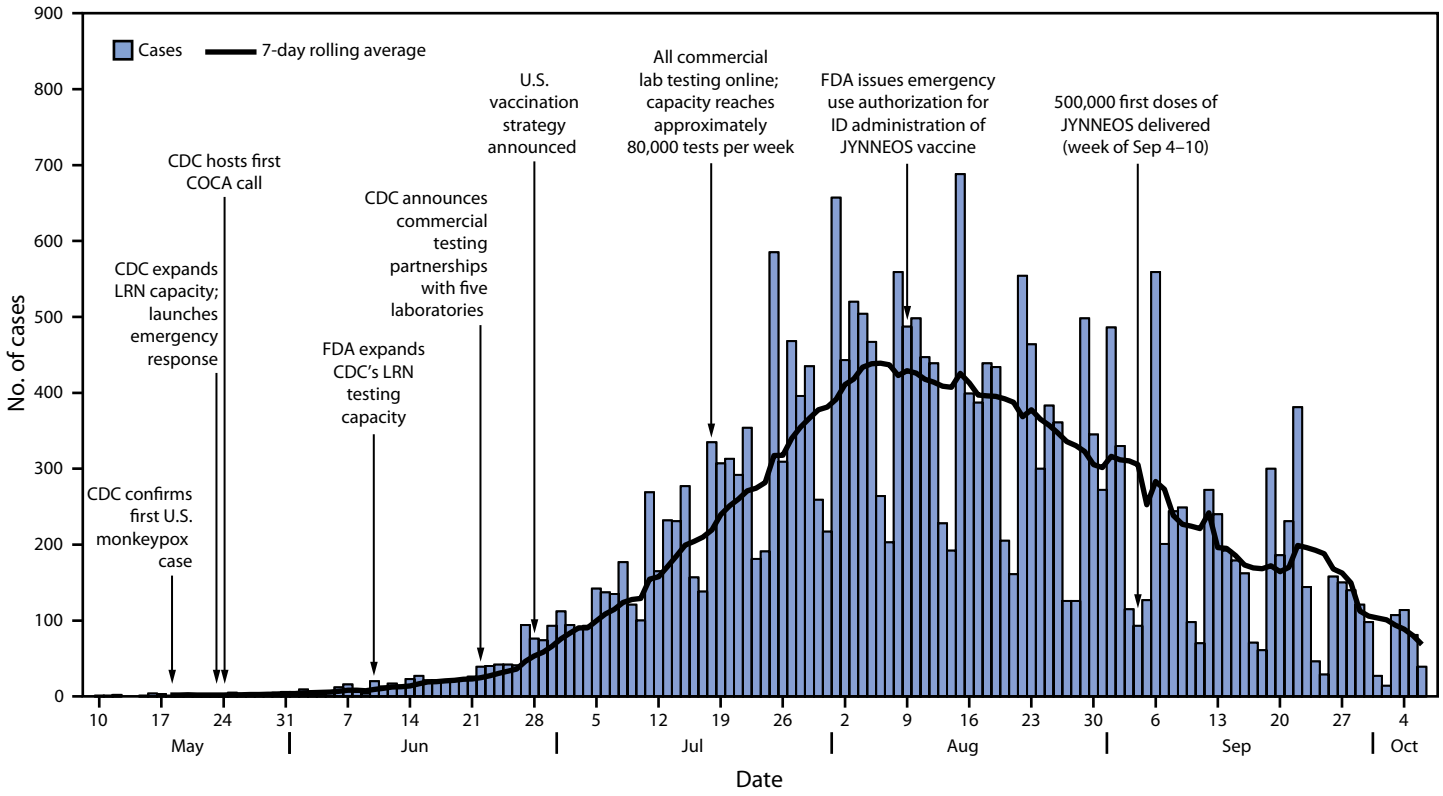
§ Sexual or close intimate contact is defined as engaging in any sex (e.g., vaginal, oral, or anal) or close intimate contact (e.g., cuddling, kissing, touching partner's genitals or anus, or sharing sex toys) during the 21 days before symptom onset.

¶ Persons who indicated Hispanic ethnicity, regardless of race, were categorized as Hispanic or Latino. Persons missing data on ethnicity were assumed to be non-Hispanic.

** https://www.cdc.gov/poxvirus/monkeypox/pdf/scrf-short-form.pdf

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

FIGURE 1. Monkeypox cases* and public health response, by date†,§ — United States, May 17–October 6, 2022



Abbreviations: COCA = Clinician Outreach and Communication Activity; FDA = Food and Drug Administration; ID = intradermal; LRN = laboratory and response network.
* N = 26,384. Figure excludes one case for which information needed to calculate date is missing.
† Date is defined as the earliest date available among the following: 1) a positive laboratory test report date, 2) CDC call center reporting date, or 3) case data entry date into CDC's Data Collation and Integration for Public Health Event Responses platform.
§ Data since approximately September 25 are incomplete because of delays in reporting.

39% to 28% (Supplementary Figure 1; https://stacks.cdc.gov/view/cdc/121988).

Among 25,001 (98%) of 25,569 cases in persons with known age who were aged ≥18 years and for whom information on gender was available, 23,683 (95%) occurred in cisgender men. Cisgender men accounted for up to 99% of cases during the week of June 5; this percentage declined to 80% by the week of October 2 (Supplementary Figure 2; https://stacks.cdc.gov/view/cdc/121989). Among 13,997 cisgender men with information reported on recent sexual or close intimate contact, 10,440 (75%) reported MMSC during the 21 days preceding symptom onset. The percentage of cases in cisgender men who reported recent MMSC decreased over time, from 80% during May 17–July 17 to 67% during July 18–October 6 (Figure 2).

Information on rash was reported by 14,133 (54%) persons with monkeypox, among whom 13,871 (98%) experienced a rash, most frequently on the face (5,478; 40%), genitals (5,006; 36%), and arms (4,563; 33%). Among 5,017 (20%) cases in persons aged ≥18 years with reported information on HIV infection status, 2,876 (57%) had HIV infection. Information on hospitalization was reported for 11,204 (43%) persons with monkeypox, 1,870 (17%) of whom were hospitalized. Six deaths were reported. Information on smallpox or monkeypox vaccination status was provided by 9,197 (35%) persons; 2,882 (31%) had received a vaccine, among whom 1,676 (58%) provided the vaccination date. Among those, 1,670 (99.6%) were vaccinated during the 2022 outbreak (i.e., after May 17). Among those vaccinated during the outbreak with race and ethnicity data available (1,626; 97%), 38% were White, 32% were Black, and 23% were Hispanic. Date of vaccination and date of symptom onset was available for 1,563 (6%) patients, 610 (39%) of whom were vaccinated after symptom onset and 953 (61%) before symptoms began.

Public Health Response

Within 1 week of announcement of the first suspected case of monkeypox in a U.S. resident by the Massachusetts Department of Public Health in mid-May, CDC launched an emergency response for monkeypox (Figure 1). In addition to enhanced surveillance, the response focused on three

strategies: 1) expansion of laboratory testing, 2) use of medical countermeasures for postexposure prophylaxis and treatment, and 3) information dissemination to providers and the public with focus on persons at highest risk within groups most affected by the monkeypox outbreak.

Laboratory and diagnostic support. As a result of smallpox preparedness efforts, an FDA-approved polymerase chain reaction laboratory test capable of detecting nonvariola orthopoxviruses was prepositioned through the Laboratory and Response Network (LRN) before the monkeypox outbreak began. In May 2022, 69 LRN laboratories had capacity to test approximately 6,000 specimens per week, and a positive orthopoxvirus test result was sufficient for clinicians and public health departments to initiate patient isolation and contact tracing. On June 10, CDC received FDA clearance to run the same test with a higher throughput extraction platform. To further increase national testing capacity, CDC provided technical assistance to expand testing to five nationwide commercial laboratory companies who began testing during July 2022, increasing the total U.S. testing capacity more than twelvefold, to 80,000 specimens per week (Figure 1). Since the start of the outbreak, testing volume has averaged 9% of capacity in any given week, ranging from 0.2% during the week May 21 to 23% the week of August 20. As of October 8, 2022, a total of 121,345 specimens had been tested.[§§]

Medical countermeasures. Licensed vaccines and therapeutics for smallpox are held in the U.S. Department of Health and Human Services Strategic National Stockpile. The JYNNEOS vaccine was stockpiled for immunization of persons who are immunocompromised in the event of a smallpox outbreak. As such, the vaccine was available to help address the monkeypox outbreak. On June 28, a national vaccination strategy was announced to allocate the limited supply of JYNNEOS vaccine based on population-adjusted incidence and the number of persons with highest risk for disease during the current outbreak.[¶¶] On August 9, 2022, FDA issued an emergency use authorization for JYNNEOS to allow intradermal administration of a lower volume of vaccine to adults aged ≥18 years,[***] increasing the number of available doses by a factor of 3–5. As of October 10, 2022, a total of 931,155 doses had been administered (*3*).

Currently, no FDA-approved products for treatment of monkeypox exist. Tecovirimat (Tpoxx) was approved for treatment of smallpox in children and adults during 2018 under FDA's animal rule, which permits efficacy findings from well-controlled animal studies to support an FDA approval when doing so is not feasible or ethical to conduct a human efficacy trial,[†††] and is available under an expanded access protocol held by CDC. Tecovirimat is recommended for patients with, or at risk for, severe monkeypox. To reduce disease incidence and facilitate appropriate use of tecovirimat, CDC and FDA reduced the number of required forms and patient samples required for approval of treatment and gave patients the option to see their doctor virtually. A randomized controlled trial led by the National Institutes of Health and the AIDS Clinical Trials Group is underway to determine effectiveness of tecovirimat for treatment of monkeypox, and patients with monkeypox in geographic areas with study sites for this trial are encouraged to enroll.[§§§]

Provider and public outreach. CDC uses a variety of mechanisms to disseminate information to public health partners and health care providers about the monkeypox outbreak. On May 20, 2022, CDC released the first Health Alert Network Health Advisory on the monkeypox outbreak,[¶¶¶] followed by four subsequent advisories. CDC has released clinical considerations for vaccination, treatment, and pain management,[****] as well as patient information on treatment and guidance for persons living with HIV infection, women who are pregnant, and children.[††††] CDC regularly hosts Clinician Outreach and Communication Activity[§§§§] calls, during which subject matter experts provide the latest information and considerations for clinicians to help them identify potential cases, request testing, and care for patients with monkeypox. Approximately 10,000 health care professionals attended the first call, and 6,000 attended the second.

CDC's community engagement strategy focuses on harm reduction messaging for populations disproportionately affected by the monkeypox outbreak. Building on existing partnerships from CDC's initiative to end the HIV epidemic by 2030, CDC has engaged with advocates, experts, and groups focused on sexual health of MSM, transgender, non-binary, gender-diverse, queer, and persons of other sexual identities to directly reach and hear from populations disproportionately affected by monkeypox. For example, on October 20, 2022, staff members from CDC's Monkeypox Response cohosted an Instagram Live session to promote the Vaccine Equity Pilot Program to agencies that serve racial and ethnic minority

[§§] https://www.cdc.gov/poxvirus/monkeypox/response/2022/2022-lab-test.html
[¶¶] As estimated by the number of MSM living with HIV infection or persons within a jurisdiction for whom HIV preexposure prophylaxis was recommended.
[***] https://www.fda.gov/media/160774/download
[†††] https://www.fda.gov/news-events/press-announcements/fda-approves-first-drug-indication-treatment-smallpox
[§§§] https://www.stomptpoxx.org/main
[¶¶¶] https://emergency.cdc.gov/han/2022/han00466.asp
[****] https://emergency.cdc.gov/han/2022/han00471.asp
[††††] https://emergency.cdc.gov/han/2022/han00475.asp
[§§§§] https://emergency.cdc.gov/coca

TABLE. Epidemiologic and demographic characteristics of persons with monkeypox — United States, May 17–October 6, 2022

Characteristic	No. (%),* by date†		
	May 17–Jul 17 n = 3,576	Jul 18–Oct 6 n = 22,807	Total N = 26,384
Age group, yrs			
≤12	3 (0.1)	32 (0.1)	**35 (0.1)**
13–17	3 (0.1)	71 (0.3)	**74 (0.3)**
18–29	707 (19.8)	6,016 (27.2)	**6,724 (26.2)**
30–39	1,594 (44.8)	9,084 (41.1)	**10,678 (41.6)**
40–49	826 (23.2)	4,481 (20.3)	**5,307 (20.7)**
50–64	402 (11.3)	2,285 (10.3)	**2,687 (10.5)**
≥65	27 (0.8)	146 (0.7)	**173 (0.7)**
Missing	14	692	**706**
Race and ethnicity			
American Indian or Alaska Native, NH	8 (0.2)	83 (0.5)	**91 (0.4)**
Asian, NH	140 (4.2)	464 (2.6)	**604 (2.8)**
Black, NH	699 (21.1)	6,179 (34.5)	**6,879 (32.4)**
Hispanic or Latino	1,096 (33.1)	5,532 (30.9)	**6,628 (31.2)**
Native Hawaiian or other Pacific Islander, NH	7 (0.2)	48 (0.3)	**55 (0.3)**
White, NH	1,281 (38.7)	5,049 (28.2)	**6,330 (29.8)**
Multiple races, NH	6 (0.2)	127 (0.7)	**133 (0.6)**
Other race, NH	71 (2.1)	420 (2.3)	**491 (2.3)**
Missing	268	4,905	**5,173**
Gender identity			
Men	3,417 (97.0)	20,326 (94.6)	**23,744 (95.0)**
Cisgender	3,404 (96.6)	20,278 (94.4)	**23,683 (94.7)**
Transgender	13 (0.4)	48 (0.2)	**61 (0.2)**
Women	87 (2.5)	999 (4.7)	**1,086 (4.3)**
Cisgender	44 (1.2)	853 (4.0)	**897 (3.6)**
Transgender	43 (1.2)	146 (0.7)	**189 (0.8)**
Another gender identity	20 (0.6)	151 (0.7)	**171 (0.7)**
Missing	32	536	**568**
Gender and recent sexual or close intimate contact§			
Cisgender men			
Reported recent MMSC	2,415 (80.4)	8,025 (67.1)	**10,440 (69.8)**
No reported recent MMSC¶	40 (1.3)	550 (4.6)	**590 (3.9)**
Reported recent sexual or close intimate contact; partner gender unknown	138 (4.6)	338 (2.8)	**476 (3.2)**
No reported recent sexual or close intimate contact	314 (10.5)	2,177 (18.2)	**2,491 (16.7)**
Transgender men			
Recent MMSC	9 (0.3)	30 (0.3)	**39 (0.3)**
No recent MMSC¶	1 (0.0)	3 (0.0)	**4 (0.0)**
Recent sexual or close intimate contact; partner gender unknown	2 (0.1)	1 (0.0)	**3 (0.0)**
No recent sexual or close intimate contact	0 (—)	8 (0.1)	**8 (0.1)**
Cisgender women			
Reported recent sexual or close intimate contact	25 (0.8)	409 (3.4)	**434 (2.9)**
No reported recent sexual or close intimate contact	8 (0.3)	187 (1.6)	**195 (1.3)**
Transgender women			
Reported recent sexual or close intimate contact	31 (1.0)	98 (0.8)	**129 (0.9)**
No reported recent sexual or close intimate contact	3 (0.1)	25 (0.2)	**28 (0.2)**
Another gender identity			
Reported recent sexual or close intimate contact	17 (0.6)	87 (0.7)	**104 (0.7)**
No reported recent sexual or close intimate contact	1 (0.0)	16 (0.1)	**17 (0.1)**
Missing**			
Missing, both	26	471	**497**
Missing, sex and gender	6	65	**71**
Missing, recent sexual or close intimate contact	520	9,522	**10,043**
No. of sexual or close intimate partners within 21 days before symptom onset§			
Cisgender men			
One partner	526 (36.3)	2,837 (54.9)	**3,363 (50.8)**
More than one partner	925 (63.7)	2,326 (45.1)	**3,251 (49.2)**
Transgender men			
One partner	4 (80.0)	15 (65.2)	**19 (67.9)**
More than one partner	1 (20.0)	8 (34.8)	**9 (32.1)**

See table footnotes on the next page.

TABLE. (*Continued*) Epidemiologic and demographic characteristics of persons with monkeypox — United States, May 17–October 6, 2022

Characteristic	No. (%),* by date†		
	May 17–Jul 17 n = 3,576	Jul 18–Oct 6 n = 22,807	Total N = 26,384
Cisgender women			
One partner	15 (78.9)	224 (72.5)	**239 (72.9)**
More than one partner	4 (21.1)	85 (27.5)	**89 (27.1)**
Transgender women			
One partner	8 (66.7)	35 (59.3)	**43 (60.6)**
More than one partner	4 (33.3)	24 (40.7)	**28 (39.4)**
Another gender identity			
One partner	4 (28.6)	20 (40.8)	**24 (38.1)**
More than one partner	10 (71.4)	29 (59.2)	**39 (61.9)**
Missing/Unknown	2,684	9,591	**12,275**
Signs or symptoms††			
Rash	2,783 (99.6)	11,088 (97.8)	**13,871 (98.1)**
Fever	1,367 (72.9)	5,224 (65.7)	**6,591 (67.1)**
Malaise	1,067 (67.6)	4,600 (64.7)	**5,667 (65.2)**
Chills	1,118 (67.6)	4,464 (61.3)	**5,582 (62.4)**
Enlarged lymph nodes	1,061 (63.8)	3,916 (55.8)	**4,977 (57.4)**
Headache	869 (61.4)	4,043 (57.1)	**4,912 (57.8)**
Myalgia	981 (63.8)	3,822 (54.9)	**4,803 (56.5)**
Pruritis	723 (61.5)	3,389 (59.1)	**4,112 (59.5)**
Rectal pain	652 (48.7)	2,597 (39.6)	**3,249 (41.1)**
Rectal bleeding	274 (35.8)	1,289 (21.4)	**1,563 (23.1)**
Tenesmus	253 (24.5)	933 (19.5)	**1,186 (20.4)**
Pus or blood in stools	249 (24.3)	866 (18.1)	**1,115 (19.1)**
Vomiting or nausea	181 (27.6)	853 (17.3)	**1,034 (18.5)**
Abdominal pain	181 (16.3)	847 (14.8)	**1,028 (15.0)**
Proctitis	56 (14.7)	608 (15.7)	**664 (15.6)**
Conjunctivitis	80 (7.7)	195 (4.3)	**275 (4.9)**
Rash location§§			
Face	1,219 (43.8)	4,259 (38.4)	**5,478 (39.5)**
Genitals	1,005 (36.1)	4,001 (36.1)	**5,006 (36.1)**
Arms	850 (30.5)	3,713 (33.5)	**4,563 (32.9)**
Trunk	900 (32.3)	3,497 (31.5)	**4,397 (31.7)**
Legs	738 (26.5)	3,277 (29.6)	**4,015 (28.9)**
Perianal	773 (27.8)	2,611 (23.5)	**3,384 (24.4)**
Head	592 (21.3)	2,350 (21.2)	**2,942 (21.2)**
Hands	473 (17.0)	1,921 (17.3)	**2,394 (17.3)**
Neck	287 (10.3)	1,140 (10.3)	**1,427 (10.3)**
Feet	251 (9.0)	1,175 (10.6)	**1,426 (10.3)**
Mouth, lips, or oral mucosa	246 (8.8)	1,115 (10.1)	**1,361 (9.8)**
Other	1,047 (37.6)	3,094 (27.9)	**4,141 (29.9)**
Missing/Unknown location	616 (22.1)	2,658 (24.0)	**3,274 (23.6)**
HIV infection status¶¶			
Yes	494 (67.7)	2,382 (55.6)	**2,876 (57.3)**
No	236 (32.3)	1,905 (44.4)	**2,141 (42.7)**
Missing	2,826	17,725	**20,552**

Abbreviations: MMSC = male-to-male sexual contact; NH = non-Hispanic or Latino.

* Percentages calculated using nonmissing data.

† July 18 was the day that the last of five commercial labs joined online reporting, expanding *Monkeypox virus* testing capacity to 80,000 per week.

§ Includes cases in persons aged ≥18 years with information on gender identity and recent sexual or close intimate contact. Recent sexual or close intimate contact is defined as engaging in any sex (e.g., vaginal, oral, or anal) or close intimate contact (e.g., cuddling, kissing, touching partner's genitals or anus, or sharing sex toys) during the 21 days before symptom onset.

¶ Includes men who have had recent sexual or close intimate contact with a cisgender woman, transgender woman, or someone with another gender identity.

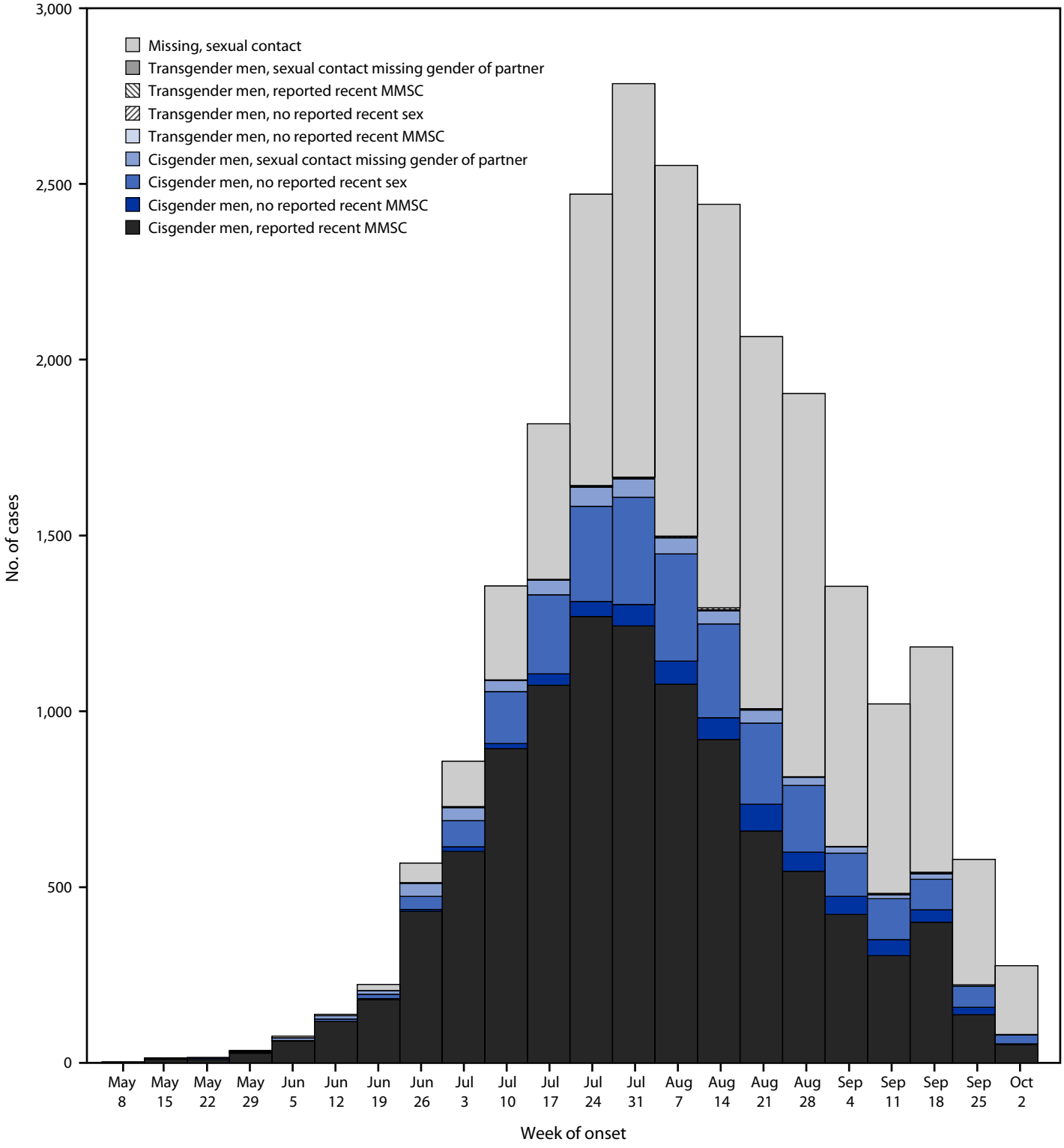
** Includes men who have had recent sexual or close intimate contact but are missing information on the gender of their partner.

†† Information on signs or symptoms was missing for the following numbers of cases: presence of a rash (12,251), fever (16,560), malaise (17,693), chills (17,442), enlarged lymph nodes (17,706), headache (17,887), pruritis (19,470), myalgia (17,884), rectal pain (18,488), rectal bleeding (19,604), tenesmus (20,570), vomiting or nausea (20,787), pus in stool (20,561), abdominal pain (19,533), proctitis (22,126), and conjunctivitis (20,828).

§§ Rash locations are not mutually exclusive.

¶¶ Includes cases in persons aged ≥18 years.

FIGURE 2. Monkeypox cases* in adult men aged ≥18 years, by week of onset, gender identity, and reported recent sexual contact history — United States, May 17–October 6, 2022



Abbreviation: MMSC = male-to-male sexual contact.

* Excludes cases in persons aged <18 years and one case with missing information needed to calculate report date. Recent sexual contact is defined as engaging in any sex (e.g., vaginal, oral, or anal) or close intimate contact (e.g., cuddling, kissing, touching partner's genitals or anus, or sharing sex toys) during the 21 days before symptom onset.

lesbian, gay, bisexual, transgender, queer or questioning, intersex, asexual, and others (LGBTQIA+) youth organizations. CDC developed communication resources to facilitate conversations about safer sex and social gatherings, which aim to reduce stigma and aid in making informed choices when persons are in situations or places where monkeypox is more likely to spread. CDC has also supported pilot programs to ensure that vaccines reach populations that have historically faced health disparities and inequity and might continue to face additional barriers to access.

Discussion

Before the 2022 outbreak, monkeypox cases were primarily reported in central and western Africa.[¶¶¶¶] In contrast, 37% of all global cases reported as of October 6, 2022, during the current monkeypox outbreak were in the United States.[*****] Previous knowledge of monkeypox and sexually transmitted infections, laboratory and diagnostic supports, medical countermeasures, and provider and public outreach have been critical components of CDC's public health response. The unprecedented nature of this outbreak has required flexibility and ongoing assessment of evidence to develop current prevention and treatment practices.

Monkeypox continues to disproportionately affect gay, bisexual, and other MSM. However, the large proportion of cases with missing data on recent sexual or close intimate contact makes generalization of this report's findings challenging. Tailored, nonstigmatizing communication[†††††] about risk, transmission, and prevention (*4*,*5*) remains a priority during this outbreak. CDC partners with communities to reduce stigma in communication, emphasizing use of inclusive language and prevention and treatment strategies to reduce fear and encourage action.

The current outbreak also continues to disproportionately affect persons with HIV infection (*6*). In light of data suggesting a higher risk for severe monkeypox disease among persons with advanced and uncontrolled HIV infection (*6*,*7*), it is recommended that persons with suspected monkeypox be offered HIV testing when they initially seek care. Clinicians should consult CDC's interim guidance on prevention and treatment of monkeypox to potentially reduce severe disease among patients with HIV infection (*7*). Although six deaths have been reported in the United States and other deaths are currently under investigation,[§§§§§] the case fatality rate for monkeypox during this outbreak remains low.[¶¶¶¶¶]

Multiple strategies exist that can help prevent and reduce transmission of monkeypox. Two vaccines, JYNNEOS and ACAM2000, can be used to prevent infection with monkeypox. During this outbreak, JYNNEOS has been used nearly exclusively because of its favorable adverse event profile overall as well as its favorable outcomes in persons who might be immunosuppressed or have other risk factors for severe monkeypox disease such as atopic dermatitis, heart disease, or a serious vaccine component allergy (*8*). JYNNEOS has not been previously well studied in persons exposed to, or at risk for, monkeypox, although early evidence suggests that vaccination provides some protection against infection (*9*).

The findings in this report are subject to at least three limitations. First, a substantial amount of case data is missing, which might reduce representativeness of findings reported here. Only 59% of adult cases had information on both gender identity and reported recent sexual or close intimate contact. Second, the percentage of missing data is higher in certain jurisdictions; thus, these findings might overrepresent cases from states with more complete data. Finally, mild cases might be underrepresented in this analysis because affected persons might not have sought testing or treatment.

Summary

What is already known about this topic?

An earlier analysis of 2,891 U.S. monkeypox cases found that up to 99% occurred in men, 94% of whom reported male-to-male sexual contact.

What is added by this report?

CDC's emergency response focused on surveillance, laboratory testing, medical countermeasures, and education. A total of 26,384 U.S. monkeypox cases were reported during May 17–October 6, 2022. Among 59% of persons with data on gender and recent sexual or close intimate contact, 70% reported recent male-to-male sexual contact. Black and Hispanic persons continue to be disproportionately affected.

What are the implications for public health practice?

Public health monkeypox prevention efforts, including vaccination, should continue to prioritize gay, bisexual, and other men who have sex with men, Black and Hispanic persons, and persons who are immunocompromised.

[¶¶¶¶] https://www.cdc.gov/poxvirus/monkeypox/about/index.html
[*****] https://www.cdc.gov/poxvirus/monkeypox/response/2022/world-map.html
[†††††] https://www.cdc.gov/poxvirus/monkeypox/resources/reducing-stigma.html
[§§§§§] https://www.cdc.gov/poxvirus/monkeypox/response/2022/index.html
[¶¶¶¶¶] https://www.cdc.gov/poxvirus/monkeypox/about/faq.html

CDC continues to evaluate new evidence and intervention strategies for monkeypox prevention and control based on available data. Public health prevention efforts should emphasize vaccination for persons at high risk for *Monkeypox virus* exposure and prioritize populations most affected by the current outbreak, including MSM, Black and Hispanic persons, and persons who are immunocompromised. Efforts should also focus on reducing stigma when communicating about monkeypox transmission and ensuring equitable access to testing, vaccination, and treatment options to reduce health disparities.

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Notes from the Field

Outbreak of Ebola Virus Disease Caused by *Sudan ebolavirus* — Uganda, August–October 2022

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Ebola virus disease (EVD) is a rare and often deadly viral hemorrhagic fever (VHF); four species of Ebola virus (*Zaire ebolavirus*, *Sudan ebolavirus*, *Taï Forest ebolavirus*, and *Bundibugyo ebolavirus*) cause occasional outbreaks among humans and nonhuman primates* (*1*). Infection is transmitted through direct contact with infectious blood, body fluids, and animal tissues. Symptoms include fever, abdominal pain, diarrhea, vomiting, generalized body weakness, and hemorrhage. Since 2000, four outbreaks of EVD caused by *Sudan ebolavirus* have been identified in Uganda; the largest outbreak (in 2000) resulted in 425 cases and 224 (53%) deaths (*2*,*3*). No vaccine is available to prevent *Sudan ebolavirus* infection, and treatment is supportive. The estimated case fatality rate is 55% (*4*).

On September 17, 2022, Uganda's National Public Health Emergency Operations Centre and the Uganda Virus Research Institute VHF program were notified of a suspected VHF case in a male patient (patient A) aged 26 years who lived in Madudu subcounty, Mubende District in central Uganda. The patient had been referred to Mubende Regional Referral Hospital (MRRH) the previous day by a private health clinic. At the time of admission, patient A had high fever, abdominal pain, diarrhea, chest pain, loss of appetite, dry cough, bloody vomitus, and bleeding from the eyes. He reported no recent travel or known Ebola virus exposures. Based on public health protocols for suspected VHF, the patient was isolated at MRRH by the Mubende District health team to await laboratory test results. Despite supportive treatment, the patient died on September 18, 2022, and the Uganda Ministry of Health (MoH) was notified. A blood sample collected from patient A on September 17 was confirmed positive for *Sudan ebolavirus* on September 19; testing by reverse transcription–polymerase chain reaction (RT-PCR) had been conducted at the Uganda Virus Research Institute (*5*). On September 19, local leaders from Madudu and Butoloogo, two contiguous subcounties, reported six community deaths during August 13–September 15 among persons with probable EVD. Upon laboratory confirmation of EVD in patient A, MRRH established an Ebola treatment unit (ETU) to manage patients, and another ETU was activated at Fort Portal Regional Referral Hospital in western Uganda.

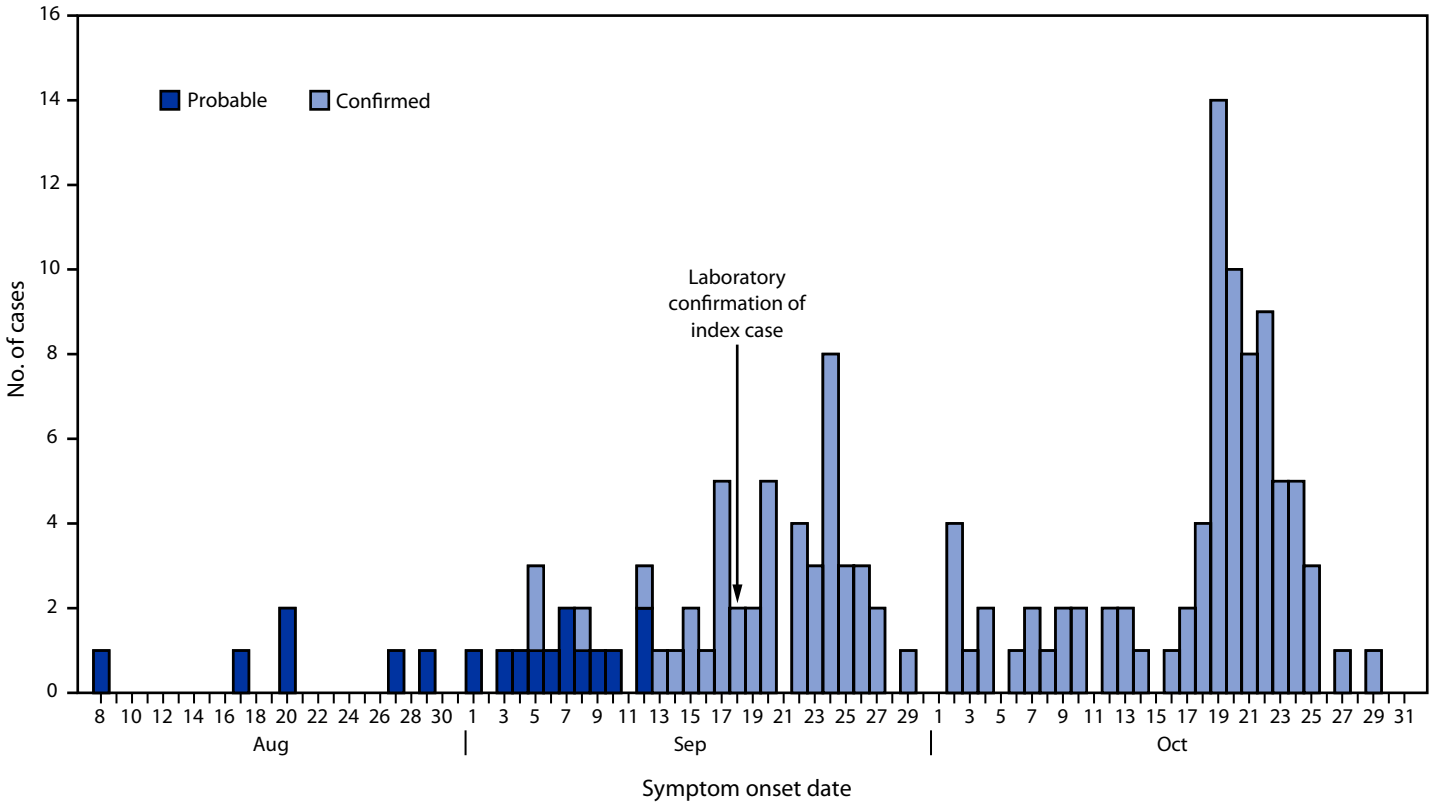
On September 21, 2022, MoH, the Mubende District health team, and other partners launched a public health emergency response to identify additional cases of EVD. The response focuses on active case finding (initiated in Madudu and Butoloogo subcounties), tracing and monitoring contacts for EVD signs and symptoms, conducting laboratory testing, and providing treatment. A probable case was defined as death in a person with suspected EVD who had a direct epidemiologic link to a confirmed case but did not have laboratory-confirmed infection. A confirmed case was a person with EVD who had received positive laboratory test results by RT-PCR or EVD immunoglobulin M serology. Patients with EVD who were discharged from ETUs with two negative RT-PCR tests 48 hours apart were considered recovered. Contact monitoring consisted of daily temperature checks and EVD symptom screening of persons who had direct (i.e., physical) or indirect contact (e.g., with used linens or utensils, or shared space) with patients with probable or confirmed EVD.

During September 18–October 31, 2022, a total of 130 confirmed and 18 probable EVD cases were identified; symptom onset in the first probable case occurred on August 8 (Figure). On October 31, a total of 1,777 contacts were monitored; among these 1,540 (87%) were successfully monitored on that day. Among probable and confirmed cases, the median patient age is 29 years (range = 1–70 years), 87 (59%) patients are men, and 81 (55%) are residents of Mubende district. Among the 130 confirmed cases, 43 (33%) deaths were reported as of October 31. Sixty-one deaths (probable and confirmed cases) were reported; the median age of decedents was 28 years (range = <1–58 years), and 31 (51%) were women. Eighteen confirmed or probable EVD cases during this period were reported among health care workers; five were linked to a surgical procedure performed on a patient with probable EVD who died on September 17. As of October 31, 45 patients had recovered, 37 patients are undergoing treatment in an ETU, and outcomes are unknown for five.

This report describes the fifth outbreak of EVD caused by *Sudan ebolavirus* in Uganda since 2000 (*2*,*3*). Given continued

* https://www.cdc.gov/vhf/ebola/index.html

FIGURE. Probable (n = 18) and confirmed (n = 130) cases of Ebola virus disease,* by symptom onset date† — Uganda, August 8–October 31, 2022



Abbreviations: EVD = Ebola virus disease; RT-PCR = reverse transcription–polymerase chain reaction.
* A probable case was defined as death in a person with suspected EVD who had a direct epidemiologic link to a confirmed case but did not have laboratory-confirmed infection. A confirmed case was a person with EVD who had received positive laboratory test results by RT-PCR or EVD immunoglobulin M serology.
† Identified cases as of October 31, 2022. Additional cases with symptom onset on or before October 31, might subsequently be identified.

transmission, public health response to this outbreak is ongoing, including epidemiologic investigation to identify the source of the outbreak.† Persons living in or traveling to Uganda should avoid activities that could result in exposures to infected persons or animals, including direct contact with body fluids or objects contaminated with blood or body fluids. Health care workers caring for EVD patients should adhere to proper infection control practices, including appropriate use of personal protective equipment.§ Public health departments, public health laboratories, and health care workers outside Uganda, including in the United States, should be aware of recommended practices to identify, report, and prevent EVD.¶ Health care providers in the United States and elsewhere should be alert for and evaluate any patients suspected of having EVD, particularly persons who have recently been in the affected areas in Uganda.

† https://www.cdc.gov/vhf/ebola/prevention/index.html
§ https://www.cdc.gov/niosh/topics/ebola/longdev/healthcare.html
¶ https://emergency.cdc.gov/han/2022/han00480.asp (Accessed November 7, 2022)

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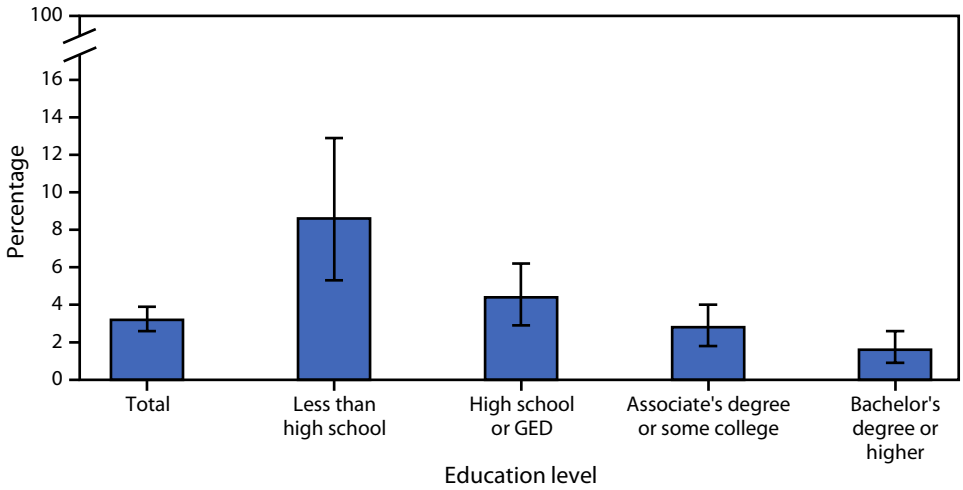
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥45 Years Who Have Ever Had Lung Cancer,† by Education Level — National Health Interview Survey,§ United States, 2021



Abbreviation: GED = general educational development certificate.
* With 95% CIs indicated by error bars.
† Based on an affirmative response to the survey question, "Have you ever been told by a doctor or other health professional that you had cancer or a malignancy of any kind?" followed by mention of "lung cancer" when asked "What kind of cancer was it?"
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

In 2021, 3.2% of adults aged ≥45 years had ever been told they had lung cancer. The prevalence of lung cancer among adults aged ≥45 years was highest for those with less than a high school education (8.6%). The percentage of adults who had ever had lung cancer decreased with increasing education level, with the lowest prevalence occurring among those with a bachelor's degree or higher (1.6%).

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

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For more information on this topic, CDC recommends the following link: https://www.cdc.gov/cancer/lung/basic_info/

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