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Characteristics of Adults Aged ≥18 Years Evaluated for Substance Use and Treatment Planning — United States, 2019

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In 2019, 65.8 million U.S. adults reported past-month binge drinking and 35.8 million reported illicit drug use or prescription pain reliever misuse during the past month; 20.4 million met diagnostic criteria for a substance use disorder during the past year (*1*). Approximately 81,000 persons died of a drug overdose* during May 2019–May 2020; excessive alcohol use contributes to an estimated 95,000 deaths per year (*2*). Persons with a substance use disorder are at elevated risk for overdose and associated harms (*3*). To examine the prevalence of past 30-day substance use patterns and the severity of problems experienced across seven biopsychosocial domains (alcohol, drug, employment, family, legal, medical, and psychiatric), CDC used 2019 data from the National Addictions Vigilance Intervention and Prevention Program (NAVIPPRO) Addiction Severity Index-Multimedia Version (ASI-MV) tool (*4*); these data are collected from adults aged ≥18 years who seek substance use treatment in the United States. Alcohol was the most commonly reported substance used during the past 30 days (35.8%), followed by cannabis (24.9%), prescription opioids (misuse) (18.5%), illicit stimulants (14.0%), heroin (10.2%), prescription sedatives or tranquilizers (misuse) (8.5%), cocaine (7.4%), illicit fentanyl (4.9%), and prescription stimulants (misuse) (1.8%).† Polysubstance use (use of two or more substances) during the past 30 days was reported by 32.6% of respondents. Among the biopsychosocial domains measured, 45.4% of assessments reported more severe problems with drugs; others reported psychiatric (35.2%), legal (28.8%), medical (27.4%), employment (25.0%), alcohol (24.2%), and family problems (22.8%). These findings highlight the complex nature of substance use in the United States, the interplay between substance use and mental illness, and the

* https://emergency.cdc.gov/han/2020/han00438.asp

† Substances assessed in the ASI-MV tool include tobacco, alcohol, cannabis, cocaine, illicit stimulants (i.e., illegal amphetamines including crank, ice, or methamphetamines; this group does not include cocaine), heroin, illicit fentanyl, prescription opioids (misuse), prescription stimulants (misuse), prescription sedatives or tranquilizers, barbiturates, hallucinogens, inhalants, ecstasy, gamma hydroxybutyrate, ketamine, synthetic cannabinoids (e.g., K2), bath salts, rohypnol, over-the-counter medications, and other (unspecified) drugs. Prescription opioid misuse is any use that is not considered "use as prescribed," which requires 1) having a current pain problem and taking a prescribed opioid medication for pain during the past 30 days; 2) obtaining the medication only from one's own prescription; and 3) no use of the medication via an alternate route of administration. Prescription stimulant misuse is any use that is not considered "use as prescribed," which requires obtaining the stimulant medication only from one's own prescription and no use of the medication via an alternate route of administration. Misuse is also assigned if a respondent indicates having used the medication during the past 30 days "not in a way prescribed by your doctor to treat a diagnosed attention deficit or hyperactivity disorder." For prescription sedatives and tranquilizers, investigators were unable to determine whether these products, which might or might not be obtained by a prescription but are available in the market with a prescription, were misused specifically.

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complex challenges that persons with substance use disorder face when seeking treatment. Actions to enhance comprehensive substance use programs that incorporate polysubstance use and co-occurring mental health problems into strategies for prevention, treatment, and response are needed, as is expanded linkage to services. CDC provides data and resources to equip and inform states, territories, and local jurisdictions to help improve opioid prescribing practices, improve linkage to care for the treatment of opioid use disorder, and prevent and reverse overdoses.[§]

NAVIPPRO ASI-MV tool is a validated self-administered, computerized, structured clinical assessment tool administered upon admission to a substance use treatment facility (5); the questionnaire is designed to assess each of seven biopsychosocial domains that might affect a respondent's substance use. A rating is calculated for each domain, indicating the severity of the problem and the need for treatment. The ASI-MV also collects detailed information on lifetime and past 30-day use of tobacco, alcohol, and illicit drugs, as well as use and misuse of prescription drugs.

Using 2019 NAVIPPRO data, CDC assessed the prevalence of past 30-day use overall and by demographic factors (sex, age, race and ethnicity, education, employment status, urban-rural residence, and U.S. Census Bureau region[¶] of treatment site) for the following substances: alcohol, cannabis, cocaine, illicit stimulants, heroin, illicit fentanyl, prescription opioids (misuse), prescription stimulants (misuse), and prescription sedatives or tranquilizers (misuse). The prevalence of moderate to extremely severe problems[**] was calculated for each of the seven biopsychosocial domains overall and by demographic characteristics. P-values were calculated using Pearson's chi-square tests to compare the distribution of demographic characteristics among those who reported past 30-day use of a given substance with those who did not report past 30-day use of that substance; those with a severity score of 4–9 (more

[§] https://www.cdc.gov/drugoverdose/strategies/index.html

[¶] U.S. Census Bureau regions: *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

[**] Severity score ratings are calculated via an algorithm that is dependent upon answers to various questions presented in the ASI-MV. Interpretation of the biopsychosocial domains are as follows: 0–1 = no problem; 2–3 = slight problem; 4–5 = moderate problem; 6–7 = severe problem; and 8–9 = extreme problem. For this analysis, scores were combined so that scores falling in the range of 4–9 were considered a moderately to extremely severe problem and were compared with scores of 0–3.

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severe) in each of the biopsychosocial domains were compared with those with a severity of 0–3 (less severe) in that domain. Respondents with unknown or no response were excluded. P-values <0.05 were considered statistically significant. The prevalences of polysubstance use during the past 30-days and substance combinations were analyzed. All analyses were conducted using SAS (version 7.1; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[††]

[††] 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.

Data from 399 treatment centers in 37 states contributed to the 2019 ASI-MV. Although the centers are primarily substance use treatment centers, other sites, such as driving while intoxicated centers, probation offices, or any site using the ASI-MV tool that agrees to share aggregate assessment data might also be included. Among the 49,138 ASI-MV adults assessed for substance use treatment planning, the majority were men (63.4%), non-Hispanic White persons (65.8%), had a high school education or less (65.4%), and were assessed in metropolitan areas (66.6%) and in the South U.S. Census Bureau region (62.2%) (Table 1).

TABLE 1. Prevalence of reported substances used during the past 30 days by adults aged ≥18 years who were assessed for substance use treatment,* by demographic characteristics — United States, 2019

Characteristic	Total assessments, % (N = 49,138)	% Substances used during the past 30 days: Alcohol (n = 17,590)	Cannabis (n = 12,222)	Cocaine (n = 3,620)	Illicit stimulants† (n = 6,898)	Heroin (n = 5,020)	Illicit fentanyl (n = 2,421)	Prescription opioid misuse§ (n = 9,073)	Prescription stimulant misuse¶ (n = 888)	Prescription sedatives, tranquilizers, sleeping pills** (n = 4,170)
Overall	**100**	**35.8**	**24.9**	**7.4**	**14.0**	**10.2**	**4.9**	**18.5**	**1.8**	**8.5**
Sex										
Male	**63.4**	36.5	23.7	7.1	12.0	10.1	4.7	16.1	1.5	6.7
Female	**36.5**	34.6	26.9	7.8	17.5	10.4	5.2	22.6	2.3	11.6
Unknown/No response	**<0.1**	55.0	40.0	10.0	15.0	5.0	10.0	15.0	5.0	15.0
p-value††	NA	<0.001	<0.001	0.058	<0.001	0.263	0.437	<0.001	<0.001	<0.001
Age group, yrs										
18–24	**14.9**	35.0	34.3	6.0	11.8	8.2	4.4	12.8	1.8	6.7
25–34	**38.0**	33.6	27.5	7.3	16.4	13.3	6.2	21.9	2.1	9.0
35–44	**25.9**	34.8	22.7	7.5	16.2	10.1	5.1	20.1	2.0	9.3
45–54	**13.3**	40.9	18.1	8.2	10.6	7.0	3.3	15.2	1.2	8.2
55–64	**6.8**	43.0	13.8	8.9	6.0	5.0	2.0	13.0	0.8	7.2
≥65	**1.2**	38.2	7.7	4.6	1.9	2.9	1.7	10.1	1.0	5.7
p-value††	NA	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Race/Ethnicity										
White, non-Hispanic	**65.8**	35.0	24.3	6.6	16.8	11.7	5.9	21.8	2.3	10.5
Black, non-Hispanic	**13.7**	40.1	26.6	14.3	4.2	7.1	3.3	11.9	0.6	3.1
AI/AN, non-Hispanic	**3.7**	29.4	21.5	2.7	14.3	4.1	1.8	11.4	1.2	4.6
Other,§§ non-Hispanic	**4.7**	36.5	31.3	8.0	14.9	9.8	4.3	16.4	1.7	8.1
Hispanic	**12.2**	37.2	24.3	5.1	9.9	7.9	2.5	10.9	1.0	4.8
p-value††	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Education level										
Less than HS	**21.9**	29.6	27.0	9.2	16.4	11.4	5.7	21.3	1.6	7.3
HS diploma	**43.4**	33.1	25.7	7.4	15.7	11.1	5.2	18.8	1.7	8.0
Some college	**24.9**	40.2	24.3	6.8	12.1	9.5	4.7	18.4	2.2	10.0
≥4 yrs college	**9.2**	51.9	18.6	4.8	6.2	5.6	2.5	10.8	2.0	9.7
Unknown/No response	**0.5**	25.2	5.2	2.6	3.0	7.4	3.9	8.3	0.4	0.9
p-value††	NA	<0.001	<0.001	<0.001	<0.001	<0.001	0.336	<0.001	0.004	<0.001
Employment status										
Full-time	**49.8**	39.4	22.6	5.9	10.3	7.8	3.8	14.1	1.5	6.3
Part-time	**18.9**	35.5	30.0	8.5	16.0	12.4	6.3	22.5	2.5	10.3
Student/Homemaker	**6.0**	34.5	27.2	5.0	16.2	7.1	3.8	22.7	2.6	10.9
Military service	**0.1**	50.8	12.7	0.0	1.6	3.2	1.6	6.3	1.6	0.0
Retired/Disabled	**7.5**	35.9	26.4	11.6	13.5	8.4	4.3	23.0	1.8	12.7
Unemployed	**13.1**	29.9	27.6	11.2	24.1	19.4	8.7	25.5	1.9	12.3
In prison/Hospital	**4.2**	14.8	17.1	4.8	16.9	8.5	3.6	17.4	1.0	4.5
Unknown/No response	**0.5**	26.1	3.4	3.0	3.0	7.7	2.6	14.1	1.7	1.7
p-value††	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

See table footnotes on the next page.

Alcohol was the substance most commonly reported (35.8%), followed by cannabis (24.9%), prescription opioid misuse (18.5%), illicit stimulants (14.0%), heroin (10.2%), misuse of prescription sedatives or tranquilizers (8.5%), cocaine (7.4%), illicit fentanyl (4.9%), and prescription stimulant misuse (1.8%). Compared with men, women reported higher use of all substances except alcohol. Comparing the prevalence of past 30-day substance use reported in each of the four U.S. Census Bureau regions, the prevalence of heroin, cocaine, illicit fentanyl, and prescription sedative use was highest at Northeast treatment sites, whereas the prevalence of illicit stimulant use was highest at Midwest treatment sites. Among all adults assessed, 32.6% reported use of two or more substances during the past 30 days; the most common polysubstance combinations were alcohol and cannabis (17.2%), followed by cannabis and illicit stimulants (3.7%), and alcohol and prescription opioids (3.4%) (Figure).

Among the biopsychosocial domain problems measured, 45.4% of adults assessed reported more severe problems with drugs, followed by psychiatric (35.2%), legal (28.8%), medical (27.4%), employment (25.0%), alcohol (24.2%), and family problems (22.8%) (Table 2). Compared with men, women reported more severe problems for all domains except alcohol. Adults aged 25–34 years reported more severe problems with drugs (49.9%) and those aged 55–64 years reported more severe problems with alcohol (41.1%). Approximately two thirds (67.4%) of unemployed adults assessed experienced more severe drug problems, and retired or disabled adults experienced more severe psychiatric (53.3%) and medical (59.6%) problems.

TABLE 1. (*Continued*) Prevalence of reported substances used during the past 30 days by adults aged ≥18 years who were assessed for substance use treatment,* by demographic characteristics — United States, 2019

Characteristic	Total assessments, % (N = 49,138)	% Substances used during the past 30 days: Alcohol (n = 17,590)	Cannabis (n = 12,222)	Cocaine (n = 3,620)	Illicit stimulants† (n = 6,898)	Heroin (n = 5,020)	Illicit fentanyl (n = 2,421)	Prescription opioid misuse§ (n = 9,073)	Prescription stimulant misuse¶ (n = 888)	Prescription sedatives, tranquilizers, sleeping pills** (n = 4,170)
Urban-rural status¶¶										
Metropolitan	**66.6**	37.5	24.5	8.0	12.7	11.5	5.5	18.3	1.6	8.7
Micropolitan	**20.2**	32.7	25.2	4.5	14.0	5.0	2.6	15.7	1.8	7.3
Rural	**12.9**	31.7	26.3	8.6	21.5	12.2	5.7	24.3	2.8	9.3
Unknown/No response	**0.4**	48.7	15.9	0.5	0.5	0.5	0.0	4.6	1.0	4.1
p-value††	NA	<0.001	0.056	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
U.S. Census Bureau region***										
Northeast	**4.2**	42.5	10.6	19.8	3.5	40.4	17.8	17.5	1.2	23.2
Midwest	**17.6**	33.2	29.0	6.6	17.2	8.5	5.0	22.3	2.9	10.1
South	**62.2**	36.2	25.5	7.9	13.6	9.8	4.9	19.3	1.7	7.9
West	**16.0**	35.3	21.5	3.0	15.1	6.0	1.4	11.2	1.0	5.2
p-value††	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Abbreviations: AI/AN = American Indian or Alaska Native; ASI-MV = Addiction Severity Index-Multimedia Version; HS = high school; NA = not applicable; NAVIPPRO = National Addictions Vigilance Intervention and Prevention Program.

* Data were obtained from responses to the NAVIPPRO ASI-MV tool during assessment for substance use at 399 treatment centers located in 37 states.

† Illicit stimulants include illegal amphetamines (e.g., crank, ice, or methamphetamines); this group does not include cocaine.

§ Prescription opioids assessment includes selection of past 30-day misuse of one or more prescription opioid medications. Prescription opioid misuse is any use that is not considered "use as prescribed." For prescription opioids, "use as prescribed" requires 1) having a current pain problem and taking a prescribed opioid medication for pain during the past 30 days; 2) obtaining the medication only from one's own prescription; and 3) no use of the medication via an alternate route of administration.

¶ Prescription stimulants assessment includes selection of past 30-day misuse of prescription stimulant medications. Stimulant misuse is any use that is not considered "use as prescribed." For prescription stimulants, "use as prescribed" is defined as obtaining the stimulant medication only from one's own prescription and no use of the medication via an alternate route of administration. Misuse is also assigned if a respondent indicates having used the medication during the past 30 days "not in a way prescribed by your doctor to treat a diagnosed attention deficit or hyperactivity disorder."

** For prescription sedatives and tranquilizers, it was not possible to determine whether these products, which might be obtained by a prescription but are available in the market for a prescription, were misused specifically.

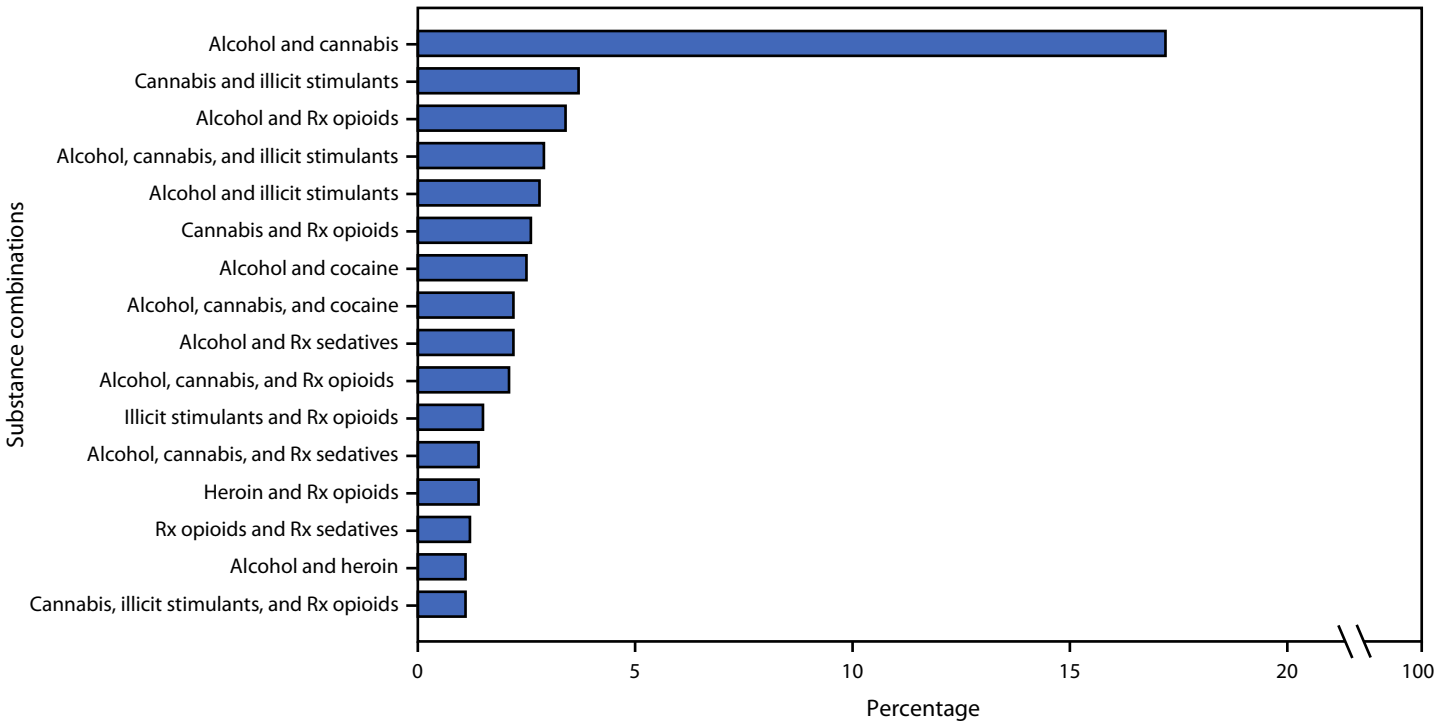
†† The p-values represent results of Pearson's chi-square tests comparing the distribution of demographic characteristics among those assessments who reported past 30-day use of the substance of interest versus those who did not report past 30-day use of that substance. The unknown or no response categories for each demographic characteristic were excluded from the chi-square tests.

§§ The Other, non-Hispanic group included those who selected Asian, Native Hawaiian or other Pacific Islander, or "Some other race," as well as those who selected multiple races. Persons who selected Hispanic ethnicity could be of any race.

¶¶ Urban-rural classification of the treatment sites region where assessments were conducted. https://www.cdc.gov/nchs/data_access/urban_rural.htm

*** U.S. Census Bureau region of treatment sites where assessments were conducted are as follows: *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

FIGURE. Most common substance combinations reported among past 30-day polysubstance* users aged ≥18 years (N = 16,033) — United States,† 2019



Source: National Addictions Vigilance Intervention and Prevention Program, Addiction Severity Index-Multimedia Version tool.
Abbreviations: ASI-MV = Addiction Severity Index-Multimedia Version; Rx = prescription.
* Polysubstance use includes past 30-day use (or prescription medication misuse) of at least two of the following: alcohol, cannabis, heroin, illicit fentanyl, prescription opioids (misuse), barbiturates, prescription sedatives or tranquilizers, cocaine, prescription stimulants (misuse), illicit stimulants (i.e., illegal amphetamines including crank, ice, or methamphetamines; this group does not include cocaine), hallucinogens, inhalants, ecstasy, gamma hydroxybutyrate, ketamine, synthetic cannabinoids (e.g., K2), bath salts, rohypnol, over-the-counter medications, and other unspecified drugs. The remaining unique substance combinations each represented <1% of all combinations among assessments reporting use of two or more substances during the past 30 days. Polysubstance use as displayed in this figure does not necessarily represent use of substances simultaneously.
† Data represent 32.6% of all 2019 adult ASI-MV assessments that reported polysubstance use (i.e., using two or more substances) during the past 30 days.

Summary

What is already known about this topic?

In 2019, 65.8 million U.S. adults reported binge drinking and 35.8 million reported illicit drug use or prescription pain reliever misuse during the past month. Persons with substance use disorders are at high risk for overdose and other harms.

What is added by this report?

Among U.S. adults assessed for substance use treatment in 2019, past 30-day use of alcohol (35.8%) and multiple substances (32.6%) were most commonly reported, along with severe problems (e.g., psychiatric, medical, or family) across multiple biopsychosocial domains.

What are the implications for public health practice?

Actions to enhance comprehensive substance use programs that incorporate polysubstance use and co-occurring mental health problems into strategies for prevention, treatment, and response are needed, as is expanded linkage to services.

Discussion

This study found that among adults assessed for substance use at 399 treatment centers during 2019, alcohol was the most commonly reported substance used during the past 30 days, followed by cannabis, prescription opioid misuse, and illicit stimulants. Nearly one third of all assessments involved polysubstance use, and co-occurring severe problems across multiple biopsychosocial domains were common. Consistent with previous research on substance use patterns in the general population (*1*), men accounted for the majority of assessments for substance use treatment. Women were more likely than men to report use of each of the substances except alcohol; the prevalence of severe problems was higher among women than among men for each of the biopsychosocial domains except alcohol. These patterns might be due to differences in substance use motivation between men and women, how substance use disorders manifest in each sex, barriers to treatment faced by women related to child care and fear of authority

TABLE 2. Percentage of assessments with moderate to extremely severe problems for each of seven biopsychosocial domains among adults aged ≥18 years who were assessed for substance use treatment,* by demographic characteristics — United States, 2019

Characteristics	Total assessments, % (N = 49,138)	% With more severe rating, by domain†						
		Medical (n = 13,467)	Employment (n = 2,261)	Legal (n = 14,135)	Family (n = 11,187)	Psychiatric (n = 17,277)	Alcohol (n = 11,877)	Drug (n = 22,289)
Overall	**100**	**27.4**	**25.0**	**28.8**	**22.8**	**35.2**	**24.2**	**45.4**
Sex								
Male	**63.4**	24.1	22.3	27.1	17.0	27.0	26.1	42.4
Female	**36.5**	33.2	29.5	31.6	32.8	49.3	20.9	50.5
Unknown/No response	**<0.1**	35.0	40.0	30.0	50.0	45.0	30.0	30.0
p-value§	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Age group, yrs								
18–24	**14.9**	16.2	23.5	30.5	20.3	31.5	14.6	39.4
25–34	**38.0**	23.3	26.9	31.1	24.1	35.5	19.9	49.9
35–44	**25.9**	29.4	25.9	28.9	24.8	37.3	25.6	47.8
45–54	**13.3**	38.0	23.4	24.6	21.7	36.7	34.9	41.1
55–64	**6.8**	45.1	19.2	21.3	17.4	32.6	41.1	36.0
≥65	**1.2**	38.5	9.9	17.5	11.5	20.2	33.6	22.4
p-value§	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Race/Ethnicity								
White, non-Hispanic	**65.8**	28.1	23.8	28.1	24.0	38.0	24.5	48.3
Black, non-Hispanic	**13.7**	29.3	30.3	26.1	19.9	30.2	26.9	43.6
AI/AN, non-Hispanic	**3.7**	26.6	28.6	35.7	21.7	27.4	31.7	40.1
Other,¶ non-Hispanic	**4.7**	29.7	26.9	32.4	27.4	40.5	21.8	43.9
Hispanic	**12.2**	21.2	23.4	32.1	18.0	25.8	18.2	33.6
p-value§	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Education level								
Less than HS	**21.9**	32.3	33.2	31.3	25.0	37.9	23.0	54.2
HS diploma	**43.4**	26.5	25.4	28.7	21.3	33.7	23.0	48.0
Some college	**24.9**	27.3	21.1	28.2	24.4	37.3	25.5	40.6
≥4 yrs of college	**9.2**	20.9	14.4	25.1	20.5	30.8	29.2	25.9
Unknown/No response	**0.5**	19.1	10.4	15.2	10.9	13.5	16.5	26.1
p-value§	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Employment status								
Full-time	**49.8**	18.9	15.1	27.0	17.4	25.7	23.5	35.6
Part-time	**18.9**	30.3	31.4	31.4	28.5	41.5	25.7	53.3
Student/Homemaker	**6.0**	31.0	27.1	31.1	30.8	47.0	19.7	47.2
Military service	**0.1**	17.5	17.5	30.2	14.3	22.2	17.5	17.5
Retired/Disabled	**7.5**	59.6	22.6	24.7	28.1	53.3	31.4	51.1
Unemployed	**13.1**	35.5	50.0	33.3	29.8	47.9	25.5	67.4
In prison/Hospital	**4.2**	28.4	39.3	29.5	18.9	31.7	15.3	47.2
Unknown/No response	**0.5**	24.8	0.0	9.4	11.5	16.2	16.7	20.1
p-value§	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

See table footnotes on the next page.

involvement (*6*), and differences in the way in which sexes perceive and self-report on biopsychosocial domains.

The observed high rates of polysubstance use among adults assessed for substance use treatment in 2019 are concerning and are consistent with recent drug overdose death data (*7*) and substance use patterns in the general population (*1*). The finding that one third or more of assessments for substance use treatment reported more severe psychiatric problems is also consistent with previous research documenting high rates of mental illness among persons with substance use disorder (*8*). This report focuses on data from 2019, preceding the COVID-19 pandemic; how these trends changed during the pandemic will be the subject of a future report.

Adults assessed in the Northeast U.S. Census Bureau region reported higher past 30-day use of cocaine, heroin, illicit fentanyl, and prescription sedatives, whereas those assessed in the Midwest reported higher past 30-day use of illicit stimulants. The geographic differences in specific substances used during the past 30 days correspond with regional variations in drug overdose deaths (*9*) and the illicit drug supply in the United States (*10*). Continued surveillance of the illicit drug supply and substance use patterns to guide the tailored development of prevention, treatment, and harm reduction interventions will be important when devising public health strategies in U.S. communities.

TABLE 2. (*Continued*) Percentage of assessments with moderate to extremely severe problems for each of seven biopsychosocial domains among adults aged ≥18 years who were assessed for substance use treatment,* by demographic characteristics — United States, 2019

Characteristics	Total assessments, % (N = 49,138)	% With more severe rating, by domain†						
		Medical (n = 13,467)	Employment (n = 2,261)	Legal (n = 14,135)	Family (n = 11,187)	Psychiatric (n = 17,277)	Alcohol (n = 11,877)	Drug (n = 22,289)
Urban-rural status**								
Metropolitan	**66.6**	25.8	24.8	27.3	20.8	33.0	23.6	43.9
Micropolitan	**20.2**	28.6	22.4	30.3	24.2	38.1	23.6	41.3
Rural	**12.9**	34.3	30.4	34.1	31.1	42.5	28.1	60.4
Unknown/No response	**0.4**	11.3	11.3	32.3	7.2	10.3	22.1	7.2
p-value§	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
U.S. Census Bureau region††								
Northeast	**4.2**	18.6	30.9	18.5	14.9	30.4	49.6	77.9
Midwest	**17.6**	33.9	26.2	28.7	27.3	42.9	27.2	49.0
South	**62.2**	26.9	24.5	29.2	21.8	33.4	20.5	43.9
West	**16.0**	24.7	23.7	29.6	23.8	34.8	28.4	38.5
p-value§	NA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Abbreviations: AI/AN = American Indian or Alaska Native; ASI-MV = Addiction Severity Index-Multimedia Version; HS = high school; NA = not applicable.

* Data were obtained from responses to the National Addictions Vigilance Intervention and Prevention Program ASI-MV tool during assessment for substance use at 399 treatment centers located in 37 states.

† The ASI-MV includes questions for each of seven biopsychosocial domains that might affect a respondent's substance use; a severity rating is calculated for each domain, indicating the severity of the problem (and the need for treatment). Severity score ratings are calculated via an algorithm that is dependent upon answers to various questions. Interpretation of biopsychosocial domain scores is as follows: 0–1 = no problem; 2–3 = slight problem; 4–5 = moderate problem; 6–7 = severe problem; and 8–9 = extreme problem. For this analysis, scores were combined so that a score falling in the range of 4–9 was considered more severe compared with scores of 0–3.

§ The p-values represent results of Pearson's chi-square tests comparing the distribution of demographic characteristics among persons with a more severe rating indicating a need for treatment (severity score 4–9) to those with a lower domain severity rating indicating that treatment is likely not necessary (severity score 0–3). The unknown or no response categories for each demographic characteristic were excluded from the chi-square tests.

¶ The Other, non-Hispanic group included those who selected Asian, Native Hawaiian or other Pacific Islander, or "Some other race," as well as those who selected multiple races. Persons who selected Hispanic ethnicity could be of any race.

** Urban-rural classification of the treatment sites region where assessments were conducted. https://www.cdc.gov/nchs/data_access/urban_rural.htm

†† U.S. Census Bureau region of treatment sites where assessments were conducted are as follows: *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

The findings in this report are subject to at least three limitations. First, ASI-MV data are self-reported and subject to recall and social desirability biases. Second, although ASI-MV collects data from a geographically diverse set of states and treatment programs, it is a convenience sample; therefore, results might not be generalizable to all adults being assessed for substance use treatment.§§ Finally, in 2019, 7.4% of ASI-MV assessments were repeat assessments; thus, it is possible for one person to have contributed more than one assessment during 2019.¶¶

These findings highlight the complex nature of substance use in the United States, the interplay between substance use and mental illness, and the complex challenges that persons with substance use disorder face when seeking treatment. Actions to enhance comprehensive substance use programs that incorporate polysubstance use and co-occurring mental health problems into strategies for prevention, treatment, and response are needed, as is expanded linkage to services. CDC provides data and resources to equip and inform states, territories, and local jurisdictions to help improve opioid prescribing practices, improve linkage to care for the treatment of opioid use disorder, and prevent and reverse overdoses.

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§§ Geographic and site participation in NAVIPPRO changes over time, and the network is not formally designed to be nationally representative.

¶¶ In 2019, 7.4% of ASI-MV assessments were repeat assessments, meaning they were completed by a person (represented by a unique identifier) who had already completed one assessment that year.

References

1. Substance Abuse and Mental Health Services Administration. Key substance use and mental health indicators in the United States: results from the 2019 National Survey on Drug Use and Health. Rockville, MD: Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality; 2020. https://www.samhsa.gov/data/sites/default/files/reports/rpt29393/2019NSDUHFFRPDFWHTML/2019NSDUHFFR090120.htm
2. Esser MB, Sherk A, Liu Y, et al. Deaths and years of potential life lost from excessive alcohol use—United States, 2011–2015. MMWR Morb Mortal Wkly Rep 2020;69:981–7. PMID:32730240 https://doi.org/10.15585/mmwr.mm6930a1
3. US Department of Health and Human Services. Facing addiction in America: the Surgeon General's report on alcohol, drug, and health. Washington, DC: US Department of Health and Human Services; 2016. https://addiction.surgeongeneral.gov/sites/default/files/surgeon-generals-report.pdf
4. Butler SF, Budman SH, Licari A, et al. National addictions vigilance intervention and prevention program (NAVIPPRO): a real-time, product-specific, public health surveillance system for monitoring prescription drug abuse. Pharmacoepidemiol Drug Saf 2008;17:1142–54. PMID:18932173 https://doi.org/10.1002/pds.1659
5. Butler SF, Budman SH, Goldman RJ, et al. Initial validation of a computer-administered Addiction Severity Index: the ASI-MV. Psychol Addict Behav 2001;15:4–12. PMID:11255937 https://doi.org/10.1037/0893-164X.15.1.4
6. National Institute on Drug Abuse. Substance use in women research report. Bethesda, MD: US Department of Health and Human Services, National Institutes of Health, National Institute on Drug Abuse; 2020. https://www.drugabuse.gov/download/18910/substance-use-in-women-research-report.pdf?v=b802679e27577e5e5365092466ac42e
7. O'Donnell J, Gladden RM, Mattson CL, Hunter CT, Davis NL. Vital signs: characteristics of drug overdose deaths involving opioids and stimulants—24 states and the District of Columbia, January–June 2019. MMWR Morb Mortal Wkly Rep 2020;69:1189–97. PMID:32881854 https://doi.org/10.15585/mmwr.mm6935a1
8. Jones CM, McCance-Katz EF. Co-occurring substance use and mental disorders among adults with opioid use disorder. Drug Alcohol Depend 2019;197:78–82. PMID:30784952 https://doi.org/10.1016/j.drugalcdep.2018.12.030
9. Drug Enforcement Administration. 2019 National drug threat assessment. Washington, DC: US Department of Justice, Drug Enforcement Administration; 2020. https://www.dea.gov/sites/default/files/2020-01/2019-NDTA-final-01-14-2020_Low_Web-DIR-007-20_2019.pdf
10. Kariisa M, Scholl L, Wilson N, Seth P, Hoots B. Drug overdose deaths involving cocaine and psychostimulants with abuse potential—United States, 2003–2017. MMWR Morb Mortal Wkly Rep 2019;68:388–95. PMID:31048676 https://doi.org/10.15585/mmwr.mm6817a3

COVID-19 Vaccination Coverage, by Race and Ethnicity — National Immunization Survey Adult COVID Module, United States, December 2020–November 2021

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Some racial and ethnic minority groups have experienced disproportionately higher rates of COVID-19–related illness and mortality (*1*,*2*). Vaccination is highly effective in preventing severe COVID-19 illness and death (*3*), and equitable vaccination can reduce COVID-19–related disparities. CDC analyzed data from the National Immunization Survey Adult COVID Module (NIS-ACM), a random-digit–dialed cellular telephone survey of adults aged ≥18 years, to assess disparities in COVID-19 vaccination coverage by race and ethnicity among U.S. adults during December 2020–November 2021. Asian and non-Hispanic White (White) adults had the highest ≥1-dose COVID-19 vaccination coverage by the end of April 2021 (69.6% and 59.0%, respectively); ≥1-dose coverage was lower among Hispanic (47.3%), non-Hispanic Black or African American (Black) (46.3%), Native Hawaiian or other Pacific Islander (NH/OPI) (45.9%), multiple or other race (42.6%), and American Indian or Alaska Native (AI/AN) (38.7%) adults. By the end of November 2021, national ≥1-dose COVID-19 vaccination coverage was similar for Black (78.2%), Hispanic (81.3%), NH/OPI (75.7%), and White adults (78.7%); however, coverage remained lower for AI/AN (61.8%) and multiple or other race (68.0%) adults. Booster doses of COVID-19 vaccine are now recommended for all adults (*4*), but disparities in booster dose coverage among the fully vaccinated have become apparent (*5*). Tailored efforts including community partnerships and trusted sources of information could be used to increase vaccination coverage among the groups with identified persistent disparities and can help achieve vaccination equity and prevent new disparities by race and ethnicity in booster dose coverage.

NIS-ACM is a random-digit–dialed cellular telephone survey of adults aged ≥18 years in all 50 states, the District of Columbia, and selected local areas and U.S. territories.* Data are weighted to represent the noninstitutionalized U.S. adult population and calibrated to state-level vaccine administration data reported to CDC.† Survey respondents who reported their race and ethnicity§ and whether they received ≥1 dose of COVID-19 vaccine¶ (516,190) during April 22–December 31, 2021, were included; race and ethnicity was reported for 97.1% of respondents. First-dose vaccination month and year were imputed for 4.9% of persons who reported they received vaccination but did not report their month and year of vaccination, using hot deck imputation (replacing missing values with observed values from a respondent with similar characteristics) from donor pools matched for month of interview, age group, region, and race and ethnicity. Monthly survey response rates ranged from 17.2% to 23.4% (average = 20.6%).**

The Kaplan-Meier survival analysis procedure was used, with vaccination month as the time-to-event variable, to estimate the cumulative percentage of persons vaccinated by the end of each month during December 2020–November 2021.†† Differences in ≥1-dose COVID-19 vaccination coverage were assessed

* Local areas that received federal immunization funds under Section 317 of the Public Health Service Act are sampled separately in NIS. Local areas include Bexar County, Texas; Chicago, Illinois; Houston, Texas; New York, New York; and Philadelphia County, Pennsylvania. Three U.S. territories were sampled separately in 2021: Guam (April–July 2021), Puerto Rico, and U.S. Virgin Islands.

† Survey weights were calibrated to the COVID-19 vaccine administration data by jurisdiction, age group, and sex. https://covid.cdc.gov/covid-data-tracker/ (Accessed May 26, 2022).

§ Race and ethnicity were assessed by the following two questions: "Are you of Hispanic or Latino origin?" and "Now, I am going to read a list of categories. Please choose one or more of the following categories to describe your race. Are you White, Black or African American, American Indian, Alaska Native, Asian, Native Hawaiian or other Pacific Islander?" Persons were categorized into mutually exclusive categories of race and ethnicity; persons who did not identify as Hispanic were categorized by their reported race or races. For persons reporting they were Asian, Black, or Hispanic, an additional question was asked to determine a more specific ethnic or racial group.

¶ Receipt of ≥1 dose of COVID-19 vaccine was assessed by the question, "Have you received at least one dose of a COVID-19 vaccine?" Month and year of first dose was assessed by the question, "During what month and year did you receive your first COVID-19 vaccine?" Respondents who were interviewed during April 22–December 31, 2021, were included in this study; month and year of vaccination could be before the study period.

** Calculated according to the American Association for Public Opinion Research type 3 response rate. https://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf

†† Kaplan-Meier methods were used to calculate cumulative monthly vaccination estimates during December 2020–November 2021. Vaccination status was assigned using the reported month and year of the first dose of COVID-19 vaccine, as of the end of the month before interview.

by race and ethnicity and stratified by U.S. Census Bureau region,[§§] urbanicity,[¶¶] age group, annual household income, and health insurance status. T-tests were used to determine differences among groups, with $p<0.05$ considered statistically significant. Analyses were conducted using SAS (version 9.4; SAS Institute) and SUDAAN (version 11; RTI International). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[***]

By the end of April 2021, when all U.S. adults were eligible to receive COVID-19 vaccine, vaccination coverage was highest among adults who were Asian (69.6%) or White (59.0%), and lower among those who were Hispanic (47.3%), Black (46.3%), NH/OPI (45.9%), multiple or other race (42.6%), or AI/AN (38.7%) (Figure). Differences in coverage among these racial and ethnic groups compared with that in White adults peaked during March–May 2021, after which disparities began to diminish (Figure). By the end of November 2021, differences in vaccination coverage were no longer statistically significant among Black and NH/OPI adults (difference = −0.5 and −3.0 percentage points, respectively), compared with coverage among White adults (Table 1). Vaccination coverage among Hispanic and Asian adults was higher than coverage among White adults (difference = 2.6 and 16.5 percentage points, respectively), whereas coverage remained lower among AI/AN (difference = −16.9) and multiple or other race (difference = −10.7) adults.

In analyses stratified by Census region, urbanicity, age, annual household income, and health insurance, similar racial and ethnic patterns emerged in most sociodemographic strata (Supplementary Figure, https://stacks.cdc.gov/view/cdc/118051). Asian adults had the highest coverage in all months since April 2021, and in November 2021, had the highest coverage across almost all sociodemographic categories, ranging from 87.2% among the uninsured to 98.1% in persons aged 50–64 years (Supplementary Table, https://stacks.cdc.gov/view/cdc/118052). By November 2021, coverage among Hispanic adults reached or exceeded that of White adults in all sociodemographic categories except those in the Midwest Census region (difference = −3.7). Differences in coverage among Black and NH/OPI adults were no longer present in November 2021, except in the Midwest (−5.4), urban areas (−6.6), and among those aged 18–29 years (−4.2) for Black adults, and in the Midwest (−24.3), South (−19.0), and among persons aged 18–29 years (−14.1) for NH/OPI adults.

Within racial and ethnic groups, coverage varied by subgroup. For example, among Asian adults, coverage ranged from 97.8% among persons identifying as Asian Indian, to 86.5% among other Asian persons (Table 2). Among Hispanic adults, coverage ranged from 90.6% among persons identifying as South American, to 79.3% among those identifying as Mexican. Coverage among Black adults was similar across subgroups (range = 73.6%–79.8%), with the exception of adults identifying as Somali (coverage = 52.6%).

Discussion

During December 2020–November 2021, disparities in COVID-19 vaccination coverage among minority racial and ethnic groups narrowed. Disparities in COVID-19 age-adjusted mortality rates decreased during 2020–2021 for most racial and ethnic groups in the United States (*6*), likely related to reduced disparities in vaccination-related protection from COVID-19 infection. Substantial programmatic efforts to provide equitable access to COVID-19 vaccines might have contributed to closing the coverage gap. COVID-19 vaccines were made available free of charge at various providers and locations, including pharmacies, mass vaccination clinics, hospitals, and federally qualified health centers. CDC awarded supplemental funding to U.S. jurisdictions and other national, state, local, and community-level partner organizations to support efforts to increase coverage equity and access to vaccines, particularly among populations disproportionately affected by COVID-19, including racial and ethnic minority adults.[†††]

Differences in coverage by race and ethnicity within high and low socioeconomic strata suggest additional factors beyond access that led to disparities in vaccination. Although Hispanic adults were slower to be vaccinated, by the end of November 2021, this group had significantly higher coverage than did White adults across almost all categories assessed. Among adults who were uninsured or below the poverty level, COVID-19 vaccination coverage among Hispanic adults was >15 percentage points higher than that among White adults, suggesting that access issues typically associated with lower socioeconomic status were not necessarily barriers to vaccination among all racial and ethnic groups. Reported difficulty obtaining vaccine did not differ between Hispanic and White adults who were

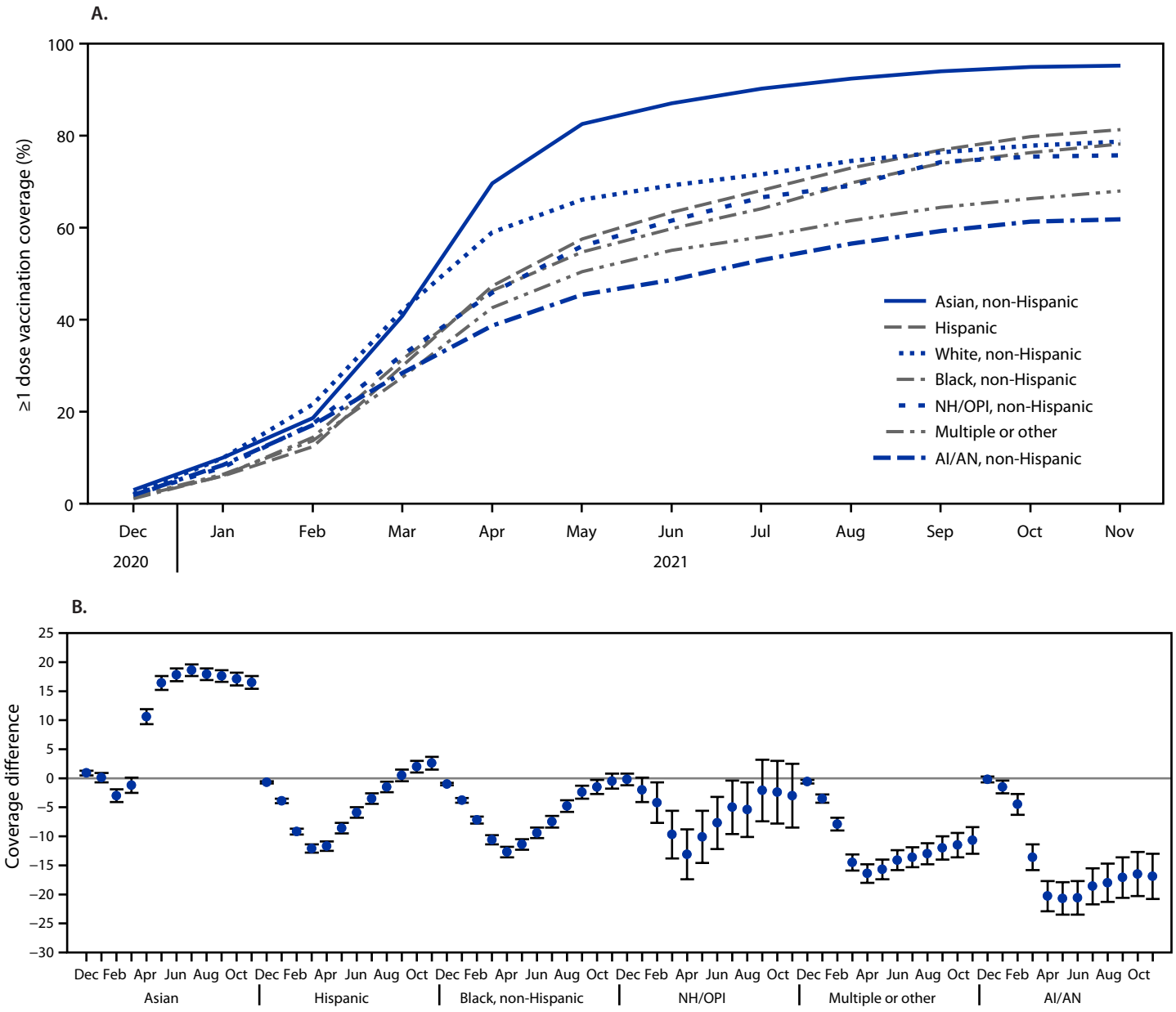
[§§] *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware,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

[¶¶] Urbanicity was determined based on household reported city and county of residence and was grouped into three categories: metropolitan statistical area (MSA) principal city (urban), MSA nonprincipal city (suburban), and non-MSA (rural). MSAs and principal cities were categorized as defined by the U.S. Census Bureau. https://www.census.gov/programs-surveys/metro-micro.html

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

[†††] https://www.cdc.gov/vaccines/health-equity/index.html

FIGURE. COVID-19 vaccination (≥1 dose) coverage estimates (A)* among adults aged ≥18 years, by race and ethnicity and differences in coverage from White, non-Hispanic adults, and by race and ethnicity (B)[†,§,¶] — National Immunization Survey Adult COVID Module, United States, December 2020–November 2021



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

* Kaplan-Meier survival analysis was used to estimate vaccination coverage based on the month and year of first dose receipt; estimates reflect the cumulative percentage vaccinated as of the end of each month.

† Referent group = White, non-Hispanic.

§ Persons were categorized into mutually exclusive categories of race and ethnicity; persons who did not identify as Hispanic were categorized by their reported race or races.

¶ 95% CIs indicated by error bars.

TABLE 1. Differences in COVID-19 vaccination (≥1 dose) coverage,* by race and ethnicity† and selected geographic and sociodemographic characteristics — National Immunization Survey Adult COVID Module, United States, April 2021 and November 2021

Characteristic	Coverage (95% CI)	Coverage difference (95% CI)					
	White, non-Hispanic (ref) n = 329,135	Black, non-Hispanic n = 61,848	Hispanic n = 67,925	AI/AN n = 6,224	Asian n = 26,468	NH/OPI n = 5,149	Multiple or other race n = 19,441
April 2021							
Overall	**59.0 (58.6 to 59.3)**	**−12.7 (−13.6 to −11.8)§**	**−11.7 (−12.5 to −10.9)§**	**−20.3 (−22.9 to −17.7)§**	**10.6 (9.3 to 11.9)¶**	**−13.1 (−17.4 to −8.8)§**	**−16.4 (−18.0 to −14.8)§**
U.S. Census Bureau region							
Northeast	69.0 (68.3 to 69.7)	−21.2 (−23.1 to −19.3)§	−22.8 (−24.6 to −21.0)§	−31.3 (−38.6 to −24.1)§	−1.4 (−3.6 to 0.8)	−16.8 (−28.1 to −5.6)§	−18.3 (−21.6 to −15.0)§
Midwest	55.9 (55.1 to 56.7)	−13.1 (−15.4 to −10.8)§	−14.5 (−16.7 to −12.3)§	−22.6 (−28.5 to −16.7)§	10.0 (6.7 to 13.4)¶	−30.5 (−39.4 to −21.6)§	−20.2 (−23.8 to −16.7)§
South	53.7 (53.1 to 54.3)	−7.2 (−8.4 to −6.1)§	−8.6 (−10.0 to −7.2)§	−21.4 (−25.0 to −17.8)§	12.8 (10.3 to 15.2)¶	−18.0 (−27.5 to −8.5)§	−18.9 (−21.1 to −16.6)§
West	63.0 (62.2 to 63.8)	−13.3 (−16.4 to −10.2)§	−13.9 (−15.5 to −12.3)§	−16.3 (−21.1 to −11.6)§	9.6 (7.5 to 11.8)¶	−13.3 (−19.2 to −7.5)§	−12.8 (−16.0 to −9.7)§
Urbanicity**							
MSA, principal city	63.4 (62.7 to 64.1)	−19.9 (−21.3 to −18.5)§	−15.9 (−17.2 to −14.5)§	−27.8 (−32.7 to −22.9)§	5.3 (3.4 to 7.2)¶	−14.2 (−21.5 to −7.0)§	−19.3 (−22.0 to −16.6)§
MSA, nonprincipal city	60.1 (59.6 to 60.5)	−11.4 (−12.6 to −10.1)§	−12.3 (−13.4 to −11.1)§	−22.3 (−26.4 to −18.2)§	11.1 (9.3 to 12.9)¶	−16.3 (−22.4 to −10.1)§	−16.3 (−18.5 to −14.0)§
Non-MSA	49.1 (48.2 to 49.9)	−2.7 (−5.4 to 0.1)	−7.1 (−9.7 to −4.4)§	−5.6 (−10.0 to −1.2)§	6.3 (−1.1 to 13.7)	−4.0 (−14.6 to 6.5)	−14.5 (−18.1 to −10.8)§
Age group, yrs							
18–29	35.9 (35.1 to 36.7)	−13.8 (−15.4 to −12.2)§	−2.6 (−4.1 to −1.2)§	−13.8 (−18.6 to −9.0)§	24.1 (21.7 to 26.5)¶	−14.9 (−20.8 to −8.9)§	−3.0 (−5.7 to −0.3)§
30–49	48.5 (47.9 to 49.1)	−12.7 (−14.0 to −11.3)§	−3.8 (−5.1 to −2.5)§	−13.9 (−18.0 to −9.9)§	21.9 (20.0 to 23.8)¶	−3.3 (−9.7 to 3.0)	−11.5 (−14.0 to −9.0)§
50–64	63.1 (62.5 to 63.8)	−6.6 (−8.2 to −4.9)§	−3.3 (−5.1 to −1.5)§	−20.0 (−24.9 to −15.1)§	14.5 (11.6 to 17.4)¶	−9.6 (−18.7 to −0.4)§	−16.6 (−20.0 to −13.2)§
≥65	82.8 (82.3 to 83.4)	−8.5 (−10.3 to −6.7)§	−7.4 (−9.5 to −5.4)§	−21.9 (−29.9 to −13.9)§	2.7 (−0.5 to 5.9)	0.2 (−8.0 to 8.4)	−12.9 (−16.4 to −9.4)§
Annual household income							
Below poverty	36.5 (35.3 to 37.7)	−2.5 (−4.8 to −0.2)§	3.4 (1.3 to 5.4)¶	−3.5 (−9.5 to 2.4)	21.6 (17.2 to 26.0)¶	−9.2 (−18.3 to 0.1)	−11.6 (−15.2 to −8.1)§
Above poverty, <$75,000	54.6 (54.0 to 55.3)	−10.1 (−11.6 to −8.7)§	−8.1 (−9.5 to −6.7)§	−16.5 (−20.5 to −12.4)§	10.9 (8.3 to 13.6)¶	−7.8 (−15.4 to −0.2)§	−14.4 (−17.0 to −11.8)§
Above poverty, ≥$75,000	67.6 (67.1 to 68.2)	−9.5 (−11.3 to −7.8)§	−9.8 (−11.5 to −8.2)§	−19.5 (−24.9 to −14.1)§	9.1 (7.3 to 10.8)¶	−14.6 (−22.4 to −6.8)§	−12.6 (−15.6 to −9.7)§
Unknown	58.6 (57.8 to 59.4)	−13.1 (−14.9 to −11.4)§	−14.8 (−16.5 to −13.1)§	−21.7 (−27.3 to −16.1)§	6.9 (4.2 to 9.7)¶	−13.1 (−22.5 to −3.7)§	−16.5 (−19.9 to −13.1)§
Health insurance							
Insured	61.6 (61.2 to 61.9)	−12.2 (−13.1 to −11.2)§	−9.6 (−10.5 to −8.6)§	−20.6 (−23.4 to −17.7)§	10.0 (8.7 to 11.3)¶	−11.3 (−16.0 to −6.6)§	−15.7 (−17.4 to −14.0)§
Not insured	28.0 (26.9 to 29.2)	−4.3 (−6.5 to −2.0)§	3.0 (1.1 to 4.9)¶	−6.4 (−12.3 to −0.5)§	23.5 (18.6 to 28.3)¶	−7.4 (−15.4 to 0.5)	−8.2 (−11.9 to −4.5)§

See table footnotes on the next page.

uninsured or below the poverty level; however, White adults in these groups reported more vaccine hesitancy, with approximately three times as many persons saying they definitely or probably would not get vaccinated (*7*).

As of October 31–December 31, 2021, 6.2% of White adults still intended to get vaccinated; among racial and ethnic minority groups, intent to get vaccinated was higher among NH/OPI (12.8%), Black (11.2%), AI/AN (10.3%), and Hispanic adults (9.3%)§§§ (*7*), indicating the potential for coverage to continue to increase among these groups. Analysis of the behavioral and social drivers of COVID-19 vaccination among those who were still unvaccinated, but willing to get vaccinated, during October 31–December 31, 2021, indicates that large proportions of AI/AN, Black, and multiple and other race adults are concerned about getting COVID-19 and think the vaccine is important and safe, yet they remain unvaccinated. For example, in the groups with continuing disparities (those in the Midwest and urban areas, and adults aged 18–29 years), fewer Black and Hispanic than White adults reported that they definitely or probably will not get vaccinated, indicating potential for increases in coverage among these groups with the appropriate interventions.

§§§ Those who said they would "definitely get a vaccine," "probably get a vaccine," or were "not sure" were considered to have intent to get vaccinated.

TABLE 1. (*Continued*) Differences in COVID-19 vaccination (≥1 dose) coverage,* by race and ethnicity† and selected geographic and sociodemographic characteristics — National Immunization Survey Adult COVID Module, United States, April 2021 and November 2021

Characteristic	Coverage (95% CI)	Coverage difference (95% CI)					
	White, non-Hispanic (ref) n = 329,135	Black, non-Hispanic n = 61,848	Hispanic n = 67,925	AI/AN n = 6,224	Asian n = 26,468	NH/OPI n = 5,149	Multiple or other race n = 19,441
November 2021							
Overall	**78.7 (78.2 to 79.1)**	**−0.5 (−1.8 to 0.8)**	**2.6 (1.5 to 3.7)¶**	**−16.9 (−20.8 to −13.0)§**	**16.5 (15.4 to 17.6)¶**	**−3.0 (−8.5 to 2.5)**	**−10.7 (−13.0 to −8.4)§**
U.S. Census Bureau region							
Northeast	88.0 (87.2 to 88.8)	−2.4 (−4.9 to 0.1)	−2.0 (−4.2 to 0.2)	−12.6 (−24.3 to −0.9)§	8.2 (6.6 to 9.8)¶	1.7 (−6.9 to 10.3)	−5.9 (−10.6 to −1.3)§
Midwest	74.0 (73.0 to 74.9)	−5.4 (−8.6 to −2.2)§	−3.7 (−6.6 to −0.7)§	−24.4 (−33.0 to −15.8)§	16.9 (12.8 to 21.1)¶	−24.3 (−43.3 to −5.3)§	−19.5 (−24.2 to −14.9)§
South	74.1 (73.4 to 74.9)	4.6 (2.9 to 6.4)¶	4.4 (2.4 to 6.4)¶	−20.8 (−26.5 to −15.0)§	20.1 (17.9 to 22.3)¶	−19.0 (−31.5 to −6.5)§	−13.9 (−18.2 to −9.5)§
West	84.3 (83.4 to 85.2)	−3.8 (−8.1 to 0.6)	−1.3 (−3.3 to 0.7)	−12.1 (−19.0 to −5.2)§	11.8 (10.0 to 13.6)¶	−3.0 (−9.7 to 3.7)	−8.4 (−12.4 to −4.4)§
Urbanicity**							
MSA, principal city	83.2 (82.4 to 84.0)	−6.6 (−8.5 to −4.6)§	−0.8 (−2.6 to 1.0)	−21.6 (−28.7 to −14.4)§	12.5 (10.9 to 14.1)¶	−4.0 (−11.1 to 3.1)	−10.9 (−14.6 to −7.2)§
MSA, nonprincipal city	79.5 (78.9 to 80.1)	−0.2 (−1.9 to 1.6)	2.1 (0.6 to 3.6)¶	−23.1 (−28.9 to −17.3)§	15.7 (14.1 to 17.3)¶	−5.1 (−13.3 to 3.2)	−9.5 (−13.1 to −5.9)§
Non-MSA	69.4 (68.2 to 70.5)	10.3 (5.1 to 15.5)¶	2.3 (−1.5 to 6.2)	0.1 (−6.6 to 6.9)	19.2 (10.7 to 27.7)¶	0.4 (−15.0 to 15.8)	−18.7 (−23.4 to −14.0)§
Age group, yrs							
18–29	62.5 (61.3 to 63.8)	−4.2 (−7.6 to −0.7)§	9.0 (6.6 to 11.5)¶	−17.3 (−25.5 to −9.1)§	30.2 (27.7 to 32.8)¶	−14.1 (−25.4 to −2.8)§	−0.4 (−5.1 to 4.4)
30–49	71.2 (70.3 to 72.1)	1.1 (−1.4 to 3.6)	9.0 (7.1 to 10.8)¶	−15.7 (−21.5 to −10.0)§	24.3 (22.5 to 26.1)¶	3.0 (−4.8 to 10.7)	−8.9 (−12.7 to −5.2)§
50–64	83.0 (82.2 to 83.8)	5.6 (3.6 to 7.6)¶	7.6 (5.8 to 9.4)¶	−14.7 (−22.4 to −7.1)§	15.1 (13.9 to 16.3)¶	10.4 (5.4 to 15.4)¶	−12.1 (−16.5 to −7.8)§
≥65	94.1 (93.6 to 94.6)	−1.2 (−2.8 to 0.4)	1.2 (−0.2 to 2.5)	−8.4 (−18.9 to 2.2)	3.5 (1.6 to 5.4)¶	5.5 (4.6 to 6.4)¶	−2.9 (−8.2 to 2.5)
Annual household income							
Below poverty	64.8 (62.8 to 66.8)	4.8 (1.1 to 8.5)¶	15.2 (12.1 to 18.3)¶	−2.6 (−12.0 to 6.8)	29.8 (26.3 to 33.3)¶	−2.5 (−18.5 to 13.6)	−8.9 (−15.7 to −2.2)§
Above poverty, <$75,000	76.4 (75.6 to 77.2)	1.3 (−0.9 to 3.5)	4.6 (2.7 to 6.5)¶	−14.3 (−20.6 to −7.9)§	17.9 (15.7 to 20.0)¶	2.5 (−7.4 to 12.4)	−10.7 (−14.7 to −6.8)§
Above poverty, ≥$75,000	84.3 (83.7 to 84.9)	0.6 (−1.5 to 2.7)	−0.1 (−2.0 to 1.8)	−14.2 (−20.7 to −7.8)§	13.3 (12.2 to 14.5)¶	−2.5 (−10.1 to 5.1)	−8.3 (−12.0 to −4.7)§
Unknown	77.4 (76.4 to 78.3)	0.5 (−2.2 to 3.2)	2.2 (−0.2 to 4.7)	−21.4 (−29.5 to −13.2)§	15.1 (12.2 to 18.0)¶	−7.1 (−18.0 to 3.8)	−8.2 (−13.6 to −2.8)§
Health insurance							
Insured	80.7 (80.3 to 81.2)	0.0 (−1.4 to 1.3)	2.9 (1.8 to 4.1)¶	−16.2 (−20.5 to −12.0)§	15.2 (14.1 to 16.3)¶	−3.7 (−9.0 to 1.6)	−8.8 (−11.3 to −6.4)§
Not insured	53.9 (51.9 to 55.9)	4.7 (0.3 to 9.1)¶	19.3 (15.9 to 22.6)¶	−11.5 (−21.2 to −1.7)§	33.3 (27.4 to 39.2)¶	19.5 (0.5 to 38.5)¶	−13.8 (−20.1 to −7.6)§

Abbreviations: AI/AN = American Indian or Alaska Native; MSA = metropolitan statistical area; NH/OPI = Native Hawaiian or other Pacific Islander; Ref = referent group.

* Kaplan-Meier survival analysis was used to estimate vaccination coverage based on the month and year of first dose receipt; estimates reflect the cumulative percentage vaccinated as of the end of each month.

† Persons were categorized into mutually exclusive categories of race and ethnicity; persons who did not identify as Hispanic were categorized by their reported race or races.

§ Coverage is statistically significantly lower than coverage among White, non-Hispanic adults (p<0.05).

¶ Coverage is statistically significantly higher than coverage among White, non-Hispanic adults (p<0.05).

** MSA status was determined based on household reported city and county of residence and was grouped into three categories: MSA principal city (urban), MSA nonprincipal city (suburban), and non-MSA (rural). MSAs and principal cities were as defined by the U.S. Census Bureau (https://www.census.gov/programs-surveys/metro-micro.html). Non-MSA areas include urban populations not located within an MSA as well as completely rural areas.

Whereas coverage among Asian adults exceeded 75% by May 2021, coverage among Hispanic and White adults did not reach this level until 4 months later (September), and until 5 months later (October) among Black and NH/OPI adults; coverage among AI/AN and multiple or other race adults remained <75% at the end of November 2021. Slower rates of vaccination by racial and ethnic minority groups likely resulted in potentially avoidable COVID-19 mortality in the interim, particularly among populations at higher risk for severe COVID-19–related outcomes or those who had

Summary

What is already known about this topic?

Racial and ethnic minority groups have been disproportionately affected by the COVID-19 pandemic. Vaccination is effective in preventing COVID-19 infection and severe illness, and equitable vaccine administration can reduce COVID-19–related disparities.

What is added by this report?

Asian and non-Hispanic White adults had the highest COVID-19 vaccination coverage by the end of April 2021. By the end of November 2021, disparities in vaccination coverage for some racial and ethnic groups narrowed, and coverage was similar for non-Hispanic Black (78.2%), Hispanic (81.3%), Native Hawaiian and other Pacific Islander (75.7%), and non-Hispanic White (78.7%) adults.

What are the implications for public health practice?

Equitable access to and receipt of COVID-19 vaccination, including booster doses, is critical to reducing racial and ethnic disparities in vaccination.

increased occupational exposure risk because they were essential or frontline workers (*8*).

The findings in this report are subject to at least five limitations. First, response rates for NIS-ACM were relatively low (<25%), although similar to those in other NIS surveys.¶¶¶ Data were weighted to mitigate possible bias resulting from incomplete sample frame (i.e., exclusion of households with no phone service or only landline telephones) or nonresponse, but some selection bias might persist. Second, all responses were self-reported; vaccination receipt, and month and year of receipt of first dose might be subject to recall or social desirability bias. Third, the survey sampled noninstitutionalized U.S. adults; therefore, adults who were incarcerated or nursing home residents might not be represented in the sample. Fourth, although survey weights were calibrated to state-level vaccine administration data reported on CDC, NIS-ACM estimates of vaccination coverage might differ from vaccine administration data reported to CDC's COVID Data Tracker.**** Finally, race and ethnicity information was missing for 2.9% of NIS-ACM respondents, compared with approximately 25% of vaccine administration records††††; coverage estimates for certain racial and ethnic groups might differ between the two sources because of differential omission of race and ethnicity information.

Equitable access to and receipt of COVID-19 vaccination is critical to reducing persistent disparities in vaccination coverage, morbidity, and mortality by race and ethnicity (*9*). Booster doses of COVID-19 vaccine are now recommended for all adults to boost immunity and improve protection against COVID-19 (*4*). Disparities in booster dose coverage among the fully vaccinated are becoming apparent (*5*), and the strategies that were successful in reducing disparities in primary dose COVID-19 vaccination could be applied to ensure equitable booster dose coverage. Tailored efforts including community partnerships and trusted sources of information could be used to increase vaccination coverage among the groups with identified persistent disparities and can help achieve vaccination equity and prevent new disparities by race and ethnicity in booster dose coverage.

TABLE 2. COVID–19 vaccination (≥1 dose) coverage estimates* among adults aged ≥18 years, by Asian, Hispanic, and Black subgroups† — National Immunization Survey Adult COVID Module, United States, November 2021

Race and ethnicity	≥1-dose COVID-19 vaccination coverage, % (95% CI)
Asian	
Asian Indian	97.8 (96.6–98.7)
Chinese	95.2 (93.2–96.8)
Korean	94.2 (90.8–96.6)
Japanese	92.9 (88.0–96.4)
Filipino	92.4 (88.7–95.3)
Vietnamese	90.0 (84.9–94.0)
Other	86.5 (82.6–90.0)
Hispanic	
South American	90.6 (87.5–93.3)
Cuban	83.8 (77.2–89.3)
Puerto Rican	82.9 (80.6–85.1)
Central American	82.0 (78.3–85.3)
Mexican	79.3 (77.8–80.7)
Other	82.6 (79.4–85.6)
Black	
Jamaican	79.8 (73.4–85.5)
Nigerian	79.4 (72.9–85.3)
African American	77.7 (76.5–78.9)
Haitian	74.1 (62.5–84.3)
Ethiopian	73.6 (62.9–83.2)
Somali	52.6 (33.0–75.1)
Other	77.5 (73.8–81.0)

* Kaplan-Meier survival analysis was used to estimate vaccination coverage based on the month and year of first dose receipt; estimates reflect the cumulative percentage vaccinated as of the end of each month.

† Persons were categorized into mutually exclusive categories of race and ethnicity; persons who did not identify as Hispanic were categorized by their reported race or races. For persons reporting they were Asian, Black, or Hispanic, an additional question was asked to determine a more specific ethnic or racial group.

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¶¶¶ https://www.cdc.gov/vaccines/imz-managers/nis/data-tables.html

**** https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-total-admin-rate-total (Accessed May 26, 2022).

†††† https://covid.cdc.gov/covid-data-tracker/#vaccination-demographic (Accessed May 26, 2022).

References

1. Mackey K, Ayers CK, Kondo KK, et al. Racial and ethnic disparities in COVID-19–related infections, hospitalizations, and deaths: a systematic review. Ann Intern Med 2021;174:362–73. PMID:33253040 https://doi.org/10.7326/M20-6306
2. Bilal U, Jemmott JB, Schnake-Mahl A, Murphy K, Momplaisir F. Racial/ethnic and neighbourhood social vulnerability disparities in COVID-19 testing positivity, hospitalization, and in-hospital mortality in a large hospital system in Pennsylvania: a prospective study of electronic health records. Lancet Reg Health Am 2022;10:100220. PMID:35262038 https://doi.org/10.1016/j.lana.2022.100220
3. Tenforde MW, Self WH, Gaglani M, et al.; IVY Network. Effectiveness of mRNA vaccination in preventing COVID-19–associated invasive mechanical ventilation and death—United States, March 2021–January 2022. MMWR Morb Mortal Wkly Rep 2022;71:459–65. PMID:35324878 https://doi.org/10.15585/mmwr.mm7112e1
4. Mbaeyi S, Oliver SE, Collins JP, et al. The Advisory Committee on Immunization Practices' interim recommendations for additional primary and booster doses of COVID-19 vaccines—United States, 2021. MMWR Morb Mortal Wkly Rep 2021;70:1545–52. PMID:34735422 https://doi.org/10.15585/mmwr.mm7044e2
5. Fast HE, Zell E, Murthy BP, et al. Booster and additional primary dose COVID-19 vaccinations among adults aged ≥65 years—United States, August 13, 2021–November 19, 2021. MMWR Morb Mortal Wkly Rep 2021;70:1735–9. PMID:34914672 https://doi.org/10.15585/mmwr.mm7050e2
6. Truman BI, Chang MH, Moonesinghe R. Provisional COVID-19 age-adjusted death rates, by race and ethnicity—United States, 2020–2021. MMWR Morb Mortal Wkly Rep 2022;71:601–5. PMID:35482556 https://doi.org/10.15585/mmwr.mm7117e2
7. Kriss JL, Hung MC, Srivastav A, et al. Intent to receive COVID-19 vaccine and behavioral and social drivers of vaccination by race and ethnicity, National Immunization Survey Adult COVID Module—United States, October 31–December 31, 2021. Atlanta, GA: US Department of Health and Human Services, CDC; 2022. https://www.cdc.gov/vaccines/imz-managers/coverage/covidvaxview/pubs-resources/intent-receive-covid19-vaccine-behavioral-social-drivers.html
8. McClure ES, Vasudevan P, Bailey Z, Patel S, Robinson WR. Racial capitalism within public health—how occupational settings drive COVID-19 disparities. Am J Epidemiol 2020;189:1244–53. PMID:32619007 https://doi.org/10.1093/aje/kwaa126
9. Wong CA, Dowler S, Moore AF, et al. COVID-19 vaccine administration, by race and ethnicity—North Carolina, December 14, 2020–April 6, 2021. MMWR Morb Mortal Wkly Rep 2021;70:991–6. PMID:34264909 https://doi.org/10.15585/mmwr.mm7028a2

Morbidity and Mortality Weekly Report

Monkeypox Outbreak — Nine States, May 2022

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On June 3, 2022, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

On May 17, 2022, the Massachusetts Department of Public Health (MDPH) Laboratory Response Network (LRN) laboratory confirmed the presence of orthopoxvirus DNA via real-time polymerase chain reaction (PCR) from lesion swabs obtained from a Massachusetts resident. Orthopoxviruses include *Monkeypox virus*, the causative agent of monkeypox. Subsequent real-time PCR testing at CDC on May 18 confirmed that the patient was infected with the West African clade of *Monkeypox virus*. Since then, confirmed cases* have been reported by nine states. In addition, 28 countries and territories,† none of which has endemic monkeypox, have reported laboratory-confirmed cases. On May 17, CDC, in coordination with state and local jurisdictions, initiated an emergency response to identify, monitor, and investigate additional monkeypox cases in the United States. This response has included releasing a Health Alert Network (HAN) Health Advisory, developing interim public health and clinical recommendations, releasing guidance for LRN testing, hosting clinician and public health partner outreach calls, disseminating health communication messages to the public, developing protocols for use and release of medical countermeasures, and facilitating delivery of vaccine postexposure prophylaxis (PEP) and antivirals that have been stockpiled by the U.S. government for preparedness and response purposes. On May 19, a call center was established to provide guidance to states for the evaluation of possible cases of monkeypox, including recommendations for clinical diagnosis and orthopoxvirus testing. The call center also gathers information about possible cases to identify interjurisdictional linkages. As of May 31, this investigation has identified 17§ cases in the United States; most cases (16) were diagnosed in persons who identify as gay, bisexual, or men who have sex with men (MSM). Ongoing investigation suggests person-to-person community transmission, and CDC urges health departments, clinicians, and the public to remain vigilant, institute appropriate infection prevention and control measures, and notify public health authorities of suspected cases to reduce disease spread. Public health authorities are identifying cases and conducting investigations to determine possible sources and prevent further spread. This activity was reviewed by CDC and conducted consistent with applicable federal law and CDC policy.¶

Monkeypox, a zoonotic disease for which the animal reservoir is unknown (*1*), is endemic in several Central and West African countries. There are two clades of *Monkeypox virus*, West African, and Congo Basin, the latter causing more severe illness (*1*,*2*). The last United States monkeypox outbreak was secondary to imported small mammals from Ghana in 2003**; however, since monkeypox reemerged in Nigeria in 2017, isolated cases outside Africa have been reported either among persons with recent travel to Nigeria or among secondary contacts of persons with travel-associated cases (*2*,*3*). Patients with monkeypox typically experience a febrile prodrome 5–13 days after exposure (range = 4–17 days), which often includes lymphadenopathy, malaise, headache, and muscle aches; this prodrome might depend on the nature of exposure (*4*). The prodrome is followed 1–4 days later by the onset of a characteristic deep-seated, vesicular or pustular skin rash with a centrifugal distribution (Figure); the lesions are well circumscribed and often umbilicate or become confluent, progressing over time to scabs. The rash can be disseminated. Some recent cases have begun atypically, with lesions in the genital and perianal region and without subjective fever or other prodromal symptoms. For this reason, cases might be confused with more commonly seen infections such as varicella zoster or sexually transmitted infections (STIs) (e.g., genital herpes or syphilis). The case-fatality ratio for the West African clade of monkeypox is reported to be 1% and might be higher in immunocompromised persons (*1*,*5*,*6*).

* Confirmed case for this outbreak is defined as either a positive orthopoxvirus assays or *Monkeypox virus* assays. Case counts as of May 31, 2022 at 11:59 p.m. EDT.

† Argentina, Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Gibraltar, Hungary, Ireland, Israel, Italy, Malta, Mexico, Morocco, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom, and United States.

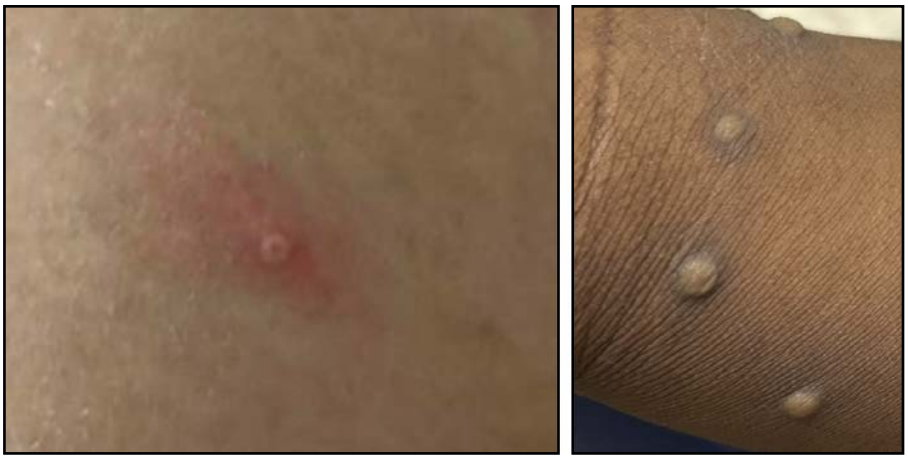
§ One case in Florida was initially identified in another country, and is not included in this report.

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

** https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5223a1.htm

A person is considered infectious from the onset of illness until all lesions have crusted over, those crusts have separated, and a fresh layer of healthy skin has formed under the crust. Human-to-human transmission occurs by direct contact with infected body fluids or lesions, via infectious fomites, or through respiratory secretions, that typically require prolonged interaction (*1*). Historically, documented reports of human-to-human transmission have been among household contacts and shared housing inhabitants (e.g., in prisons), and health care providers who have had close, sustained contact with a patient or patient fomites (e.g., bedding) (*6*,*7*).

FIGURE. Characteristic monkeypox lesions*,† — United States, May 2022



* The rash associated with monkeypox involves firm, deep-seated, and well-circumscribed vesicles or pustules, which might umbilicate or become confluent. Lesions progress over time to scabs.
† Photos used with patients' permission.

Investigation and Results

United Kingdom. The United Kingdom Health Security Agency (UKHSA) announced a confirmed monkeypox case on May 7, 2022, in a traveler returning from Nigeria. On May 14 and 16, UKHSA announced a second unrelated cluster of two cases and a third clustered group of four cases identified at sexual health clinics; the four-case cluster involved persons who identify as gay, bisexual, or MSM.

Massachusetts. On May 4, a Massachusetts resident developed an anogenital rash 3 days after returning from international travel. This rash progressed to vesicles and pustules and spread to the face and trunk; the patient sought medical care four times at outpatient clinics during May 4–12, during which time common causes were ruled out. The patient was hospitalized on May 12 for management of refractory perianal pain from the rash. Prompted by UKHSA's announcement regarding the recent monkeypox cases, clinicians notified the MDPH and CDC for testing. On May 17, the patient received a diagnosis of confirmed *Orthopoxvirus* by the Massachusetts LRN laboratory, and CDC confirmed *Monkeypox virus* West African clade the following day. The local hospital infection prevention team, MDPH, and CDC responded to identify contacts and determine exposure risk, facilitate PEP with one of two orthopoxvirus vaccines (ACAM2000[††] or JYNNEOS[§§]), and provide guidance on infection prevention and control. Outbreak case definitions were created (Table 1). Exposure risk assessment tools used during investigation of a 2021 travel-associated monkeypox case in Texas (*8*) were adapted to monitor cases and determine criteria for recommending PEP.

New York. On May 4, a traveler returning to New York City (NYC) was evaluated for an oral lesion, and a new painful, perianal rash; the patient was tested and treated for a presumed common STI and sent home. The rash spread, progressing to pustules, and the patient was seen again and treated for a different STI; all testing results were ultimately negative. On May 19, after the announcement of the monkeypox case in Massachusetts, a clinician caring for the NYC patient notified the NYC Department of Health and Mental Hygiene (NYC DOHMH) about the possibility of monkeypox. The patient received a positive orthopoxvirus test result at the NYC LRN laboratory and continued to isolate at home. NYC DOHMH began identifying contacts, determining exposure risk, and facilitating PEP for at-risk contacts.

Other U.S. states. Over the next 5 days from the identification of the NYC case, multiple states received notifications from clinicians about suspected monkeypox cases; on May 23, an incident command structure was created within CDC's National Center for Emerging and Zoonotic Infectious Diseases to respond to this outbreak. As of May 31, nine states (California, Colorado, Florida, Georgia, Massachusetts, New York, Utah, Virginia, and Washington) have reported 17 patients with confirmed orthopoxvirus infections, which until proven otherwise, are considered to be *Monkeypox virus* during this outbreak response (Supplementary Figure 1, https://stacks.cdc.gov/view/cdc/117901).

Fourteen patients of the 17 patients reported international travel involving 11 different countries during the 21 days preceding symptom onset, and 16 of the 17 patients identified as MSM. All patients were adults (average age = 40 years; range = 28–61 years), and all had rash onset dates during May 1–27; three patients were immunocompromised. Diagnosis of an orthopoxvirus infection occurred an average of 11 days after rash onset (range = 0–21 days) (Supplementary Figure 2,

[††] https://www.fda.gov/media/75792/download
[§§] https://www.fda.gov/media/131078/download

TABLE 1. Interim clinical, laboratory and epidemiologic criteria for case classification — U.S. Monkeypox Response, May 2022

Clinical and laboratory classification	Criteria
Suspected	New characteristic rash* **OR** Meets one of the epidemiologic criteria and has high clinical suspicion† for monkeypox
Probable	No suspicion of other recent orthopoxvirus exposure (e.g., *Vaccinia virus* in ACAM2000 vaccination) **AND** demonstration of the presence of • Orthopoxvirus DNA by polymerase chain reaction testing of a clinical specimen **OR** • *Orthopoxvirus* using immunohistochemical or electron microscopy testing methods **OR** • Detectable levels of antiorthopoxvirus IgM antibody during the period of 4–56 days after rash onset
Confirmed	Demonstration of the presence of *Monkeypox virus* DNA by polymerase chain reaction testing or next-generation sequencing of a clinical specimen **OR** Isolation of *Monkeypox virus* in culture from a clinical specimen
Epidemiologic classification	
Within 21 days of illness onset	Reports having contact with a person or persons with a similar appearing rash or received a diagnosis of confirmed or probable monkeypox **OR** Had close or intimate in-person contact with persons in a social network experiencing monkeypox activity, including MSM who meet partners through an online website, digital app, or social event (e.g., a bar or party) **OR** Traveled outside the United States to a country with confirmed cases of monkeypox or where *Monkeypox virus* is endemic **OR** Had contact with a dead or live wild animal or exotic pet that is an African endemic species, or used a product derived from such animals (e.g., game meat, creams, lotions, or powders)
Exclusions	
A case might be excluded as a suspect, probable or confirmed case if:	An alternative diagnosis* can fully explain the illness **OR** A person with symptoms consistent with monkeypox does not develop a rash within 5 days of illness onset **OR** A case where high-quality specimens do not demonstrate the presence of *Orthopoxvirus* or *Monkeypox virus* or antibodies to *Orthopoxvirus*

Abbreviations: IgM = immunoglobulin M; MSM = men who have sex with men.

* The characteristic rash associated with monkeypox lesions involve the following: deep-seated and well-circumscribed lesions, often with central umbilication; and lesion progression through specific sequential stages: macules, papules, vesicles, pustules, and scabs. The rash can sometimes be confused with other diseases that are more commonly encountered in clinical practice (e.g., secondary syphilis, herpes, and varicella zoster). Historically, sporadic accounts of patients co-infected with *Monkeypox virus* and other infectious agents (e.g., varicella zoster, or syphilis) have been reported, therefore patients with a characteristic rash should be considered to receive testing, even if other test results are positive.

† Clinical suspicion can exist if initial signs and symptoms are consistent with illnesses confused with monkeypox (e.g., secondary syphilis, herpes, and varicella zoster).

https://stacks.cdc.gov/view/cdc/117900). In addition to skin rash, patients commonly reported chills (12), fatigue or malaise (11), and lymphadenopathy (nine); fever was reported in seven patients (Table 2). Twelve patients reported prodromal symptoms before rash onset such as fatigue, fever, or headache. Among eight patients, the rash started in the genital or perianal area. All but one patient developed a disseminated rash, occurring on the arms, trunk, legs, and face.

Public Health Response

Currently, all patients are clinically well and being monitored by health authorities to determine the end of isolation (i.e., after all lesion scabs have fallen off, and new, healed skin has formed). One patient was treated with tecovirimat, an antiviral agent from the strategic national stockpile with antiorthopoxvirus activity, licensed for smallpox but available from CDC under an expanded access Investigational New Drug protocol (*9*). CDC also facilitated the availability of vaccine PEP to contacts with high-risk exposures (e.g., unprotected contact with the skin or mucous membranes, lesion, or body fluids of a patient) or certain intermediate risk exposures (e.g., being within ≤6 ft of an unmasked patient for ≥3 hours without wearing, at a minimum, a surgical mask). PEP is not recommended for low or uncertain risk (e.g., health care providers entering a patient's room without eye protection). Eligible intermediate- and high-risk contacts are offered PEP with ACAM2000 or JYNNEOS vaccines.

Contact investigation is ongoing; among the 13 patients who have identified contacts, there are 56 high-, 117 intermediate-, and 235 low- or uncertain-risk contacts. Contacts are recommended to be monitored for signs and symptoms consistent with monkeypox (e.g., fever, chills, lymphadenopathy, and rash) for 21 days following last exposure.

Genome sequencing results from virus recovered from the patient in Massachusetts display similarities to other published genomes in this outbreak from Europe (Nextstrain/monkeypox)¶¶ and are related to the 2017–2018 monkeypox outbreak in Nigeria. As of June 2, preliminary data indicates approximately

¶¶ https://nextstrain.org/monkeypox

TABLE 2. Clinical characteristics of patients with confirmed orthopoxvirus and monkeypox (N = 17) — United States, May 2022*

Characteristic	No. (%)		
	At illness onset	Prodromal period†	At any point in illness
Signs and symptoms§ during illness			
Rash	5 (29)	NA	17 (100)
Fatigue or malaise	3 (18)	13 (76)	13 (76)
Chills	0 (—)	4 (24)	12 (71)
Lymphadenopathy	0 (—)	1 (6)	9 (53)
Inguinal	0 (—)	0 (—)	6 (35)
Cervical¶	0 (—)	1 (6)	3 (18)
Headache	2 (12)	5 (29)	8 (47)
Fever	6 (35)	5 (29)	7 (41)
Body ache	1 (6)	2 (12)	6 (35)
Sore throat or cough	2 (12)	3 (18)	5 (29)
Sweat	1 (6)	2 (12)	4 (24)
Other	3 (18)	4 (24)	13 (76)
Rash locations§			
Arm	4 (24)	NA	9 (53)
Trunk	1 (6)	NA	9 (53)
Leg	0 (—)	NA	8 (47)
Face	2 (12)	NA	7 (41)
Hand	1 (6)	NA	6 (35)
Perianal	5 (29)	NA	6 (35)
Oral	0 (—)	NA	5 (29)
Neck	1 (6)	NA	5 (29)
Genital (penis or vagina)	4 (24)	NA	4 (24)
Feet	1 (6)	NA	4 (24)

Abbreviation: NA = not applicable.
* Data final through May 31, 2022, 11:59 p.m EDT.
† Any symptoms before rash onset. The development of initial symptoms (e.g., fever, malaise, headache, and weakness) marks the beginning of the prodromal period.
§ Multiple response options possible per patient.
¶ In one patient it was unclear when cervical lymphadenopathy occurred in relation to rash.

800 monkeypox cases have been reported in this outbreak from 28 countries, including the United States.***

Discussion

The current identification of monkeypox clusters in several countries that do not have endemic disease and involving patients with no direct travel history to an area with endemic monkeypox suggests person-to-person community spread. Close contact with infected persons or fomites (e.g., shared linens) is the most significant risk factor for *Monkeypox virus* infection in human monkeypox outbreaks (*10*). *Monkeypox virus* is spread through close, often sustained skin-to-skin contact, but the initial appearance or occurrence of lesions in the anogenital area observed in the current outbreak differs from the typical appearance or occurrence beginning on the face, oral mucosa, and hands and feet, then spreading to other parts of the body in a centrifugal distribution. The high proportion of initial cases diagnosed in this outbreak in persons who identify as gay, bisexual, or other MSM, might simply reflect an early introduction of monkeypox into interconnected social networks; this finding might also reflect ascertainment bias because of strong, established relationships between some MSM and clinical providers with robust STI services and broad knowledge of infectious diseases, including uncommon conditions. However, infections are often not confined to certain geographies or population groups; because close physical contact with infected persons can spread monkeypox, any person, irrespective of gender or sexual orientation, can acquire and spread monkeypox.

The following measures can be taken by the public to prevent infection with monkeypox: 1) isolate ill persons from uninfected persons; 2) practice good hand hygiene and use appropriate personal protective equipment to protect household members if ill or caring for ill persons at home (e.g., a surgical mask, long sleeves and pants, and disposable gloves); 3) use an Environmental Protection Agency–registered disinfectant with an emerging viral pathogens claim that is found on EPA's List Q for disinfection of surfaces.††† Patients should also avoid contact with pets and other animals while infectious, because some mammals might be susceptible to monkeypox. Persons with symptoms of monkeypox, including unexplained lesions, should contact their health care provider for an evaluation and should avoid close contact with others, including intimate or sexual contact, until they are evaluated or receive testing.

CDC urges health care providers in the United States to be alert for patients who have rash illnesses consistent with monkeypox, regardless of a patient's gender or sexual orientation or a history of international travel or specific risk factors for monkeypox. Clinicians should contact their local or state

Summary

What is already known about this topic?

Monkeypox, a rare disease caused by infection with *Monkeypox virus*, is endemic in several Central and West African countries. Cases in persons outside Africa are often linked to international travel or imported animals.

What is added by this report?

CDC is tracking multiple reported U.S. monkeypox cases, and monitoring cases in persons in countries without endemic monkeypox and with no known travel links to an endemic area; current epidemiology suggests person-to-person community spread.

What are the implications for public health practice?

CDC urges health departments, clinicians, and the public to remain vigilant, institute appropriate infection prevention and control measures, and notify public health authorities of suspected cases to reduce disease spread.

*** Sources include publicly available information from official government or government affiliated websites and verified media information quoting health officials.

††† https://www.epa.gov/pesticide-registration/disinfectants-emerging-viral-pathogens-evps-list-q

health department if they suspect a case of monkeypox. There are 110 LRN laboratories available and equipped for rapid diagnostic testing of emerging pathogens across the United States; currently 68 test for orthopoxviruses. The prolonged interval from rash onset to positive test result was reflective of delays in clinical suspicion of an unfamiliar illness; all patients had results within 0–2 days after specimens were collected. During this outbreak, a positive test result for an *Orthopoxvirus* at an LRN laboratory is presumed to be monkeypox and is actionable for antiorthopoxviral treatment, and by public health authorities to initiate isolation, contact tracing, monitoring, investigation, and PEP of exposed contacts. PEP with smallpox vaccines remains available from the strategic national stockpile for eligible exposed persons.

As the source and spread of this outbreak are being investigated, it is crucial to assess all possible modes of transmission and identify risk groups, as well as institute appropriate public health preventive measures. CDC is providing guidance on case definitions, identification of contacts, clinical management, and infection control and prevention within health care facilities and the home, creating resources for disseminating information on monkeypox, and supporting laboratory testing infrastructure domestically and globally.[§§§]

[§§§] https://www.cdc.gov/poxvirus/monkeypox/index.html

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References

1. McCollum AM, Damon IK. Human monkeypox. Clin Infect Dis 2014;58:260–7. PMID:24158414 https://doi.org/10.1093/cid/cit703
2. Mauldin MR, McCollum AM, Nakazawa YJ, et al. Exportation of monkeypox virus from the African continent. J Infect Dis 2022;225:1367–76. PMID:32880628 https://doi.org/10.1093/infdis/jiaa559
3. Eteng W-E, Mandra A, Doty J, et al. Notes from the field: responding to an outbreak of monkeypox using the one health approach—Nigeria, 2017–2018. MMWR Morb Mortal Wkly Rep 2018;67:1040–1. PMID:30235181 https://doi.org/10.15585/mmwr.mm6737a5
4. Reynolds MG, Yorita KL, Kuehnert MJ, et al. Clinical manifestations of human monkeypox influenced by route of infection. J Infect Dis 2006;194:773–80. PMID:16941343 https://doi.org/10.1086/505880
5. Durski KN, McCollum AM, Nakazawa Y, et al. Emergence of monkeypox—west and central Africa, 1970–2017. MMWR Morb Mortal Wkly Rep 2018;67:306–10. PMID:29543790 https://doi.org/10.15585/mmwr.mm6710a5
6. Yinka-Ogunleye A, Aruna O, Dalhat M, et al.; CDC Monkeypox Outbreak Team. Outbreak of human monkeypox in Nigeria in 2017–18: a clinical and epidemiological report. Lancet Infect Dis 2019;19:872–9. PMID:31285143 https://doi.org/10.1016/S1473-3099(19)30294-4
7. Vaughan A, Aarons E, Astbury J, et al. Human-to-human transmission of monkeypox virus, United Kingdom, October 2018. Emerg Infect Dis 2020;26:782–5. PMID:32023204 https://doi.org/10.3201/eid2604.191164
8. Rao AK, Schulte J, Chen T-H, et al.; July 2021 Monkeypox Response Team. Monkeypox in a traveler returning from Nigeria—Dallas, Texas, July 2021. MMWR Morb Mortal Wkly Rep 2022;71:509–16. PMID:35389974 https://doi.org/10.15585/mmwr.mm7114a1
9. Merchlinsky M, Albright A, Olson V, et al. The development and approval of tecoviromat (TPOXX®), the first antiviral against smallpox. Antiviral Res 2019;168:168–74. PMID:31181284 https://doi.org/10.1016/j.antiviral.2019.06.005
10. Fleischauer AT, Kile JC, Davidson M, et al. Evaluation of human-to-human transmission of monkeypox from infected patients to health care workers. Clin Infect Dis 2005;40:689–94. PMID:15714414 https://doi.org/10.1086/427805

Ventilation Improvement Strategies Among K–12 Public Schools — The National School COVID-19 Prevention Study, United States, February 14–March 27, 2022

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Effective COVID-19 prevention in kindergarten through grade 12 (K–12) schools requires multicomponent prevention strategies in school buildings and school-based transportation, including improving ventilation (*1*). Improved ventilation can reduce the concentration of infectious aerosols and duration of potential exposures (*2*,*3*), is linked to lower COVID-19 incidence (*4*), and can offer other health-related benefits (e.g., better measures of respiratory health, such as reduced allergy symptoms) (*5*). Whereas ambient wind currents effectively dissipate SARS-CoV-2 (the virus that causes COVID-19) outdoors,* ventilation systems provide protective airflow and filtration indoors (*6*). CDC examined reported ventilation improvement strategies among a nationally representative sample of K–12 public schools in the United States using wave 4 (February 14–March 27, 2022) data from the National School COVID-19 Prevention Study (NSCPS) (420 schools), a web-based survey administered to school-level administrators beginning in summer 2021.† The most frequently reported ventilation improvement strategies were lower-cost strategies, including relocating activities outdoors (73.6%), inspecting and validating existing heating, ventilation and air conditioning (HVAC) systems (70.5%), and opening doors (67.3%) or windows (67.2%) when safe to do so. A smaller proportion of schools reported more resource-intensive strategies such as replacing or upgrading HVAC systems (38.5%) or using high-efficiency particulate air (HEPA) filtration systems in classrooms (28.2%) or eating areas (29.8%). Rural and mid-poverty–level schools were less likely to report several resource-intensive strategies. For example, rural schools were less likely to use portable HEPA filtration systems in classrooms (15.6%) than were city (37.7%) and suburban schools (32.9%), and mid-poverty–level schools were less likely than were high-poverty–level schools to have replaced or upgraded HVAC systems (32.4% versus 48.8%). Substantial federal resources to improve ventilation in schools are available.§ Ensuring their use might reduce SARS-CoV-2 transmission in schools. Focusing support on schools least likely to have resource-intensive ventilation strategies might facilitate equitable implementation of ventilation improvements.

NSCPS is an ongoing population-based, longitudinal study that explores implementation and effectiveness of COVID-19 prevention strategies in a representative sample of U.S. K–12 public schools. The sampling frame consists of all public schools in the 50 states and the District of Columbia and includes a combination of Common Core Data from the National Center for Education Statistics (NCES) and Market Data Retrieval database.¶,** A web-based survey is administered to school administrators (e.g., principals) or school-level designees familiar with COVID-19 prevention strategies (e.g., nurses) at the eligible school. Recruitment involves emails and telephone calls to potential participants at eligible schools. A stratified random sample of schools by region, school level, and NCES locale is conducted.†† The final sample includes 1,602 schools.§§

* https://www.medrxiv.org/content/10.1101/2020.10.03.20206110v6

† https://www.cdc.gov/healthyyouth/data/nscps/index.htm

§ Federal funding for ventilation improvements in schools includes the U.S. Department of Education's Elementary and Secondary School Emergency Relief Fund (https://oese.ed.gov/offices/education-stabilization-fund/elementary-secondary-school-emergency-relief-fund/), the Governor's Emergency Education Relief Fund (https://oese.ed.gov/offices/education-stabilization-fund/governors-emergency-education-relief-fund/), the U.S. Department of Health and Humans Services' FY 2021 American Rescue Plan Funding Increase for Head Start Programs funds (https://eclkc.ohs.acf.hhs.gov/policy/pi/acf-pi-hs-21-03), and the Epidemiology and Laboratory Capacity for Prevention and Control of Emerging Infectious Diseases Reopening Schools supplement (https://www.cdc.gov/ncezid/dpei/elc/covid-response/index.html).

¶ The following types of schools were excluded from the sampling frame: private, alternative, those run by the U.S. Department of Defense, and those with fewer than 30 students. In addition, schools providing services to a "pull-out" population in another eligible school were excluded from the sampling frame; for example, if students from an eligible school received specific vocational or educational services at a different school for a portion of the day, the latter school would not be included in the sampling frame.

** The Market Data Retrieval database provides information about individual U.S. schools, collating data from various other sources. https://mdreducation.com

†† A stratified random sample of schools was conducted using strata defined by U.S. Census region (Northeast, Midwest, South, and West), school level (elementary, middle, and high), and NCES locale (city, town, suburb, and rural). School level was categorized as elementary (included any grade from kindergarten through grade 4), middle (included either grade 7 or 8), or high (included any grade from 10 through 12). Schools assigned to more than one core level (e.g., K–8) were considered separate schools for sampling purposes.

§§ The first wave of data collection was administered during June–September 2021 to a subset of 600 schools and focused on the 2020–21 school year. The subsequent four waves of data collection, including wave 4 analyzed in this report, focus on the 2021–22 school year with a sample of 1,602 schools.

Data from survey wave 4 (420 schools; response rate = 26%), collected during February 14–March 27, 2022, were weighted to account for nonresponse and design strata. This study examined 11 ventilation improvement strategies in schools and on school-based transportation. The percentage of students eligible for free or reduced-priced meals during 2019–20 served as a proxy for school poverty level (*7*). Low-, mid-, and high-poverty schools were defined as schools with ≤25%, 26%–75%, and ≥76% of students, respectively, eligible for free or reduced-priced meals.[¶¶] School locale was categorized as city, suburban, town, or rural according to NCES.[***]

Weighted percentages (with 95% CIs) of ventilation improvement strategies among K–12 public schools, including by locale and school poverty level, were estimated. Chi-square tests were used to test for differences in the percentage of schools reporting each ventilation strategy by school-level characteristics; p-values <0.05 were considered statistically significant. Analyses were conducted using R (version 4.1.2; R Foundation). This activity was reviewed by CDC and conducted consistent with applicable federal law and CDC policy.[†††] The study was reviewed and approved by ICF's Institutional Review Board.[§§§]

Among 11 ventilation improvement strategies assessed, the four most frequently reported were relocating activities outdoors when possible (73.6%), having existing HVAC systems inspected and validated since the start of the pandemic (70.5%), and opening doors (67.3%) and windows (67.2%) when safe to do so (Table 1). The least frequently reported strategies were using portable HEPA filtration systems in classrooms (28.2%), using HEPA filtration systems in areas where students eat (29.8%), using portable HEPA filtration systems for high-risk areas (32.8%), using fans to increase effectiveness of windows opened when safe to do so (37.0%), and having replaced or upgraded HVAC systems since the beginning of the pandemic (38.5%).

Six ventilation strategies significantly differed by locale (Table 2).[¶¶¶] City schools were less likely to report opening windows when safe to do so (53.9%) than were suburban (69.5%), town (75.3%), and rural (73.5%) schools; city schools also were less likely to use fans to increase effectiveness of opening windows when safe to do so (26.1%) than were town (43.0%) and rural (43.3%) schools. City schools were less likely to open windows on school buses (54.5%) than were rural schools (72.9%). Rural schools were less likely to use HEPA filtration systems in areas where students eat

[¶¶] https://nces.ed.gov/programs/coe/indicator/clb
[***] https://nces.ed.gov/programs/edge/Geographic/LocaleBoundaries
[†††] 5 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.
[§§§] https://www.icf.com

[¶¶¶] Chi-square tests were used to identify differences in each ventilation strategy by NCES locale and school poverty level. Even when p-values were <0.05, 95% CIs for percentages by subgroup might overlap because of varying underlying statistical assumptions of chi-square tests compared with examining overlap of 95% CIs when determining statistical significance.

TABLE 1. Strategies to improve ventilation in U.S. kindergarten through grade 12 public schools (N = 420) — National School COVID-19 Prevention Study, wave 4, United States, February 14–March 27, 2022

Strategies (no.)[†]	% (95% CI)*		
	Yes	No	Don't know
Implemented since the start of the COVID-19 pandemic[§]			
Inspected and validated existing HVAC systems for cleanliness, function, and code-compliant operation (403)	70.5 (65.6–75.1)	7.1 (4.8–10.5)	22.3 (18.3–26.9)
Replaced/Upgraded HVAC systems (403)	38.5 (33.6–43.6)	33.9 (29.1–39.0)	27.7 (23.4–32.4)
Implemented currently[¶]			
Open doors to hallway or outside when safe to do so (403)	67.3 (62.3–71.9)	29.4 (24.9–34.4)	3.3 (1.9–5.8)
Open windows when safe to do so (404)	67.2 (62.2–71.8)	29.5 (24.9–34.6)	3.3 (1.9–5.7)
Use fans to increase effectiveness of open windows when safe to do so (404)	37.0 (32.1–42.1)	57.3 (52.1–62.4)	5.7 (3.7–8.6)
Relocate activities to outdoors when possible (404)	73.6 (68.7–78.0)	23.3 (19.0–28.3)	—**
Increase ventilation in areas where students eat (403)	43.0 (37.9–48.3)	46.6 (41.2–52.1)	10.4 (7.8–13.7)
Use HEPA filtration systems in areas where students eat (402)	29.8 (25.2–34.8)	48.6 (43.3–54.0)	21.6 (17.7–26.0)
Use portable HEPA filtration systems in classrooms (404)	28.2 (24.0–32.8)	58.2 (53.1–63.1)	13.6 (10.5–17.6)
Use portable HEPA filtration systems for high-risk areas[††] (403)	32.8 (28.0–38.0)	54.0 (48.7–59.2)	13.2 (10.0–17.2)
Open windows on school buses (361)	63.6 (58.1–68.7)	8.9 (6.4–12.3)	27.5 (22.9–32.8)

Abbreviations: HEPA = high-efficiency particulate air; HVAC = heating, ventilation, and air conditioning.
* Weighted percentages and 95% CIs are presented for each category. The following responses were categorized as missing and excluded from analyses: "Not applicable, my school has been virtual since the start of the pandemic" for survey questions assessing ventilation strategies implemented since the start of the COVID-19 pandemic; "Not applicable, my school is currently virtual" for survey questions assessing ventilation strategies implemented currently; and "Not applicable, our school does not use school buses" for strategies to improve ventilation in school-based transportation.
† Unweighted count of schools with available data for each ventilation strategy.
§ Respondents were asked whether their school had implemented this measure "since the start of the COVID-19 pandemic."
¶ Respondents were asked whether their school currently has this measure in place.
** Estimate was suppressed because the relative SE was >30%.
†† Examples include nurse's office, isolation areas, or rooms where mask guidance is less likely to be followed.

TABLE 2. Strategies to improve ventilation in kindergarten through grade 12 public schools by locale (N = 420) — National School COVID-19 Prevention Study, wave 4, United States, February 14–March 27, 2022

Strategies (no.)[¶]	NCES school locale,[*,†] % (95% CI)[§]			
	City	Suburb	Town	Rural
Strategies implemented since the start of the COVID-19 pandemic**				
Inspected/Validated existing HVAC systems for cleanliness, function, and code-compliant operation (364)	72.1 (61.6–80.6)	76.4 (66.4–84.2)	67.5 (54.3–78.4)	65.6 (54.8–74.9)
Replaced/Upgraded HVAC systems (364)	42.8 (32.1–54.2)	42.8 (34.4–51.5)	39.2 (25.7–54.6)	29.7 (20.6–40.9)
Strategies implemented currently[††]				
Open doors to hallway or outside when safe to do so (364)	63.4 (51.7–73.7)	63.8 (54.7–72.1)	63.8 (49.8–75.8)	73.2 (62.7–81.5)
Open windows when safe to do so (365)[§§,¶¶,***]	53.9 (42.8–64.6)	69.5 (60.3–77.5)	75.3 (60.2–86.0)	73.5 (63.1–81.8)
Use fans to increase effectiveness of open windows when safe to do so (365)[§§,***]	26.1 (17.4–37.2)	35.3 (26.2–45.5)	43.0 (30.2–56.9)	43.3 (34.0–53.1)
Relocate activities to outdoors when possible (365)	70.7 (59.2–80.1)	77.9 (68.1–85.3)	70.5 (58.9–79.9)	71.0 (60.7–79.6)
Increase ventilation in areas where students eat (364)	45.4 (34.4–56.9)	48.3 (38.8–57.9)	44.2 (31.7–57.4)	36.2 (26.1–47.7)
Use HEPA filtration systems in areas where students eat (363)[§§,†††]	33.4 (23.1–45.5)	33.2 (25.0–42.5)	27.4 (15.7–43.3)	19.1 (12.4–28.3)
Use portable HEPA filtration systems in classrooms (365)[§§,†††]	37.7 (28.2–48.4)	32.9 (25.1–41.7)	22.8 (13.4–36.1)	15.6 (9.7–24.0)
Use portable HEPA filtration systems for high-risk areas§§§ (364)[§§]	44.7 (33.2–56.8)	34.1 (25.6–43.8)	35.3 (22.8–50.2)	22.0 (14.3–32.3)
Open windows on school buses (325)[§§]	54.5 (41.4–66.9)	60.1 (49.9–69.5)	64.4 (50.1–76.5)	72.9 (62.8–81.0)

Abbreviations: HEPA = high-efficiency particulate air; HVAC = heating, ventilation, and air conditioning; NCES = National Center for Education Statistics.

* School locale was categorized based on the NCES locale classification scheme into four categories: city, suburb, town, or rural. https://nces.ed.gov/programs/edge/Geographic/LocaleBoundaries

† No significant differences between rural versus town and suburb versus town schools were noted based on chi-square test (p>0.05).

§ Weighted percentages and 95% CIs of respondents indicating "yes" for each ventilation measure is reported. Respondents who indicated "no" or "don't know" for each ventilation measure are combined and included in the denominator. The following responses were categorized as missing and excluded from analyses: "Not applicable, my school has been virtual since the start of the pandemic" for survey questions assessing ventilation strategies implemented since the start of the COVID-19 pandemic; "Not applicable, my school is currently virtual" for survey questions assessing ventilation strategies implemented currently; and "Not applicable, our school does not use school buses" for strategies to improve ventilation in school-based transportation.

¶ Unweighted count of schools with available data for each ventilation strategy and NCES school locale.

** Respondents were asked whether their school had implemented this measure "since the start of the COVID-19 pandemic."

†† Respondents were asked whether their school currently had this measure in place.

§§ City schools differed significantly from rural schools based on chi-square test (p<0.05).

¶¶ Suburb schools differed significantly from city schools based on chi-square test (p<0.05).

*** City schools differed significantly from town schools based on chi-square test (p<0.05).

††† Suburb schools differed significantly from rural schools based on chi-square test (p<0.05).

§§§ Examples include nurse's office, isolation areas, or rooms where mask guidance is less likely to be followed.

(19.1%) or to use portable HEPA filtration systems in classrooms (15.6%) than were city (33.4% and 37.7%, respectively) and suburban schools (33.2% and 32.9%, respectively). Rural schools were less likely than were city schools to use portable HEPA filtration systems for high-risk areas (22.0% versus 44.7%).

Six ventilation strategies significantly differed by school poverty level (Table 3). Mid-poverty schools were less likely than were low-poverty schools to have inspected and validated existing HVAC systems (66.0% versus 83.0%). Mid-poverty schools were less likely than were high-poverty schools to have replaced or upgraded HVAC systems (32.4% versus 48.8%), relocated activities outdoors when possible (69.1% versus 83.0%), and increased ventilation in areas where students eat (37.8% versus 55.4%). Mid-poverty schools were less likely to use portable HEPA filtration systems in classrooms (20.5%) and use portable HEPA filtration systems for high-risk areas (24.1%) than were low-poverty (43.8% and 49.8%, respectively) and high-poverty schools (36.0% and 44.7%, respectively).

Discussion

These findings show differences in schools' reported ventilation improvement strategies by school characteristics, including NCES locale and school poverty-level status. The study also found strategies that could be easily and affordably implemented (e.g., opening doors or windows when safe to do so) were among those most frequently reported and did not vary significantly by school poverty level. City schools were least likely to report strategies related to opening windows when safe to do so and might experience unique challenges that prohibit opening windows, including air and noise pollution, and limitations of the building (e.g., windows that cannot be opened). CDC's COVID-19 guidance for schools (*1*) and for improving ventilation in buildings,[****] as well as ASHRAE[††††] guidance for schools and universities (*8*), emphasize numerous ways to improve ventilation, with strategies varying substantially in both financial cost and ease of implementation.[§§§§]

**** https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html

†††† Formerly known as the American Society of Heating, Refrigerating and Air-Conditioning Engineers, the organization is now known as ASHRAE.

§§§§ Ventilation strategies examined have a range of initial and operating costs. Opening windows and doors when safe to do so and relocating activities outside likely have no associated costs. The cost of using fans to increase the effectiveness of open windows when safe to do so is estimated to be <$100 per unit. The cost of adding portable HEPA filtration systems is approximately $500 per unit. Additional information about estimated costs of ventilation strategies is available on CDC's website for ventilation in buildings. https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html

TABLE 3. Strategies to improve ventilation in U.S. kindergarten through grade 12 public schools by school poverty level (N = 420) — National School COVID-19 Prevention Study, wave 4, United States, February 14–March 27, 2022

Strategies (no.)[¶]	School poverty level,[*,†] % (95% CI)[§]		
	Low	Mid	High
Strategies implemented since the start of the COVID-19 pandemic**			
Inspected and validated existing HVAC systems for cleanliness, function, and code-compliant operation (375)[††]	83.0 (70.9–90.7)	66.0 (58.6–72.7)	74.8 (64.4–83.0)
Replaced/Upgraded HVAC systems (375)[§§]	45.3 (33.1–58.0)	32.4 (26.3–39.2)	48.8 (37.0–60.6)
Strategies implemented currently[¶¶]			
Open doors to hallway or outside when safe to do so (375)	66.1 (52.9–77.2)	66.0 (59.0–72.4)	69.1 (57.1–78.9)
Open windows when safe to do so (376)	74.4 (61.6–84.0)	65.3 (58.0–72.0)	69.7 (57.6–79.5)
Use fans to increase the effectiveness of open windows when safe to do so (376)	32.8 (21.8–46.0)	37.2 (30.5–44.4)	34.6 (24.9–45.8)
Relocate activities to outdoors when possible (376)[§§]	74.6 (62.1–84.0)	69.1 (61.7–75.6)	83.0 (71.8–90.4)
Increase ventilation in areas where students eat (376)[§§]	42.1 (30.3–54.9)	37.8 (31.1–45.0)	55.4 (43.0–67.1)
Use HEPA filtration systems in areas where students eat (375)	36.5 (25.3–49.3)	24.8 (19.2–31.4)	35.1 (24.8–47.1)
Use portable HEPA filtration systems in classrooms (376)[††,§§]	43.8 (31.5–56.9)	20.5 (15.7–26.4)	36.0 (25.9–47.4)
Use portable HEPA filtration systems for high-risk areas*** (376)[††,§§]	49.8 (37.0–62.6)	24.1 (18.4–30.8)	44.7 (33.1–56.9)
Open windows on school buses (338)	74.3 (59.7–84.9)	59.7 (52.3–66.6)	64.3 (52.4–74.7)

Abbreviations: FRPM = free or reduced-price meals; HEPA = high-efficiency particulate air; HVAC = heating, ventilation, and air conditioning; NCES = National Center for Education Statistics.

* The percentage of students eligible for FRPM during 2019–20 was used as a proxy for school poverty level. High-poverty schools were defined as public schools in which >75% of the students were eligible for FRPM, mid-poverty schools had 26%–75% students eligible for FRPM, and low-poverty schools had ≤25% students eligible for FRPM.

† No significant differences between low- versus high-poverty schools were noted based on chi-square test (p>0.05).

§ Weighted percentages and 95% CIs of respondents indicating "yes" for each ventilation measure is reported. Respondents who indicated "no" or "don't know" for each ventilation measure are combined and included in the denominator. The following responses were categorized as missing and excluded from analyses: "Not applicable, my school has been virtual since the start of the pandemic" for survey questions assessing ventilation strategies implemented since the start of the COVID-19 pandemic; "Not applicable, my school is currently virtual" for survey questions assessing ventilation strategies implemented currently; and "Not applicable, our school does not use school buses" for strategies to improve ventilation in school-based transportation.

¶ Unweighted count of schools with available data for each ventilation strategy and school poverty level.

** Respondents were asked whether their school had implemented this measure "since the start of the COVID-19 pandemic."

†† Mid-poverty schools differed significantly from low-poverty schools based on chi-square test (p<0.05).

§§ Mid-poverty schools differed significantly from high-poverty schools based on chi-square test (p<0.05).

¶¶ Respondents were asked whether their school currently had this measure in place.

*** Examples include nurse's office, isolation areas, or rooms where mask guidance is less likely to be followed.

Summary

What is already known about this topic?

School-based strategies to improve ventilation are associated with reduced incidence of COVID-19 in schools. Substantial federal resources are available to improve ventilation in schools.

What is added by this report?

Among a nationally representative sample of U.S. K–12 public schools, higher-cost and resource-intensive ventilation improvement strategies, such as using portable high-efficiency particular air (HEPA) filtration systems in classrooms were less frequently reported. Overall, rural and mid-poverty schools were the least likely to report implementing several resource-intensive ventilation strategies.

What are the implications for public health practice?

Ensuring use of ventilation improvement resources might reduce transmission of SARS-CoV-2 and other infectious diseases in schools. Focusing support on schools least likely to have implemented resource-intensive ventilation strategies might facilitate equitable implementation.

With regard to HVAC and HEPA filtration systems, having inspected and validated existing HVAC systems was reported as the only strategy used by a majority of schools. The other strategies related to HVAC and HEPA filtration systems require additional resources with varying costs. Differences by locale and school poverty level in implementing more resource-intensive strategies might be due to supply chain challenges, differences in school or community resources, or accessibility of technical assistance and support for applying to available sources of funding. NSCPS did not provide data on the funds schools used to implement these resource-intensive strategies; however, mid-poverty schools might have been least likely to implement these strategies because higher poverty schools might have had more experience in accessing and using federal funds, and lower poverty schools might have been able to implement some of these strategies without additional government support. Despite availability of substantial federal resources to improve ventilation in schools, findings suggest that additional efforts might be needed to ensure that all schools successfully access and use resources for ventilation improvements, particularly schools least likely to report using resource-intensive ventilation strategies (i.e., rural and mid-poverty schools). Public health professionals and funding agencies can support state and local education agencies and school districts by raising awareness about funding sources and

ensuring their equitable distribution. Supplemental training and technical assistance can help schools identify and access applicable funding and understand what types of strategies can improve ventilation.

Strategies to improve ventilation are integral to CDC's guidance for COVID-19 prevention in schools (*1*). Schools can work with local public health officials and monitor CDC COVID-19 community levels[¶¶¶¶] to determine which prevention strategies might be needed based on their local context. Schools can put in place a core set of infectious disease prevention strategies, including optimizing ventilation and improving indoor air quality as part of normal operations. The addition of COVID-19–specific prevention strategies, including those that increase outdoor air intake and improve air filtration, can be tied to CDC COVID-19 community levels (*1*). In addition to preventing spread of COVID-19 and other infections, such as influenza (*9*), ventilation improvements implemented now might lead to broader and lasting improvements in the health of students and staff members. For example, improved ventilation has been linked to better measures of respiratory health (e.g., allergy symptoms), higher student performance, and decreased student absenteeism (*5*).

The findings in this report are subject to at least five limitations. First, presence of ventilation improvement strategies was assessed through a self-report survey, and responses might be influenced by social desirability bias or respondents' level of awareness of ventilation-related strategies at the school. Second, ascertaining the knowledge and training of persons who completed the survey was not possible, and this might vary by school characteristics. Third, the survey response rate was low (26%); however, nonresponse weight adjustments were incorporated into analyses. Fourth, this study only identified respondents' reports of strategies implemented to improve ventilation; it did not include direct measurements of the impact of those strategies (e.g., increased air flow). Finally, appropriate ventilation improvements likely vary by seasonality, environment, building type, and safety-related concerns; this study was not able to account for these distinctions.

Ventilation is a key strategy recommended to reduce COVID-19 spread in school settings. Ensuring use of ventilation improvement resources might reduce SARS-CoV-2 transmission in schools and also prevent transmission of other infectious diseases and lead to broader improvements in the health of students and staff members. Public health professionals can focus support on schools least likely to report using resource-intensive ventilation strategies to ensure more equitable implementation of ventilation strategies to reduce SARS-CoV-2 transmission.

[¶¶¶¶] https://www.cdc.gov/coronavirus/2019-ncov/science/community-levels.html

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References

1. CDC. Operational guidance for K–12 schools and early care and education programs to support safe in-person learning. Atlanta, GA: US Department of Health and Human Services, CDC; 2022. Accessed May 31, 2022. https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-childcare-guidance.html
2. Lindsley WG, Derk RC, Coyle JP, et al. Efficacy of portable air cleaners and masking for reducing indoor exposure to simulated exhaled SARS-CoV-2 aerosols—United States, 2021. MMWR Morb Mortal Wkly Rep 2021;70:972–6. PMID:34237047 https://doi.org/10.15585/mmwr.mm7027e1
3. Curtius J, Granzin M, Schrod J. Testing mobile air purifiers in a school classroom: reducing the airborne transmission risk for SARS-CoV-2. Aerosol Sci Technol 2021;55:586–99. https://doi.org/10.1080/02786826.2021.1877257
4. Gettings J, Czarnik M, Morris E, et al. Mask use and ventilation improvements to reduce COVID-19 incidence in elementary schools—Georgia, November 16–December 11, 2020. MMWR Morb Mortal Wkly Rep 2021;70:779–84. PMID:34043610 https://doi.org/10.15585/mmwr.mm7021e1
5. Fisk WJ. The ventilation problem in schools: literature review. Indoor Air 2017;27:1039–51. PMID:28683161 https://doi.org/10.1111/ina.12403
6. Somsen GA, van Rijn C, Kooij S, Bem RA, Bonn D. Small droplet aerosols in poorly ventilated spaces and SARS-CoV-2 transmission. Lancet Respir Med 2020;8:658–9. PMID:32473123 https://doi.org/10.1016/S2213-2600(20)30245-9
7. Underwood JM, Pampati S, Everett Jones S, et al. School-level poverty and rurality associated with differences in sexual risk behaviors among US public high school students. J Adolesc Health 2021;69:964–9. PMID:34304989 https://doi.org/10.1016/j.jadohealth.2021.06.005

8. ASHRAE. ASHRAE epidemic task force: schools and universities, updated 5–14–2021. Peachtree Corners, GA: ASHRAE; 2021. Accessed April 30, 2022. https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-reopening-schools-and-universities-c19-guidance.pdf

9. Li Y, Leung GM, Tang JW, et al. Role of ventilation in airborne transmission of infectious agents in the built environment - a multidisciplinary systematic review. Indoor Air 2007;17:2–18. PMID:17257148 https://doi.org/10.1111/j.1600-0668.2006.00445.x

Notes from the Field

Initial Outbreak Response Activity Following Wild Poliovirus Type 1 Detection — Malawi, February 2022

Malawi Ministry of Health; Global Polio Eradication Initiative; Elizabeth Davlantes, MD[1]

Since the Global Polio Eradication Initiative (GPEI) began in 1988, the number of wild poliovirus (WPV) cases has decreased by >99.99%, and five of the six World Health Organization (WHO) regions are now certified WPV-free.* WPV serotypes 2 and 3 have been declared eradicated (*1*), and WPV type 1 (WPV1) is currently endemic only in Pakistan and Afghanistan in the WHO's Eastern Mediterranean Region (*2*,*3*).

The WHO African Region was certified free of indigenous WPV transmission on August 25, 2020 (*4*). Approximately 18 months later on February 16, 2022, a paralytic WPV1 case was confirmed in a child aged 3 years residing in Lilongwe, Malawi, in southeastern Africa, with paralysis onset November 19, 2021. The affected child had no history of travel or contact with anyone who had traveled internationally and had received only 1 of 5 doses of poliovirus vaccine recommended by the Malawi Ministry of Health through routine childhood immunization services. Genomic sequence analysis of the isolated poliovirus indicated that its closest relative was a WPV1 lineage isolated from samples taken in Sindh Province, Pakistan, in October 2019. Before this detection in Malawi, the last WPV1 case in Africa had been reported in Nigeria in 2016 (*4*).

Within 24 hours of virus identification, the president of Malawi declared a public health emergency and activated the country's emergency operations center. Within 3 days of case confirmation, a team of GPEI partners had arrived in Malawi to support the Ministry of Health in strengthening acute flaccid paralysis surveillance, reeducating local clinicians and public health professionals, and organizing nationwide outbreak response supplementary immunization activities (SIAs) to reach 2.9 million children aged <5 years with bivalent oral poliovirus vaccine (bOPV, containing Sabin strain serotypes 1 and 3). The first nationwide bOPV outbreak response SIA began on March 21, 2022, and additional nationwide SIAs are planned over the coming months.

In addition, GPEI has engaged with the countries surrounding Malawi to increase their preparedness for potential cross-border spread of the virus. Until polio is eradicated worldwide, all countries must be vigilant against importation of polio and reestablishment of local transmission. GPEI teams have worked closely with the Ministries of Health in Mozambique, Tanzania, and Zambia to strengthen surveillance and support implementation of subnational bOPV SIAs in areas bordering Malawi (Figure). The coordinated campaigns began on March 24, 2022, targeting 6.4 million children aged <5 years. Subsequent nationwide SIAs are planned in these neighboring countries, as well as in Zimbabwe.

An additional case of paralytic WPV1 was detected in Tete Province, Mozambique, on April 1, 2022, with paralysis onset March 25, 2022. Existing response efforts are being modified to address this case in addition to the case in Malawi.

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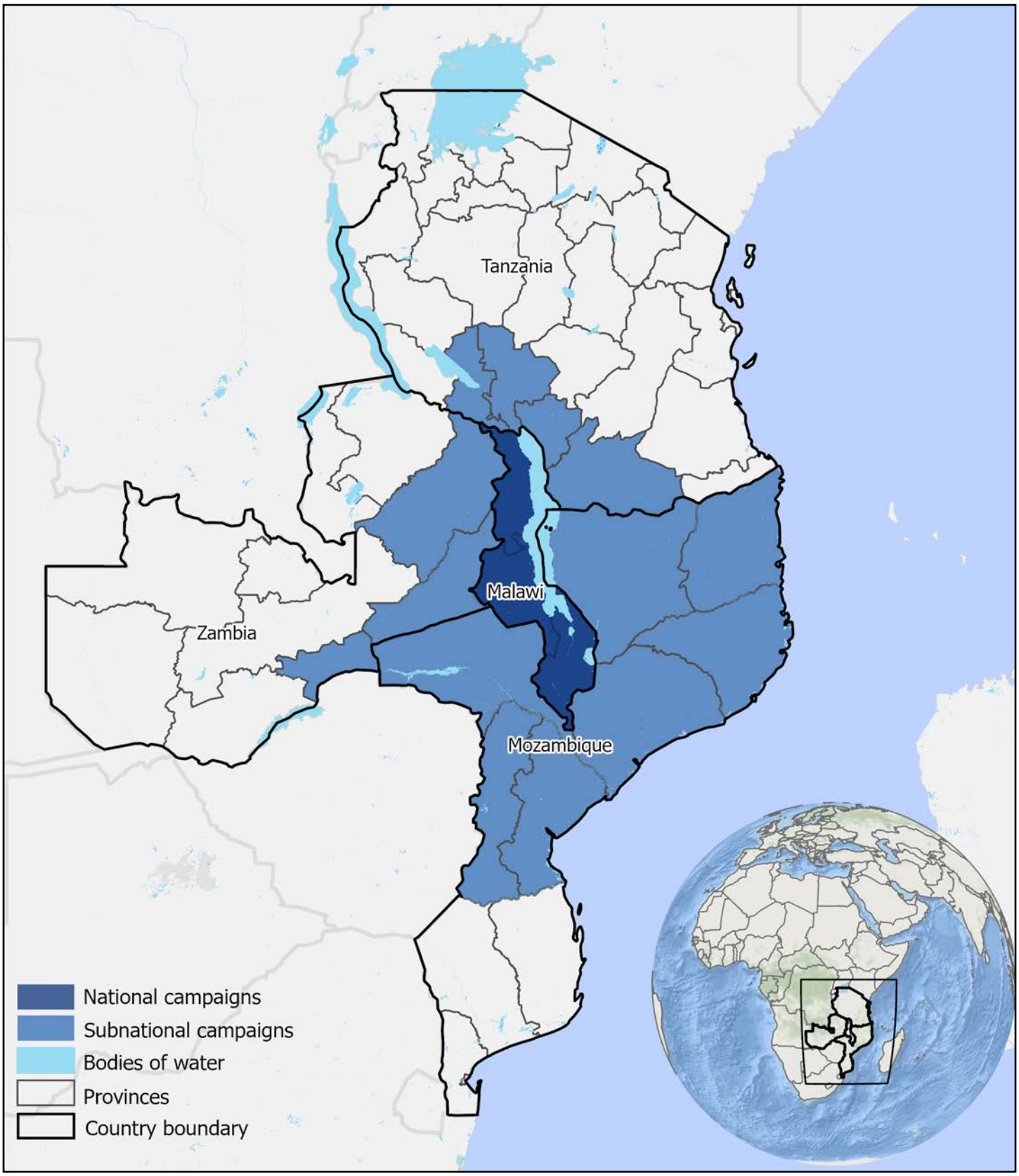
References

1. Bigouette JP, Wilkinson AL, Tallis G, Burns CC, Wassilak SGF, Vertefeuille JF. Progress toward polio eradication—worldwide, January 2919–June 2021. MMWR Morb Mortal Wkly Rep 2021;70:1129–35. PMID:34437527 https://doi.org/10.15585/mmwr.mm7034a1
2. Cousins S. Polio in Afghanistan: a changing landscape. Lancet 2021;397:84–5. PMID:33422251 https://doi.org/10.1016/S0140-6736(21)00030-1
3. Mbaeyi C, Baig S, Khan Z, et al. Progress toward poliomyelitis eradication—Pakistan, January 2020–July 2021. MMWR Morb Mortal Wkly Rep 2021;70:1359–64. PMID:34591827 https://doi.org/10.15585/mmwr.mm7039a1
4. Fomban Leke RG, King A, Pallansch MA, et al.; Africa Regional Commission for the Certification of Poliomyelitis Eradication. Certifying the interruption of wild poliovirus transmission in the WHO African region on the turbulent journey to a polio-free world. Lancet Glob Health 2020;8:e1345–51. PMID:32916086 https://doi.org/10.1016/S2214-109X(20)30382-X

*https://www.cdc.gov/polio/progress/index.htm#:~:text

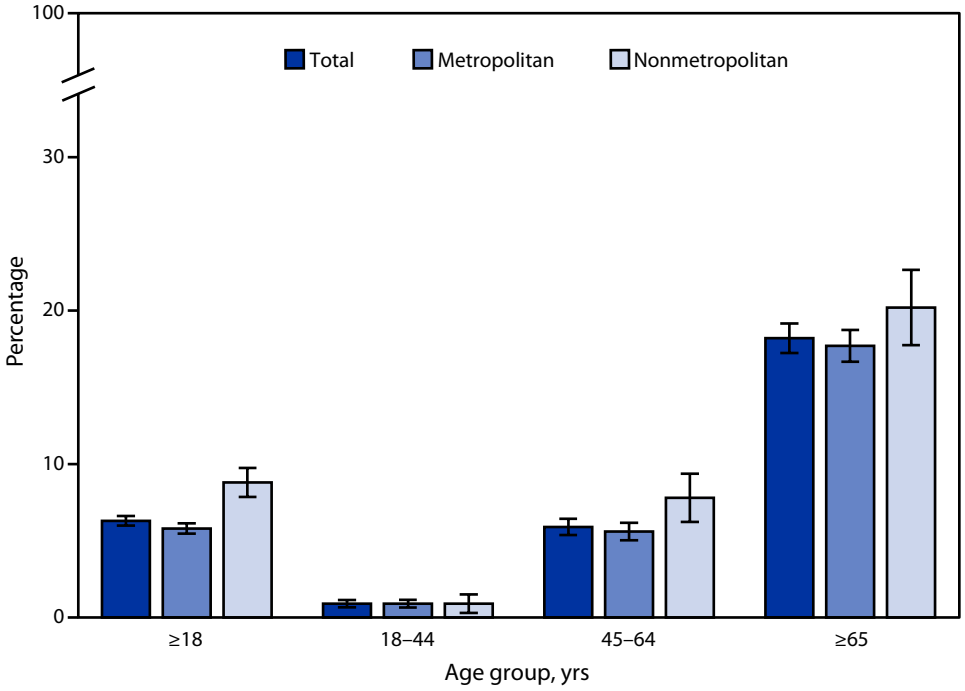
FIGURE. Multicountry outbreak response supplementary immunization activity (round 1) in response to a case of wild poliovirus type 1 — Malawi, 2022



QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥18 Years with Diagnosed Heart Disease,† by Urbanization Level§ and Age Group — National Health Interview Survey, United States, 2020¶



* With 95% CIs indicated by error bars.
† Based on a composite of positive responses to at least one of three survey questions, "Have you ever been told by a doctor or other health professional that you had coronary heart disease… angina pectoris… myocardial infarction?"
§ Urbanization level is based on the Office of Management and Budget's February 2013 delineation of metropolitan statistical areas (MSAs), in which each MSA must have at least one urbanized area of ≥50,000 inhabitants. Areas with <50,000 inhabitants are grouped into the nonmetropolitan category.
¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

In 2020, 6.3% percent of adults aged ≥18 years had diagnosed heart disease. The prevalence of heart disease among adults aged ≥18 years was higher among those living in nonmetropolitan areas (8.8%) compared with those living in metropolitan areas (5.8%). Prevalence increased with age from 0.9% among adults aged 18–44 years to 5.9% among those aged 45–64 years and 18.2% among those aged ≥65 years. Among adults aged 45–64 years, those living in nonmetropolitan areas (7.8%) were more likely to have heart disease than those living in metropolitan areas (5.6%). There was no statistically significant difference by urbanization level for adults aged 18–44 or ≥65 years.

Source: National Center for Health Statistics, National Health Interview Survey, 2020. https://www.cdc.gov/nchs/nhis.htm

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