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Report of Health Care Provider Recommendation for COVID-19 Vaccination Among Adults, by Recipient COVID-19 Vaccination Status and Attitudes — United States, April–September 2021

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Vaccination is critical to controlling the COVID-19 pandemic, and health care providers play an important role in achieving high vaccination coverage (*1*). To examine the prevalence of report of a provider recommendation for COVID-19 vaccination and its association with COVID-19 vaccination coverage and attitudes, CDC analyzed data among adults aged ≥18 years from the National Immunization Survey-Adult COVID Module (NIS-ACM), a nationally representative cellular telephone survey. Prevalence of report of a provider recommendation for COVID-19 vaccination among adults increased from 34.6%, during April 22–May 29, to 40.5%, during August 29–September 25, 2021. Adults who reported a provider recommendation for COVID-19 vaccination were more likely to have received ≥1 dose of a COVID-19 vaccine (77.6%) than were those who did not receive a recommendation (61.9%) (adjusted prevalence ratio [aPR] = 1.12). Report of a provider recommendation was associated with concern about COVID-19 (aPR = 1.31), belief that COVID-19 vaccines are important to protect oneself (aPR = 1.15), belief that COVID-19 vaccination was very or completely safe (aPR = 1.17), and perception that many or all of their family and friends had received COVID-19 vaccination (aPR = 1.19). Empowering health care providers to recommend vaccination to their patients could help reinforce confidence in, and increase coverage with, COVID-19 vaccines, particularly among groups known to have lower COVID-19 vaccination coverage, including younger adults, racial/ethnic minorities, and rural residents.

NIS-ACM is a nationally representative household telephone survey of noninstitutionalized U.S. adults aged ≥18 years that uses a random-digit–dialed sample of cellular telephone numbers stratified by state and selected local jurisdictions (*2*). Data from five data collection periods were used for these analyses: April 22–May 29, May 30–June 26, June 27–July 31, August 1–August 28, and August 29–September 25, 2021. Response rates for these five periods ranged from 17.2% to 20.9%*; sample sizes ranged from 56,749 to 77,162, with an overall sample size of 340,543 participants.

* 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

INSIDE

1731 SARS-CoV-2 B.1.1.529 (Omicron) Variant — United States, December 1–8, 2021
1735 Booster and Additional Primary Dose COVID-19 Vaccinations Among Adults Aged ≥65 Years — United States, August 13, 2021–November 19, 2021
1740 Trends in and Characteristics of Drug Overdose Deaths Involving Illicitly Manufactured Fentanyls — United States, 2019–2020
1747 Notes from the Field: Mucormycosis Cases During the COVID-19 Pandemic — Honduras, May–September 2021
1750 Notes from the Field: COVID-19–Associated Mucormycosis — Arkansas, July–September 2021
1752 QuickStats

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

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The survey assessed report of health care provider recommendation for COVID-19 vaccination,[†] COVID-19 vaccination status,[§] and attitudes toward vaccination. Attitudes toward vaccination were assessed by responses to four questions regarding 1) concern about COVID-19 infection (risk appraisal), 2) belief about the importance of COVID-19 vaccination (confidence), 3) belief about the safety of COVID-19 vaccination (confidence), and 4) belief about how many family and friends had received COVID-19 vaccination (social norms). These questions are based on the Behavioral and Social Drivers framework for increasing vaccine confidence[¶] (*1*).

Prevalence of report of provider recommendation was assessed during April 22–September 25, 2021, and by period of data collection, sociodemographic characteristics,[**] U.S. Department of Health and Human Services (HHS) region,[††] and jurisdiction.[§§] Logistic regression was used to generate unadjusted and adjusted prevalence ratios (PRs and aPRs) of the association between the four attitudinal measures and both provider recommendation for COVID-19 vaccination and COVID-19 vaccination status. Adjusted analyses controlled for age group, sex, transgender identity, sexual orientation, race/ethnicity, education, income, insurance status, metropolitan

[†] Report of a provider recommendation was assessed with the following question: "Has a doctor, nurse, or other health professional ever recommended that you get a COVID-19 vaccine?"

[§] COVID-19 vaccination status was assessed by response to the following question: "Have you received at least one dose of a COVID-19 vaccine?"

[¶] Concern about COVID-19 infection was assessed by the following questions: "How concerned are you about getting COVID-19? Would you say you are: not at all concerned; a little concerned; moderately concerned; or very concerned?" Adults who responded with moderately or very concerned were categorized as being concerned about COVID-19 infection. Beliefs about the importance of vaccination was assessed by the following question: "How important do you think getting a COVID-19 vaccine is to protect yourself against COVID-19? Would you say it is not at all important, a little important, somewhat important, or very important?" Adults who responded with somewhat or very important were categorized as believing that vaccination is important for protection against COVID-19. Beliefs about the safety of COVID-19 vaccines was assessed by the following questions: "How safe do you think a COVID-19 vaccine is for you? Would you say not at all safe; somewhat safe; very safe; or completely safe?" Adults who responded with very or completely safe were categorized as having beliefs that vaccine is safe. Finally, social norms were assessed by the following questions: "If you had to guess, about how many of your family and friends have received a COVID-19 vaccine? Would you say none; some; many; or almost all?" Adults who responded with many or almost all were categorized as having family and friends who were all or mostly vaccinated.

[**] Sociodemographic demographic characteristics were age group, sex, transgender identity, sexual orientation, race/ethnicity, education, income, insurance status, MSA, U.S. Census region, comorbidity status, disability status, essential worker status, and work or school requirement.

[††] *Region 1:* Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; *Region 2:* New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands; *Region 3:* Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; *Region 4*: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee); *Region 5:* Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *Region 6*: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; *Region 7:* Iowa, Kansas, Missouri, and Nebraska; *Region 8:* Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; *Region 9:* Arizona, California, Hawaii, Nevada, American Samoa, Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, and Palau; *Region 10:* Alaska, Idaho, Oregon, and Washington.

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statistical area (MSA),[¶¶] U.S. Census region, comorbidity status,[***] disability status,[†††] essential worker status,[§§§] and work or school COVID-19 vaccination requirement.[¶¶¶] All variables assessed in this study were self-reported. The interaction between provider recommendation and each sociodemographic characteristic in predicting COVID-19 vaccination status was also assessed. The ecologic association between jurisdiction-level provider recommendation prevalence and jurisdiction-level vaccination coverage was also assessed using a Pearson correlation coefficient.

Data were analyzed using SAS (version 9.4; SAS Institute) and SUDAAN (version 11.0.3; RTI International). Results were weighted to represent the noninstitutionalized U.S. adult population aged ≥18 years and calibrated to COVID-19 vaccine administration data[****] (*3*). For all analyses, statistical significance was defined as p<0.05. This activity was reviewed by the CDC and was conducted consistent with applicable federal law and CDC policy.[††††]

Prevalence of report of a provider recommendation for COVID-19 vaccines among adults increased from 34.6% during April 22–May 29 to 40.5% during August 29–September 25, 2021 (Table 1). From April 22–May 29 to August 29–September 25, report of provider recommendation ranged from 34.3% in HHS Region 10 to 42.7% in HHS Region 2 (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/112307). Report of a provider recommendation was more common among adults aged ≥65 years (44.2%) than among those aged 18–29 years (28.3%); those with more than a college degree (45.6%) than among those with a high school education or less (33.5%); adults with annual household income of ≥$75,000 (39.8%) compared with those below the U.S. poverty threshold (36.9%); adults with health insurance (39.1%) compared with those without insurance (24.7%); adults who are essential health care workers (51.8%) compared with those in other essential work settings (32.1%–38.8%); and adults with comorbidities (50.4%) compared with those without (32.1%) (Table 1).

Adults who had received a provider recommendation were more likely to have received ≥1 dose of COVID-19 vaccine (77.6%) than were those who did not receive a recommendation (61.9%) (aPR = 1.12) (Table 2). Analyses of the interaction between provider recommendation and sociodemographic characteristics on vaccine receipt found that provider recommendation was associated with higher likelihood of receipt of ≥1 COVID-19 vaccine dose among most subgroups, with highest aPR for younger adults (aged 18–29 and 30–39 years; aPR = 1.22), non-Hispanic American Indian or Alaska Native adults (aPR = 1.19), adults living in rural areas (aPR = 1.18), adults living in the West (aPR = 1.17) or Midwest (aPR = 1.15), and adults who did not have a school or work COVID-19 vaccination requirement (aPR = 1.15).

Report of a provider recommendation was associated with concern about COVID-19 (aPR = 1.31), confidence that COVID-19 vaccines are important to protect oneself (aPR = 1.15), confidence that COVID-19 vaccination was very or completely safe (aPR = 1.17), and perception that many or all of their family and friends had received COVID-19 vaccination (aPR = 1.19) (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/112308).

[§§] Fifty-three jurisdictions were defined as the 50 states; Washington, DC; and two U.S. territories (Puerto Rico and U.S. Virgin Islands). The U.S. territory of Guam was excluded because of a limited data collection period.

[¶¶] 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

[***] Comorbidity status was ascertained by the following question: "Do you have a health condition that may put you at higher risk for COVID-19?" This was followed by the question, "Can you tell me what that is?" Responses to this second question indicate ≥75% of respondents interpreted the question as medical conditions that have been associated with higher risk of severe COVID-19.

[†††] Disability status was ascertained by the following question: "Do you have serious difficulty seeing, hearing, walking, remembering, making decisions, or communicating?"

[§§§] Essential worker status was defined based on the following questions: "Are you a frontline or essential worker according to your state or region?" and "In what location or setting do you currently work?" Response options were 1) health care (e.g., hospital, doctor, dentist or mental health specialist office, outpatient facility, long-term care, home health care, pharmacy, or medical laboratory); 2) social service (e.g., child, youth, family, elderly, or disability services); 3) preschool or daycare; 4) K–12 school; 5) other schools and instructional settings (e.g., college, university, professional, business, technical or trade school, driving school, test preparation, or tutoring); 6) first response (e.g., police or fire protection, or emergency relief services); 7) death care (e.g., funeral home, crematory, or cemetery); 8) correctional facility (e.g., jail, prison, detention center, or reformatory); 9) food and beverage store (e.g., grocery store, warehouse club, supercenters, convenience store, specialty food store, or bakery); 10) agriculture, forestry, fishing, or hunting; 11) food manufacturing facility (e.g., meat processing, produce packing, or food or beverage manufacturing); 12) nonfood manufacturing facility (e.g., metals, equipment and machinery, or electronics); 13) public transit (e.g., bus, commuter rail, subway, or school bus); 14) United States Postal Service; and 15) other. Essential worker groups who responded with 1, 2, and 7 were categorized as "essential health care," 3–5 were categorized as "school and childcare," 6 and 8–14 were categorized as "other frontline," and 15 were categorized as "other essential," and those who answered "no" to the first question were categorized as "not an essential worker." Nonessential could include both employed and unemployed persons.

[¶¶¶] Work or school requirement was assessed by the following question: "Does your work or school require you to get a COVID-19 vaccine?" Response options were "yes," "no," or "unemployed/not applicable." Responses for "no" and "not applicable" were combined into one category.

[****] Survey weights were calibrated to the COVID-19 vaccine administration data by jurisdiction, age group, and sex.

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

TABLE 1. Characteristics of adults who reported a health care provider recommendation for COVID-19 vaccination, by selected sociodemographic characteristics and associated factors — National Immunization Survey-Adult COVID Module, United States, April 22–September 25, 2021

Characteristic	Overall		Provider recommendation		
			Prevalence	Prevalence ratio	
	No.	% (95% CI)	% (95% CI)	Unadjusted (95% CI)	Adjusted* (95% CI)
All adults	**340,543**	**100.0**	**37.4 (37.1–37.7)**	—	—
Period of data collection					
Apr 22–May 29	77,162	20.0 (19.7–20.3)	34.6 (33.9–35.3)	Ref	Ref
May 30–Jun 26	56,749	20.0 (19.7–20.3)	35.8 (35.0–36.6)	1.03 (1.00–1.07)	1.03 (1.00–1.06)
Jun 27–Jul 31	73,512	20.0 (19.7–20.3)	37.6 (36.9–38.3)	1.09 (1.06–1.12)	1.08 (1.05–1.11)
Aug 1–Aug 28	63,193	20.0 (19.7–20.3)	38.6 (37.9–39.4)	1.12 (1.09–1.15)	1.10 (1.07–1.13)
Aug 29–Sep 25	73,426	20.0 (19.7–20.2)	40.5 (39.8–41.2)	1.17 (1.14–1.20)	1.14 (1.10–1.17)
Age group, yrs					
18–29	58,464	21.0 (20.7–21.3)	28.3 (27.6–29.0)	0.64 (0.62–0.66)	0.72 (0.69–0.74)
30–39	56,584	17.3 (17.1–17.6)	34.9 (34.2–35.7)	0.79 (0.77–0.81)	0.83 (0.80–0.85)
40–49	52,694	16.0 (15.7–16.2)	37.9 (37.1–38.7)	0.86 (0.83–0.88)	0.86 (0.83–0.89)
50–64	95,399	24.5 (24.2–24.8)	41.0 (40.4–41.7)	0.93 (0.91–0.95)	0.92 (0.89–0.94)
≥65	75,147	21.2 (20.9–21.5)	44.2 (43.5–45.0)	Ref	Ref
Sex					
Male	168,106	48.4 (48.1–48.8)	34.4 (34.0–34.9)	Ref	Ref
Female	173,190	51.6 (51.2–51.9)	40.3 (39.9–40.8)	1.17 (1.15–1.19)	1.07 (1.05–1.09)
Transgender					
Yes	13,287	4.5 (4.4–4.7)	36.5 (34.9–38.1)	0.98 (0.93–1.02)	1.01 (0.96–1.05)
No	309,379	95.5 (95.3–95.6)	37.4 (37.0–37.7)	Ref	Ref
Sexual orientation					
Heterosexual	298,486	92.6 (92.4–92.7)	37.5 (37.2–37.8)	Ref	Ref
Gay or lesbian	8,857	2.3 (2.2–2.4)	41.0 (39.0–43.1)	1.09 (1.04–1.15)	1.12 (1.06–1.17)
Bisexual	9,745	3.3 (3.1–3.4)	34.1 (32.3–35.9)	0.91 (0.86–0.96)	1.02 (0.96–1.07)
Other	5,654	1.9 (1.8–2.0)	36.3 (33.8–38.8)	0.97 (0.90–1.04)	1.06 (0.98–1.14)
Race/Ethnicity					
White, non-Hispanic	210,659	62.1 (61.8–62.4)	37.3 (36.9–37.7)	Ref	Ref
Black, non-Hispanic	40,610	12.0 (11.8–12.2)	38.4 (37.5–39.4)	1.03 (1.00–1.06)	1.02 (0.99–1.05)
Hispanic	43,420	17.2 (16.9–17.5)	37.2 (36.3–38.1)	1.00 (0.97–1.02)	1.09 (1.06–1.12)
Asian, non-Hispanic	17,859	4.2 (4.1–4.3)	40.0 (38.5–41.6)	1.07 (1.03–1.12)	1.11 (1.06–1.16)
American Indian or Alaska Native, non-Hispanic	8,319	1.3 (1.3–1.4)	38.8 (36.2–41.5)	1.04 (0.97–1.12)	1.13 (1.05–1.21)
Other or multiple races, non-Hispanic	12,865	3.2 (3.0–3.3)	36.2 (34.4–38.1)	0.97 (0.92–1.02)	1.03 (0.98–1.09)
Educational level					
High school or less	85,450	39.1 (38.7–39.4)	33.5 (33.0–34.1)	0.74 (0.72–0.75)	0.83 (0.80–0.85)
Some college	94,461	30.5 (30.2–30.9)	37.6 (37.0–38.2)	0.82 (0.80–0.84)	0.88 (0.86–0.90)
College graduate	85,631	19.2 (18.9–19.4)	40.7 (40.1–41.4)	0.89 (0.87–0.91)	0.96 (0.94–0.99)
Above college graduate	68,286	11.2 (11.1–11.4)	45.6 (44.8–46.4)	Ref	Ref
Annual household income,† USD					
Below poverty	32,552	11.3 (11.1–11.5)	36.9 (35.9–37.9)	0.93 (0.90–0.95)	1.00 (0.96–1.03)
Above poverty and <$75,000	106,976	32.1 (31.8–32.5)	36.1 (35.5–36.7)	0.91 (0.89–0.93)	0.95 (0.93–0.97)
Above poverty and ≥$75,000	129,250	32.7 (32.4–33.0)	39.8 (39.3–40.3)	Ref	Ref
Unknown income	75,264	23.9 (23.6–24.2)	36.1 (35.5–36.8)	0.91 (0.89–0.93)	0.95 (0.92–0.97)

See table footnotes on the next page.

In the jurisdiction-level correlation analysis, COVID-19 vaccination coverage was higher among persons living in jurisdictions with higher prevalence of provider recommendation (correlation coefficient = 0.66) (Figure) (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/112307). For example, in Wyoming, prevalence of report of a provider recommendation was 30.1%, and COVID-19 vaccination coverage was 51.2%, whereas in Puerto Rico, prevalence of provider recommendation was 50.5%, and COVID-19 vaccination coverage was 77.5%.

Discussion

Health care providers are among the most trusted sources of information on safety and effectiveness of vaccines, and their recommendations are strongly associated with vaccination acceptance (*4*,*5*). This study found that provider recommendation was associated with higher likelihood of getting vaccinated, as well as higher likelihood of having concerns about COVID-19, confidence that vaccines are important to protect oneself from COVID-19, confidence that COVID-19 vaccines are very or completely safe, and perception that many

TABLE 1. (*Continued*) Characteristics of adults who reported a health care provider recommendation for COVID-19 vaccination, by selected sociodemographic characteristics and associated factors — National Immunization Survey-Adult COVID Module, United States, April 22–September 25, 2021

Characteristic	Overall		Provider recommendation		
			Prevalence	Prevalence ratio	
	No.	% (95% CI)	% (95% CI)	Unadjusted (95% CI)	Adjusted* (95% CI)
Health insurance status					
Insured	306,694	89.5 (89.3–89.7)	39.1 (38.7–39.4)	Ref	Ref
Not insured	27,335	10.5 (10.3–10.7)	24.7 (23.8–25.7)	0.63 (0.61–0.66)	0.75 (0.72–0.78)
Essential worker status§					
Essential health care	36,028	9.1 (8.9–9.3)	51.8 (50.8–52.9)	1.40 (1.37–1.43)	1.38 (1.35–1.42)
School and child care	12,789	2.9 (2.8–3.0)	38.8 (37.1–40.5)	1.05 (1.00–1.09)	1.02 (0.97–1.07)
Other frontline	24,835	8.4 (8.2–8.6)	32.3 (31.2–33.4)	0.87 (0.84–0.90)	1.02 (0.98–1.06)
Other essential	39,597	12.5 (12.2–12.7)	32.1 (31.2–33.0)	0.87 (0.84–0.89)	1.00 (0.97–1.04)
Not an essential worker	228,472	67.2 (66.9–67.5)	37.1 (36.7–37.5)	Ref	Ref
MSA¶					
MSA, principal city	106,173	29.1 (28.8–29.4)	38.6 (38.0–39.2)	Ref	Ref
MSA, nonprincipal city	172,259	57.2 (56.9–57.5)	37.4 (37.0–37.8)	0.97 (0.95–0.99)	0.96 (0.94–0.98)
Non-MSA	65,610	13.7 (13.5–13.9)	34.9 (34.1–35.7)	0.90 (0.88–0.93)	0.92 (0.89–0.95)
U.S. Census region					
Northeast	70,694	17.4 (17.3–17.6)	42.1 (41.4–42.7)	Ref	Ref
Midwest	54,434	20.8 (20.5–21.0)	36.7 (35.9–37.4)	0.87 (0.85–0.89)	0.93 (0.90–0.95)
South	70,212	23.8 (23.5–24.0)	36.3 (35.6–37.1)	0.86 (0.84–0.89)	0.88 (0.86–0.91)
West	126,934	38.0 (37.8–38.3)	36.0 (35.5–36.5)	0.86 (0.84–0.87)	0.92 (0.90–0.94)
Comorbidities**					
Yes	102,135	29.2 (28.9–29.5)	50.4 (49.8–51.1)	1.57 (1.54–1.60)	1.47 (1.44–1.50)
No	237,651	70.8 (70.5–71.1)	32.1 (31.7–32.5)	Ref	Ref
Disability status††					
Yes	30,864	9.7 (9.5–9.9)	44.9 (43.8–46.0)	1.23 (1.20–1.26)	1.11 (1.07–1.14)
No	312,280	90.3 (90.1–90.5)	36.6 (36.3–36.9)	Ref	Ref
Work or school requirement§§					
Yes	43,949	10.8 (10.6–11.0)	49.8 (48.8–50.7)	1.39 (1.36–1.42)	1.32 (1.29–1.36)
No/Other	297,453	89.2 (89.0–89.4)	35.9 (35.5–36.2)	Ref	Ref

Abbreviations: MSA = metropolitan statistical area; Ref = referent group; USD = U.S. dollars.

* Adjusted for age group, sex, transgender identity, sexual orientation, race/ethnicity, education, income, insurance status, MSA, U.S. Census region, comorbidity status, disability status, and essential worker status.

† Household income is derived from the number of persons reported in the household, the reported household income, and the 2020 U.S. Census poverty thresholds.

§ Essential worker status was defined based on the following questions: "Are you a frontline or essential worker according to your state or region?" and "In what location or setting do you currently work?" Essential worker groups were categorized as "essential healthcare," "school and childcare," "other frontline," "other essential," and "nonessential." Nonessential could include both employed and unemployed individuals.

¶ 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.

** Comorbidity status was ascertained by the following question: "Do you have a health condition that may put you at higher risk for COVID-19?"

†† Disability status was ascertained by the following question: "Do you have serious difficulty seeing, hearing, walking, remembering, making decisions, or communicating?"

§§ Work or school requirement was assessed by the following question: "Does your work or school require you to get a COVID-19 vaccine?" Response options were yes, no, or unemployed/not applicable. Responses for "no" and "not applicable" were combined into one category.

or all of one's family and friends had received COVID-19 vaccine. The findings from an ecologic analysis also suggest that jurisdictions' prevalence of provider recommendations was positively associated with jurisdiction-level COVID-19 vaccination coverage.

Similar to report of a provider recommendation for influenza vaccine, which was 33.0% in 2016 (*6*), report of a provider recommendation for vaccination against COVID-19 remains low. Approximately less than one half of participants nationwide reported receiving a provider recommendation, with <40% of persons in rural areas and in some jurisdictions reporting a provider recommendation. These patterns mirror known patterns in disparities in health insurance coverage, financial barriers to care, and the use of wellness visits and checkups; as a result, lower access to health care might reduce the opportunity for interactions with trusted providers (*7*).

As COVID-19 vaccine availability in primary care settings increases and patients become eligible for additional or booster doses, provider recommendation will continue to serve an important role in motivating individual patient vaccination acceptance and completion (*8*). Health care systems and medical practices can benefit from procedures that build

TABLE 2. Association of report of a health care provider recommendation for COVID-19 vaccination and receipt of ≥1 COVID-19 vaccine dose, overall and by selected sociodemographic characteristics — National Immunization Survey-Adult COVID Module, United States, April 22–September 25, 2021

Characteristic	Receipt of ≥1 COVID-19 vaccine dose, % (95% CI)			
	Provider recommendation		Prevalence ratio	
	Yes	No	Unadjusted	Adjusted*
Overall	**77.6 (77.1–78.1)**	**61.9 (61.5–62.3)**	**1.25 (1.24–1.27)**	**1.12 (1.11–1.14)**
Age group, yrs				
18–29	63.3 (61.9–64.7)	45.4 (44.5–46.3)	1.39 (1.35–1.44)	1.22 (1.18–1.26)
30–39	68.7 (67.4–70.1)	51.1 (50.1–52.2)	1.34 (1.31–1.38)	1.22 (1.18–1.25)
40–49	74.5 (73.2–75.8)	57.5 (56.4–58.6)	1.30 (1.26–1.33)	1.19 (1.16–1.22)
50–64	80.9 (80.0–81.8)	70.0 (69.1–70.8)	1.16 (1.14–1.18)	1.08 (1.06–1.10)
≥65	91.0 (90.3–91.7)	87.4 (86.7–88.1)	1.04 (1.03–1.05)	1.03 (1.01–1.04)
Sex				
Male	78.9 (78.2–79.5)	64.2 (63.6–64.9)	1.23 (1.21–1.24)	1.12 (1.11–1.14)
Female	78.9 (78.2–79.5)	64.2 (63.6–64.9)	1.23 (1.21–1.24)	1.15 (1.13–1.16)
Race/Ethnicity				
White, non-Hispanic	80.5 (79.9–81.1)	63.1 (62.6–63.7)	1.27 (1.26–1.29)	1.17 (1.15–1.19)
Black, non-Hispanic	69.0 (67.5–70.5)	56.4 (55.1–57.7)	1.22 (1.19–1.26)	1.07 (1.03–1.10)
Hispanic	74.0 (72.6–75.4)	60.2 (58.9–61.4)	1.23 (1.20–1.26)	1.09 (1.06–1.12)
Asian, non-Hispanic	88.3 (86.2–90.5)	87.1 (85.5–88.7)	1.01 (0.98–1.05)	1.01 (0.96–1.05)
American Indian or Alaska Native, non-Hispanic	69.1 (64.7–73.5)	46.6 (43.1–50.1)	1.48 (1.34–1.64)	1.19 (1.09–1.30)
Other or multiple races, non-Hispanic	67.8 (64.6–71.1)	48.7 (46.3–51.1)	1.39 (1.30–1.49)	1.15 (1.07–1.24)
Essential worker†				
Essential health care	81.8 (80.6–83.1)	68.3 (66.7–69.8)	1.20 (1.17–1.23)	1.12 (1.08–1.15)
School and child care	84.9 (82.4–87.4)	78.5 (76.4–80.5)	1.08 (1.04–1.13)	1.04 (0.99–1.10)
Other frontline	67.0 (64.8–69.1)	52.2 (50.7–53.7)	1.28 (1.23–1.34)	1.10 (1.07–1.14)
Other essential	68.2 (66.5–69.9)	50.2 (49.0–51.4)	1.36 (1.31–1.41)	1.15 (1.11–1.18)
Not an essential worker	79.3 (78.7–79.9)	64.5 (63.9–65.0)	1.23 (1.22–1.24)	1.15 (1.13–1.16)
MSA§				
MSA, principal city	78.1 (77.2–79.0)	65.4 (64.6–66.2)	1.19 (1.17–1.21)	1.10 (1.08–1.12)
MSA, nonprincipal city	78.6 (78.0–79.3)	62.6 (62.0–63.2)	1.26 (1.24–1.27)	1.14 (1.12–1.16)
Non-MSA	71.7 (70.3–73.0)	52.2 (51.1–53.3)	1.37 (1.33–1.41)	1.18 (1.14–1.21)
U.S. Census region				
Northeast	81.8 (80.9–82.8)	71.9 (71.0–72.8)	1.14 (1.12–1.16)	1.08 (1.05–1.10)
Midwest	75.4 (74.2–76.6)	57.9 (56.9–59.0)	1.30 (1.27–1.33)	1.15 (1.12–1.18)
South	81.3 (80.2–82.4)	67.8 (66.8–68.8)	1.20 (1.18–1.22)	1.11 (1.09–1.14)
West	74.1 (73.3–74.9)	55.9 (55.3–56.6)	1.32 (1.30–1.35)	1.17 (1.15–1.19)
Comorbidities¶				
Yes	83.5 (82.8–84.2)	71.2 (70.3–72.1)	1.17 (1.15–1.19)	1.15 (1.13–1.17)
No	74.1 (73.4–74.7)	59.3 (58.8–59.8)	1.25 (1.23–1.27)	1.13 (1.11–1.14)
Work or school requirement**				
Yes	88.2 (87.1–89.2)	85.7 (84.6–86.8)	1.03 (1.01–1.05)	1.03 (1.01–1.05)
No/Other	75.8 (75.2–76.3)	59.6 (59.2–60.1)	1.27 (1.26–1.28)	1.15 (1.14–1.17)

Abbreviation: MSA = metropolitan statistical area.

* Adjusted for age group, sex, transgender identity, sexual orientation, race/ethnicity, education, income, insurance status, MSA, U.S. Census region, comorbidity status, disability status, and essential worker status.

† Essential worker status was defined based on the following questions: "Are you a frontline or essential worker according to your state or region?" and "In what location or setting do you currently work?" Essential worker groups were categorized as "essential healthcare," "school and childcare," "other frontline," "other essential," and "nonessential." Nonessential may include both employed and unemployed individuals.

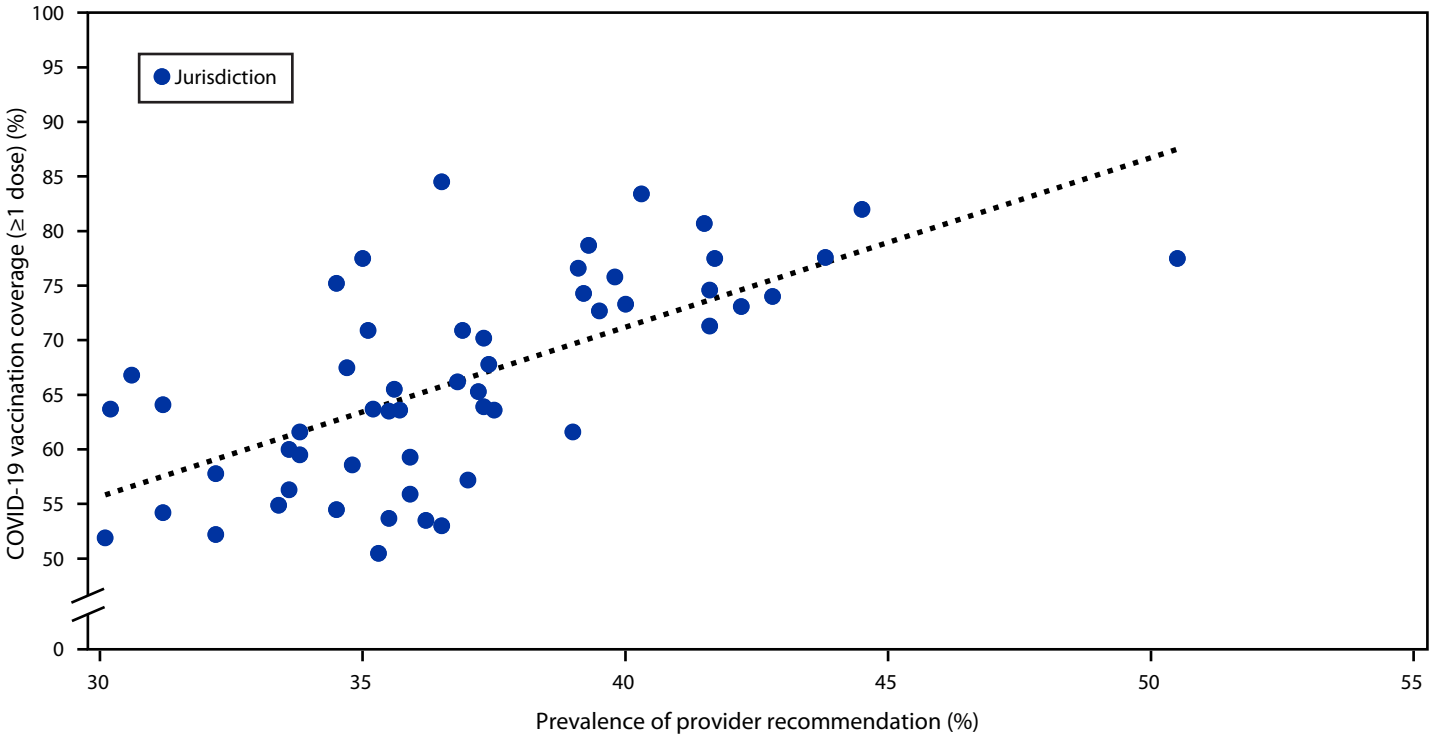
§ MSA status was determined based on household reported city and county of residence and was grouped into three categories: MSA principal city (urban), MSA nonprincipal city (suburban), and non-MSA (rural). MSAs and principal cities were as defined by the U.S. Census Bureau (https://www.census.gov/programs-surveys/metro-micro.html).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

¶ Comorbidity status was ascertained by the following question: "Do you have a health condition that may put you at higher risk for COVID-19?"

** Work or school requirement was assessed by the following question: "Does your work or school require you to get a COVID-19 vaccine?" Response options were yes, no, or unemployed/not applicable. Responses for "no" and "not applicable" were combined into one category.

patient and provider confidence in COVID-19 vaccination and strengthen the capacity of health care providers to have conversations about vaccines, address misinformation, and provide tailored information to patients. As trusted sources of medical information, providers have the opportunity to clearly recommend COVID-19 vaccines as a main strategy for preventing serious health outcomes from COVID-19 (*9*).

FIGURE. Correlation of prevalence of report of health care provider recommendation and COVID-19 vaccination coverage (≥1 dose) among 53 jurisdictions,* by jurisdiction — National Immunization Survey Adult-COVID Module, United States, April 22–September 25, 2021



* Sample correlation coefficient = 0.66.

The findings in this study are subject at least six limitations. First, response rates were low (approximately 20%), but consistent with other NIS surveys (*2*). Bias in estimates might remain after weighting for household nonresponse and incomplete sample frame (households with only landline or no telephone service were excluded). Second, vaccination receipt, provider recommendation, and other characteristics (e.g., essential worker status or medical conditions) were self-reported and subject to recall and misclassification bias. For example, the question on medical conditions could have been interpreted by some survey respondents as medical conditions that place them at higher risk for exposure to COVID-19; however, a secondary analysis of a follow-up question on condition type found that approximately 75% indicated a medical condition associated with higher risk for severe COVID-19. Moreover, survey weights were calibrated to COVID-19 vaccine administration data (*3*) to mitigate possible bias from incomplete sample frame, nonresponse, and misclassification of vaccination status. Third, the survey did not measure health care provider visits, so a low number of reports of provider recommendation could be due to limited access to health care providers. Fourth, attitudes might have changed over time with changes in the Advisory Committee on Immunization Practices vaccination recommendations or the emergence of the highly transmissible SARS-CoV-2 B.1.617.2 (Delta) variant (*10*). Fifth, the categorization of attitudinal measures was conservative (e.g., classifying someone who reported "somewhat safe" as not believing COVID-19 vaccination is safe), which might

Summary

What is already known about this topic?

COVID-19 vaccination is critical to controlling the COVID-19 pandemic; health care providers play an important role in achieving high vaccination coverage.

What is added by this report?

Adults who reported a provider COVID-19 vaccination recommendation were more likely to have been vaccinated, to be concerned about COVID-19, to have confidence that COVID-19 vaccines are important and safe, and to perceive that family and friends had been vaccinated.

What are the implications for public health practice?

A health care provider recommendation for COVID-19 vaccines at every visit could increase coverage and confidence in vaccines, particularly among groups with lower COVID-19 vaccination coverage, including younger adults, racial/ethnic minorities, and rural residents.

have underestimated observed associations. Finally, the survey is cross-sectional; thus, causal relationships cannot be inferred, including the association between beliefs about COVID-19 vaccination and report of a provider recommendation. For example, providers might be more likely to recommend vaccines to persons who express more concerns or who seem more receptive to vaccination; alternatively, these persons might be more likely to remember and report receiving a provider recommendation. In addition, causality between the ecological association of provider recommendation at the jurisdiction level and vaccination coverage cannot be inferred.

Health care providers are uniquely positioned to provide COVID-19 vaccination recommendations, and it is important that they continue to promote COVID-19 vaccination to eligible persons. This is particularly important among groups with lower COVID-19 vaccination coverage, including younger adults, racial/ethnic minorities, persons with lower education and income, and rural residents. Empowering health care providers to recommend COVID-19 vaccines at every visit and reducing barriers to health care access could increase confidence in vaccines and COVID-19 vaccination coverage.

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SARS-CoV-2 B.1.1.529 (Omicron) Variant — United States, December 1–8, 2021

CDC COVID-19 Response Team

On December 10, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr)*

A new variant of SARS-CoV-2 (the virus that causes COVID-19), B.1.1.529 (Omicron) (*1*), was first reported to the World Health Organization (WHO) by South Africa on November 24, 2021. Omicron has numerous mutations with potential to increase transmissibility, confer resistance to therapeutics, or partially escape infection- or vaccine-induced immunity (*2*). On November 26, WHO designated B.1.1.529 as a variant of concern (*3*), as did the U.S. SARS-CoV-2 Interagency Group (SIG)* on November 30. On December 1, the first case of COVID-19 attributed to the Omicron variant was reported in the United States. As of December 8, a total of 22 states had identified at least one Omicron variant case, including some that indicate community transmission. Among 43 cases with initial follow-up, one hospitalization and no deaths were reported. This report summarizes U.S. surveillance for SARS-CoV-2 variants, characteristics of the initial persons investigated with COVID-19 attributed to the Omicron variant and public health measures implemented to slow the spread of Omicron in the United States. Implementation of concurrent prevention strategies, including vaccination, masking, increasing ventilation, testing, quarantine, and isolation, are recommended to slow transmission of SARS-CoV-2, including variants such as Omicron, and to protect against severe illness and death from COVID-19.

Surveillance for SARS-CoV-2 Variants and Initial Detection of Omicron in the United States

CDC has a multifaceted surveillance system for analyzing SARS-CoV-2 variants circulating in the United States. This system obtains genomic surveillance data from 1) National SARS-CoV-2 Strain Surveillance, 2) CDC-supported contracts with several commercial diagnostic laboratories, and 3) public repositories (the Global Initiative on Sharing Avian Influenza Data [GISAID]† and the National Center for Biotechnology Information [NCBI]§) of randomly sampled viruses with metadata tagging of sequences by various partners. Genomic surveillance is implemented in partnership with state and local public health laboratories, the Association of Public Health Laboratories, and other academic and government partners.¶ As of the week ending December 4, the SARS-CoV-2 B.1.617.2 (Delta) variant was estimated to account for 99.9% of SARS-CoV-2 circulating in the United States.** Based on CDC analysis of the sequences currently available, and accounting for clustering, CDC estimates a 95% chance of detecting the Omicron variant if it accounted for ≥0.03% of circulating SARS-CoV-2 lineages during the week ending November 13 and for ≥0.05% of circulating lineages during the week ending November 20 (*4*).

To accelerate detection of COVID-19 cases attributed to the Omicron variant until they are common enough to be reliably measured by routine genomic surveillance, enhanced surveillance was initiated through National SARS-CoV-2 Strain Surveillance on November 28. The method is based on rapid screening for S-gene target failures (SGTFs) by polymerase chain reaction (PCR)–based diagnostic assays to flag potential cases of Omicron variant infection for confirmation by genomic sequencing (*5*). Specimens that display SGTFs have a higher likelihood to be Omicron (although SGTFs are not unique to Omicron) based on a mutation (69–70 deletion) that reduces S-gene target amplification in some PCR assays.

The first U.S. case of COVID-19 attributed to the Omicron variant was identified on December 1. As of December 8, cases had been reported from across the country; 22 states have reported at least one case (Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Illinois, Louisiana, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, Pennsylvania, Texas, Utah, Washington, and Wisconsin) (Figure). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.††

Characteristics of the First Investigated U.S. COVID-19 Cases Attributed to the Omicron Variant

Details are available for 43 cases of COVID-19 attributed to the Omicron variant; 25 (58%) were in persons aged

* SIG includes representatives from CDC, the National Institutes of Health (NIH), the Food and Drug Administration (FDA), the Biomedical Advanced Research and Development Authority (BARDA), the U.S. Department of Defense (DoD), the U.S. Department of Agriculture (USDA), and the U.S. Department of Health and Human Services (HHS). This interagency group focuses on the rapid characterization of emerging variants and actively monitors their potential impact on critical SARS-CoV-2 countermeasures, including vaccines, therapeutics, and diagnostics.

† https://www.gisaid.org

§ https://www.ncbi.nlm.nih.gov/sars-cov-2

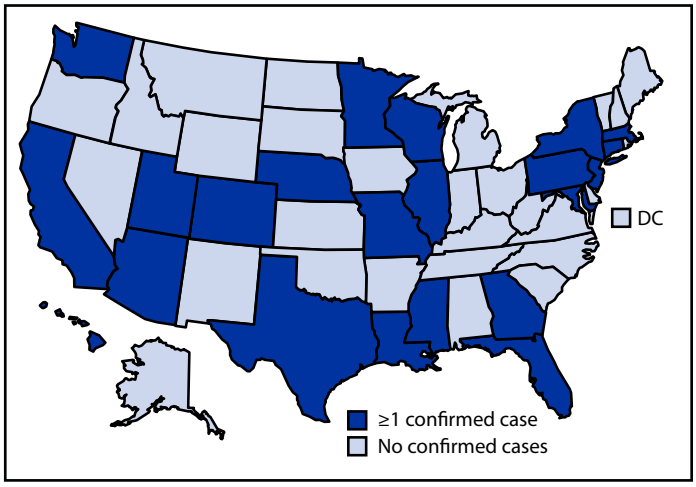
¶ https://www.cdc.gov/coronavirus/2019-ncov/variants/spheres.html

** https://covid.cdc.gov/covid-data-tracker/#variant-proportion

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

18–39 years (Table). The earliest date of symptom onset was November 15 in a person with a history of international travel. Fourteen (33%) persons reported international travel during the 14 days preceding symptom onset or receipt of a positive test result. Among these cases of COVID-19 attributed to the Omicron variant, 34 (79%) occurred in persons who completed the primary series of an FDA-authorized or approved COVID-19 vaccine ≥14 days before symptom onset or receipt of a positive SARS-CoV-2 test result, including 14 who had received an additional or booster dose; five of the 14 persons had received the additional dose <14 days before symptom onset. Six (14%) persons had a documented previous SARS-CoV-2 infection. The most commonly reported symptoms were cough, fatigue, and congestion or runny nose. One vaccinated patient was hospitalized for 2 days, and no deaths have been reported to date. Case investigations have identified exposures associated with international and domestic travel, large public events, and household transmission.

FIGURE. States reporting at least one confirmed SARS-CoV-2 B.1.1.529 (Omicron) variant COVID-19 case — United States, December 1–8, 2021



Abbreviation: DC = District of Columbia.

Measures to Slow Initial Travel-Related Spread of the Omicron Variant

On November 26, a Presidential Proclamation[§§] suspended entry into the United States for noncitizens (as immigrants and nonimmigrants) who were present in any of eight countries in southern Africa (Botswana, Eswatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, and Zimbabwe) during the 14 days preceding travel to the United States. This policy was intended to reduce overall travel volume from the region where Omicron was first identified to delay the introduction and spread of Omicron while U.S. public health measures were enhanced. Multiple factors were considered in determining the eight countries based on what was known about the spread of the Omicron variant at the time, including case counts, community transmission levels, and U.S.-bound travel volume from countries with cases. On December 2, CDC amended its existing Order requiring predeparture testing for all air passengers to the United States from any other country.[¶¶] The Amended Order, effective December 6, shortened the window for obtaining a negative SARS-CoV-2 viral test result to no more than 1 day before the flight's departure. A negative test result closer to the time of travel enhances reduction in transmission risk during travel (*6*).

On November 28, CDC expanded a voluntary airport-based genomic surveillance program in Atlanta, New York City, Newark, and San Francisco to prioritize recruitment of travelers from southern Africa for testing. The four participating airports receive a large, diverse volume of international travelers, including direct flights from southern Africa. Through this program, international air travelers are offered molecular testing of pooled samples collected upon arrival and a take-home collection kit (saliva collection for nucleic acid amplification test) to be used 3–5 days after arrival with subsequent sequencing of SARS-CoV-2–positive specimens; persons in pools with a positive test result are contacted and advised to get retested using the home collection kit or another method. Five pools collected November 30–December 6, representing 59 travelers, had evidence of SGTF. As of December 8, one of these pools was confirmed positive for Omicron, and four were pending. CDC continues to work with state and local health departments and other public health partners to conduct case investigation and contact tracing of travelers into and within the United States with confirmed COVID-19 attributed to the Omicron variant. As of November 8, all airlines are required to collect contact information for all inbound passengers to the United States to facilitate aircraft contact investigations and other follow-up of travelers when indicated.[***] To date, at least one confirmed case attributed to the Omicron variant has been identified in the United States through these aircraft contact investigation efforts.

Measures to Slow Domestic Spread of the Omicron Variant

CDC recommends prioritizing case investigation and contact tracing[†††] for confirmed COVID-19 cases attributed to

[§§] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/11/26/a-proclamation-on-suspension-of-entry-as-immigrants-and-nonimmigrants-of-certain-additional-persons-who-pose-a-risk-of-transmitting-coronavirus-disease-2019

[¶¶] https://www.cdc.gov/quarantine/fr-proof-negative-test.html

[***] https://www.cdc.gov/quarantine/order-collect-contact-info.html

[†††] https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/overview.html

TABLE. Characteristics of reported confirmed B.1.1.529 (Omicron) variant SARS-CoV-2 cases (n = 43) — United States, December 1–8, 2021

Characteristic	No. (%)
Age group, yrs	
<18	4 (9)
18–39	25 (58)
40–64	10 (23)
≥65	4 (9)
Sex	
Male	17 (40)
Female	25 (58)
Unknown	1 (2)
International travel*	14 (33)
COVID-19 vaccination status†	
Unvaccinated	8 (19)
Partially vaccinated	0 (—)
Vaccinated	20 (47)
Vaccinated plus an additional dose§	14 (33)
Unknown	1 (2)
Previous SARS-CoV-2 infection	
Yes	6 (14)
No	21 (49)
Unknown	16 (37)
Symptom profile	
Symptomatic	40 (93)
Asymptomatic/Unknown	3 (7)
Initial signs or symptoms¶	
Cough	33 (89)
Fatigue	24 (65)
Congestion or runny nose	22 (59)
Fever	14 (38)
Nausea or vomiting	8 (22)
Shortness of breath or difficulty breathing	6 (16)
Diarrhea	4 (11)
Loss of taste or smell	3 (8)
Outcomes	
Hospitalization	1 (2)
Death	0 (—)

* International travel within 14 days of symptom onset or, if asymptomatic, first positive SARS-CoV-2 test result.
† An unvaccinated person had received no COVID-19 vaccine. A partially vaccinated person had received a COVID-19 vaccine but not completed the primary series ≥14 days before illness onset or receipt of a positive SARS-CoV-2 test result. A vaccinated person had completed the primary series of a Food and Drug Administration–authorized or approved COVID-19 vaccine ≥14 days before illness onset or receipt of a positive SARS-CoV-2 test result.
§ Among the 14 persons who were vaccinated and had received an additional dose, five had received the additional dose <14 days before symptom onset.
¶ Specific symptom information was available from 37 symptomatic persons.

the Omicron variant. This prioritization should be balanced with maintaining case investigation and contact tracing for outbreaks of confirmed cases of SARS-CoV-2 infection in high-risk congregate settings (e.g., long-term care facilities, correctional facilities, and homeless shelters) and for persons at increased risk for severe COVID-19–related health outcomes. Timely case investigation and contact tracing can help ensure compliance with isolation and quarantine guidance§§§ and link persons with positive SARS-CoV-2 test results and their close contacts to testing and supportive services.

§§§ https://www.cdc.gov/coronavirus/2019-ncov/your-health/quarantine-isolation.html

Discussion

The first U.S. case of COVID-19 attributed to the Omicron variant was detected on December 1, 2021. Among the cases described in this report, the earliest report of symptom onset was November 15. For the week ending December 4, the Delta variant accounted for >99.9% of circulating SARS-CoV-2 variants. Given the 2–3 weeks from the time of specimen collection to availability of sequence data for analysis, it is likely that additional infections with Omicron from late November will be detected during the coming days. Scientists around the world are working to rapidly learn more about the Omicron variant to better understand how easily it might be transmitted and the effectiveness of current diagnostic tests, vaccines, and therapeutics against this variant. Many of the first reported cases of Omicron variant infection appear to be mild (*7*), although as with all variants, a lag exists between infection and more severe outcomes, and symptoms would be expected to be milder in vaccinated persons and those with previous SARS-CoV-2 infection than in unvaccinated persons. Characteristics of the cases described in this report might also not be generalizable because case findings might be associated with individual characteristics (e.g., persons with recent international travel might be more likely to be younger and vaccinated). Even if most infections are mild, a highly transmissible variant could result in enough cases to overwhelm health systems. The clinical severity of infection with the Omicron variant will become better understood as additional cases are identified and investigated. Scientists in South Africa and elsewhere have established systems that allow study of the laboratory, clinical, and epidemiologic characteristics; CDC is collaborating with health officials around the world to learn more about the characteristics of patients with Omicron variant infections.

The rapid emergence and worldwide detection of the SARS-CoV-2 Omicron variant underscores the importance of robust genomic surveillance systems and prompt information-sharing among global public health partners. During the past several years, CDC has intensified efforts to significantly expand genomic sequencing capacity at the federal and state levels. Through these investments, an average of 50,000–60,000 positive specimens are sequenced weekly as part of national SARS-CoV-2 genomic surveillance, which assisted with identifying initial cases of COVID-19 attributed to the Omicron variant in the United States.

A number of measures have been implemented throughout the COVID-19 pandemic to reduce the introduction and spread of SARS-CoV-2 in the United States through travel. For example, masks are required in indoor areas on public

transportation conveyances traveling into, within, or out of the United States, and on the indoor premises of U.S. transportation hubs.¶¶¶ Current travel requirements and recommendations,**** surveillance programs, and efforts to educate travelers are intended to reduce COVID-19 transmission and support safer global travel. CDC is also supporting efforts to prevent, detect, and respond to COVID-19 internationally, including through support for laboratory and sequencing capacity and strengthening global vaccine programs.

Implementation of concurrent prevention strategies, including vaccination, masking, improving ventilation, testing, quarantine, and isolation, are recommended to slow transmission of SARS-CoV-2 and to protect against severe illness, hospitalization, and death from COVID-19. All persons aged ≥5 years should be vaccinated against COVID-19. Persons aged ≥18 years who completed a primary mRNA COVID-19 vaccination series ≥6 months previously or who received an initial Janssen (Johnson & Johnson) vaccine dose ≥2 months previously should receive a booster dose; persons aged 16–17 years are eligible to receive a Pfizer-BioNTech COVID-19 booster dose >6 months after completion of the primary series. Booster doses are especially urgent for those at higher risk of severe disease, such as persons residing in nursing homes and long-term care facilities. In addition, CDC recommends that everyone aged ≥2 years wear masks in public indoor places in areas of substantial or high transmission.

¶¶¶ https://www.cdc.gov/quarantine/masks/mask-travel-guidance.html
**** https://www.cdc.gov/coronavirus/2019-ncov/travelers/international-travel/index.html

Acknowledgments

Public health departments and laboratories in Arizona, California (including Alameda County, Los Angeles, and San Francisco), Colorado, Connecticut, Florida, Georgia, Hawaii, Illinois, Louisiana, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, (including New York City), Pennsylvania, Texas, Utah, Washington, and Wisconsin.

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All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

Summary

What is already known about this topic?

SARS-CoV-2 variant B.1.1.529 (Omicron), first reported to WHO on November 24, 2021, has been designated a variant of concern. Mutations in Omicron might increase transmissibility, confer resistance to therapeutics, or partially escape infection- or vaccine-induced immunity.

What is added by this report?

During December 1–8, 2021, 22 U.S. states reported at least one COVID-19 case attributed to the Omicron variant. Among 43 cases with initial follow-up, one hospitalization and no deaths were reported.

What are the implications for public health practice?

Implementation of concurrent prevention strategies, including vaccination, masking, improving ventilation, testing, quarantine, and isolation are recommended to slow transmission of SARS-CoV-2, including variants such as Omicron, to protect against severe illness and death from COVID-19.

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Booster and Additional Primary Dose COVID-19 Vaccinations Among Adults Aged ≥65 Years — United States, August 13, 2021–November 19, 2021

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Vaccination against SARS-CoV-2 (the virus that causes COVID-19) is highly effective at preventing hospitalization due to SARS-CoV-2 infection and booster and additional primary dose COVID-19 vaccinations increase protection (*1*–*3*). During August–November 2021, a series of Emergency Use Authorizations and recommendations, including those for an additional primary dose for immunocompromised persons and a booster dose for persons aged ≥18 years, were approved because of reduced immunogenicity in immunocompromised persons, waning vaccine effectiveness over time, and the introduction of the highly transmissible B.1.617.2 (Delta) variant (*4*,*5*). Adults aged ≥65 years are at increased risk for COVID-19–associated hospitalization and death and were one of the populations first recommended a booster dose in the U.S. (*5*,*6*). Data on COVID-19 vaccinations reported to CDC from 50 states, the District of Columbia (DC), and eight territories and freely associated states were analyzed to ascertain coverage with booster or additional primary doses among adults aged ≥65 years. During August 13–November 19, 2021, 18.7 million persons aged ≥65 years received a booster or additional primary dose of COVID-19 vaccine, constituting 44.1% of 42.5 million eligible* persons in this age group who previously completed a primary vaccination series.† Coverage was similar by sex and age group, but varied by primary series vaccine product and race and ethnicity, ranging from 30.3% among non-Hispanic American Indian or Alaska Native persons to 50.5% among non-Hispanic multiple/other race persons. Strategic efforts are needed to encourage eligible persons aged ≥18 years, especially those aged ≥65 years and those who are immunocompromised, to receive a booster and/or additional primary dose to ensure maximal protection against COVID-19.

On August 13, 2021, CDC's Advisory Committee on Immunization Practices (ACIP) recommended that moderately or severely immunocompromised recipients of an mRNA COVID-19 vaccine (Pfizer-BioNTech or Moderna) primary series receive a homologous additional primary dose ≥28 days after the second dose in the primary series (*5*). On September 23, 2021, ACIP recommended a Pfizer-BioNTech booster dose for eligible populations§ ≥6 months after completion of the Pfizer-BioNTech primary series (*5*,*7*). On October 21, 2021, ACIP released additional recommendations for eligible¶ Moderna and Janssen (Johnson & Johnson) primary series recipients to receive a booster vaccine dose ≥6 months after completion of the Moderna primary series and ≥2 months after receipt of the Janssen vaccine (*5*,*8*). Both sets of booster dose recommendations identified persons aged ≥65 years as a population that should receive a booster dose once eligible. The October 21 recommendations also allowed for all eligible persons to receive a heterologous booster dose, (i.e., different vaccine product

* The source population includes persons aged ≥65 years who completed an mRNA primary series (received 2 mRNA doses) by May 19, 2021 (≥6 months before the end of the analysis period) or received a Janssen (Johnson & Johnson) vaccination by September 24, 2021 (≥8 weeks before the end of the analysis period). Those vaccinated with an mRNA primary series became eligible to receive a vaccination during the analysis period in three sequential groups: 1) moderately or severely immunocompromised persons who were eligible to receive an additional primary dose on August 13, 2021 (date corresponding to CDC's Advisory Committee on Immunization Practices recommendations); 2) Pfizer-BioNTech primary series recipients who were eligible to receive a booster dose on or after September 23, 2021; and 3) Moderna primary series recipients who were eligible to receive a booster dose on or after October 21, 2021. The source population does not include moderately or severely immunocompromised persons who received their second mRNA dose after May 19, 2021, because information on immunocompromise status was not available to identify these persons. Finally, persons who received a Janssen vaccination by September 24, 2021, were eligible to receive a booster dose during October 21, 2021–November 19, 2021; additional primary dose recommendations do not apply to these persons.

† Primary series completion was defined as receipt of 2 vaccine doses for persons who received Pfizer-BioNTech, Moderna, or unspecified U.S.-authorized or approved mRNA COVID-19 vaccine, or receipt of 1 dose for persons who received Janssen. Primary series vaccine product is defined by the vaccine administered as the first dose for 1-dose series and the second dose for 2-dose series. Persons who received a different mRNA vaccine product for the first and second dose would be represented under the vaccine product administered for the second dose. All results were limited to only persons who had received Pfizer-BioNTech, Moderna, Janssen, and unspecified U.S.-authorized or approved mRNA COVID-19 vaccine; recipients who received other vaccine products were excluded from the analysis.

§ The September 23, 2021, Pfizer-BioNTech booster dose recommendations from ACIP included the following populations: persons aged ≥65 years, residents in long-term care settings, persons aged 50–64 years with underlying medical conditions, and persons aged 18–49 years with underlying medical conditions. CDC expanded these recommendations to include persons aged 18–64 years at increased risk for COVID-19 exposure and transmission because of occupational or institutional setting.

¶ The October 21, 2021, Moderna booster dose recommendations included the following populations: persons aged ≥65 years, residents in long-term care settings, persons aged 50–64 years with underlying medical conditions, persons aged 18–49 years with underlying medical conditions, and persons aged 18–64 years at increased risk for COVID-19 exposure and transmission because of occupational or institutional setting. The October 21, 2021, Janssen booster dose recommendations included all persons aged ≥18 years.

from that which had been administered as the primary series) (*5*,*8*). On November 19, 2021, ACIP further recommended that all persons aged ≥18 years receive a booster dose after the minimum recommended interval** since completion of primary vaccination (*9*,*10*).

Data from booster and additional primary dose COVID-19 vaccinations administered in the United States during August 13–November 19, 2021, among persons aged ≥65 years were analyzed.†† The analysis evaluated coverage by primary series vaccine product, demographic characteristics (sex, age group, and race/ethnicity) of vaccine recipients, trends over time, and whether the vaccine product administered as a booster or additional primary dose was a homologous or heterologous product. Booster or additional primary dose coverage was analyzed as a composite measure to account for immunocompromised persons who were not eligible to receive a booster dose during the analysis period because they received an additional primary dose after the August 13 recommendations. Coverage was calculated among a source population of persons aged ≥65 years who were eligible, as defined by interval since completion of the primary series, to receive either a booster or an additional primary dose by the end of the analysis period (November 19, 2021); information on immunocompromise status was not available to further stratify the eligible population. Booster or additional primary dose recipients during the analysis period were recipients of a third COVID-19 vaccine dose ≥24 days after completion of a 2-dose primary mRNA COVID-19 vaccine series, or a second dose (booster) administered ≥52 days after receipt of the Janssen vaccine.§§

Information on recipient race/ethnicity was available for 71.3% of persons included in the source population. The analysis was completed in SQL Server Management Studio (version 18; Microsoft). Tests for statistical significance were not conducted because these data are reflective of the U.S. population aged ≥65 years and were not based on population samples. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.¶¶

Among 42.5 million eligible persons aged ≥65 years, 18,745,803 (44.1%) received a booster or additional primary dose of COVID-19 vaccine during August 13–November 19, 2021 (Table 1), including 9.9 million (49.9%) of 19.9 million eligible Pfizer-BioNTech recipients, 8.4 million (41.3%) of 20.4 million eligible Moderna recipients, and 369,000 (17.0%) of 2.2 million eligible Janssen recipients. Coverage was similar (<1.0 percentage point difference) among men and women, as well as among persons aged 65–74 years and ≥75 years. Booster or additional primary dose coverage varied by race and ethnicity, with lowest coverage among eligible non-Hispanic American Indian or Alaska Native persons (30.3%), Hispanic or Latino persons (34.4%), and Native Hawaiian or Other Pacific Islander persons (35.0%). Highest coverage was among eligible non-Hispanic White (46.6%) and non-Hispanic multiracial/other race recipients (50.5%).

Among Pfizer-BioNTech recipients, the daily number of persons who received a booster or additional primary dose peaked 5 days after release of the Pfizer-BioNTech booster recommendations (September 23, 2021) with 341,395 recipients vaccinated (Figure). After release of the Moderna and Janssen booster recommendations (October 21, 2021), the number of Moderna recipients peaked 6 days later (415,877 persons vaccinated) and the number of Janssen recipients peaked 13 days later (17,774 persons vaccinated). Overall, 2,014,820 (10.7%) of total booster or additional primary dose recipients received an additional primary dose after the recommendations were released for persons with immunocompromising conditions on August 13, but before booster dose recommendations specific to each primary series were released (899,431 [9.1%] of Pfizer-BioNTech and 1,111,317 [13.2%] of Moderna primary series recipients).*** Homologous booster or additional primary doses were administered to 95.8% of recipients; 4.0% received a heterologous dose (Table 2). Among Janssen recipients, 227,079 (61.5%) received a heterologous booster dose, compared with 168,336 (1.7%) Pfizer-BioNTech primary series recipients and 352,684 (4.2%) Moderna primary series recipients.

** Pfizer-BioNTech and Moderna primary series recipients are recommended to receive a booster dose ≥6 months after primary series completion; Janssen recipients are recommended to receive a booster dose ≥2 months (counted as ≥8 weeks) after receipt of the primary series dose.

†† Vaccine administration data are collected and reported to CDC through jurisdictions' immunization information systems and the Vaccine Administration Management System. Providers are required to document vaccination in their medical records within 24 hours of administration and submit these data to their jurisdiction's immunization information system within 72 hours of administration. Data from 50 states, DC, and eight territories and freely associated states, and reported to CDC by December 7, 2021, were included in the analysis.

§§ There is a 4-day grace period that applies to the recommended 28-day minimum interval between primary series completion and an additional primary dose, and the recommended 2-month (8-week) minimum interval between receipt of the Janssen vaccine and a booster dose. With the 4-day grace period, an additional primary dose received ≥24 days after mRNA primary series completion is considered valid. Furthermore, a booster dose received ≥52 days after receipt of the Janssen vaccine is considered valid. More information about the 4-day grace period is available at https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html.

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

*** Additional primary doses administered before booster dose recommendations were also received by 4,072 persons with a primary series of unspecified U.S.-authorized or approved mRNA COVID-19 vaccine.

TABLE 1. Characteristics of COVID-19 booster or additional primary dose vaccination recipients aged ≥65 years as percentage of eligible population* aged ≥65 years with a completed primary series, by primary series vaccine product,† sex,§ age group, and race/ethnicity,¶ — United States, August 13, 2021–November 19, 2021

Characteristic	No. (% eligible population)			
	Total	Pfizer-BioNTech	Moderna	Janssen (Johnson & Johnson)
No. of eligible persons	**42,521,211**	19,896,380	20,396,160	2,175,205
Overall received additional primary or booster	**18,745,803 (44.1)**	9,925,719 (49.9)	8,425,884 (41.3)	369,260 (17.0)
Sex				
Women	**10,287,072 (44.5)**	5,492,894 (50.0)	4,585,645 (41.8)	195,356 (17.4)
Men	**8,406,212 (43.8)**	4,410,192 (49.9)	3,812,071 (40.9)	172,212 (16.7)
Age group, yrs				
65–74	**11,074,114 (44.1)**	5,829,039 (50.0)	4,974,541 (41.5)	257,412 (17.8)
≥75	**7,671,689 (44.1)**	4,096,680 (49.8)	3,451,343 (41.0)	111,848 (15.3)
Race/Ethnicity				
AI/AN, non-Hispanic	**59,539 (30.3)**	29,729 (33.8)	28,851 (28.4)	898 (13.2)
Asian, non-Hispanic	**367,868 (40.2)**	208,873 (45.4)	151,259 (36.4)	7,453 (18.6)
Black, non-Hispanic	**912,059 (37.8)**	504,594 (42.8)	382,590 (35.6)	23,790 (15.4)
Hispanic/Latino	**900,097 (34.4)**	501,804 (39.9)	377,341 (31.6)	19,761 (12.1)
NHPI, non-Hispanic	**17,465 (35.0)**	10,511 (42.4)	6,609 (29.9)	328 (11.3)
White, non-Hispanic	**10,472,303 (46.6)**	5,637,792 (53.1)	4,615,302 (43.1)	203,570 (18.5)
Multiple/Other, non-Hispanic	**849,648 (50.5)**	488,616 (53.1)	347,279 (49.6)	12,470 (20.9)
Unknown	**5,166,824 (42.4)**	2,543,800 (47.6)	2,516,653 (40.7)	100,990 (15.6)

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

* Eligible population is defined as persons aged ≥65 years who completed a primary COVID-19 vaccination series and were eligible to receive a booster or additional primary dose by the end of the analysis period, November 19, 2021. For Pfizer-BioNTech, Moderna, and unspecified mRNA primary series recipients, the primary series must have been completed by May 19, 2021 (≥6 months earlier); for Janssen (Johnson & Johnson) recipients, 1 dose must have been received by September 24, 2021 (≥8 weeks earlier).

† An unspecified U.S.-authorized or approved mRNA COVID-19 vaccine primary series was reported for 0.1% (53,466) of the population with a primary series completed. Among these, 24,940 (46.6%) persons received a booster or additional primary dose.

§ Information on the recipient's sex was not available for 0.5% (222,034) of the population with a primary series completed. Among these, 52,519 (23.7%) persons received a booster or additional primary dose.

¶ Information on the recipient's race/ethnicity was not available for 28.7% (12,185,606) of the population with a primary series completed. Among these, 5,166,824 (42.4%) persons received a booster or additional primary dose.

Discussion

As of November 19, 2021, 44.1% of 42.5 million eligible adults aged ≥65 years had received a booster or additional primary dose, leaving an estimated 23.8 million eligible adults in this age group in need of a booster or additional primary dose. Coverage with booster or additional primary COVID-19 vaccine doses varied by the primary series vaccine product and race/ethnicity; approximately one third of eligible American Indian or Alaska Native persons, Hispanic or Latino persons, and Native Hawaiian or Other Pacific Islander persons received a booster or additional dose, compared with approximately one half of non-Hispanic White and multiple/other race persons. All adults aged ≥65 years should be vaccinated against COVID-19, including receiving an additional primary dose if they are immunocompromised and/or a booster dose after the minimum recommended interval after primary series completion.

Differences in coverage between recipients of different primary series vaccine products can partially be explained by the staggered timing of ACIP recommendations, which also lowered overall coverage because not all persons represented in these results had an equal amount of time to receive a booster or additional primary dose. For example, based on timing of recommendations, Pfizer-BioNTech primary series recipients had 28 days longer to receive a booster dose than did Moderna or Janssen recipients. In addition, Moderna and Pfizer-BioNTech coverage includes recipients of additional primary doses administered since August 13, whereas Janssen coverage does not. However, only 10.7% of booster or additional primary dose recipients received an additional primary dose before booster dose recommendations, so inclusion of these recipients in mRNA primary series coverage cannot account for the differences observed. Certain groups (i.e., additional primary dose recipients and Pfizer-BioNTech booster dose recipients during September 23–October 20, 2021) were recommended to receive a homologous dose, while the first recommendations for Janssen recipients allowed a heterologous booster dose. Although 61.5% of Janssen recipients received a heterologous booster dose, this represents only 227,079 persons, or 1.2% of overall booster or additional primary dose recipients.

FIGURE. Daily number of COVID-19 booster or additional primary dose recipients aged ≥65 years, by primary series vaccine product — United States, August 13–November 19, 2021

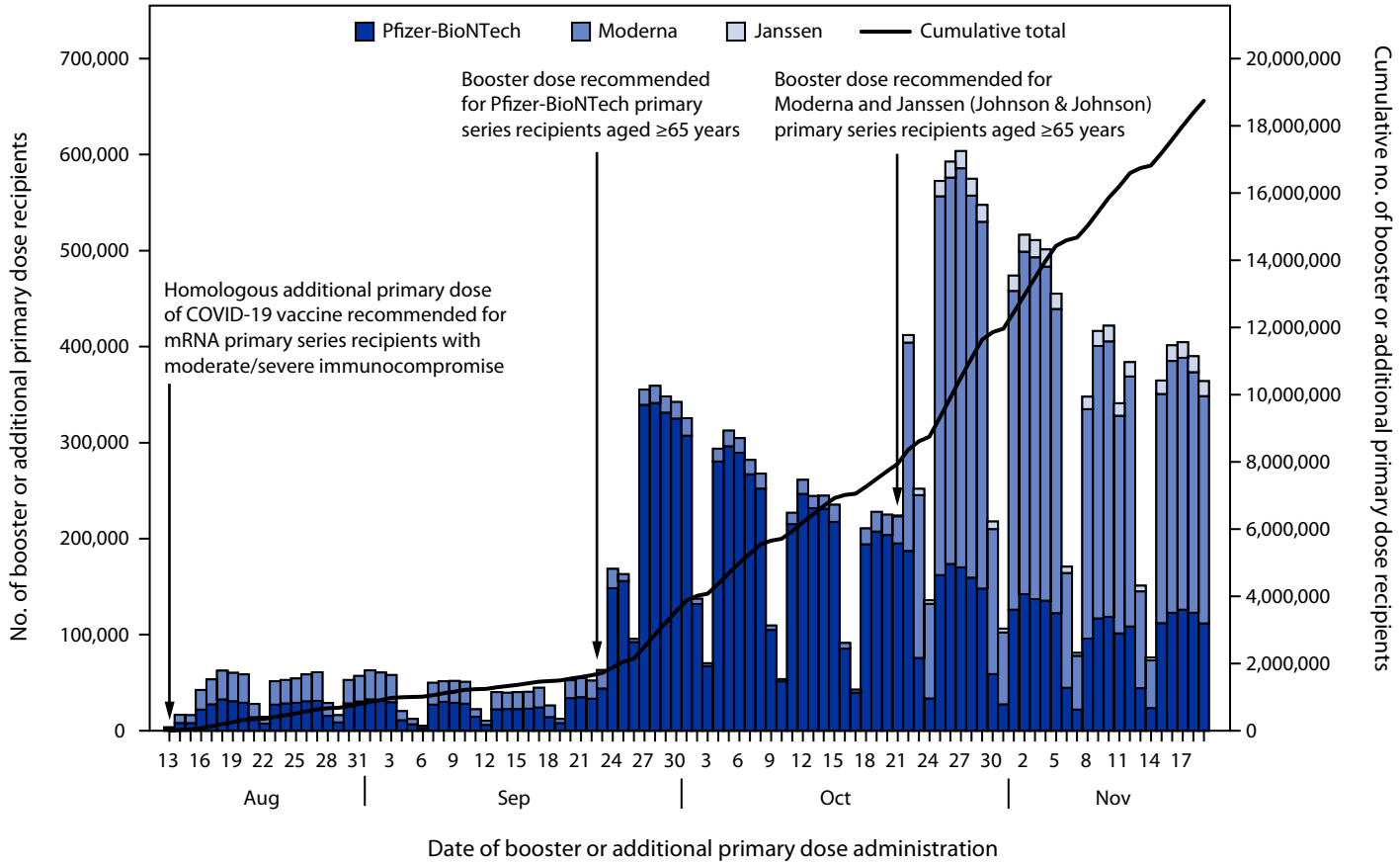

TABLE 2. Vaccine product administered as booster or additional primary dose* in respect to that used in primary series for booster or additional primary dose recipients aged ≥65 years, by primary series vaccine product — United States, August 13–November 19, 2021

Characteristic	No. (column %), by primary series vaccine product			
	Total	**Pfizer-BioNTech**	**Moderna**	**Janssen (Johnson & Johnson)**
No. of booster or additional primary dose recipients	**18,745,803**	9,925,719	8,425,884	369,260
Type of booster or additional primary dose				
Homologous dose	**17,957,427 (95.8)**	9,744,109 (98.2)	8,071,200 (95.8)	142,118 (38.5)
Heterologous dose	**748,099 (4.0)**	168,336 (1.7)	352,684 (4.2)	227,079 (61.5)

* The type of vaccine product administered for the booster or additional primary dose in respect to that used in the primary series was unable to be determined for 40,277 (0.2%) persons. These persons had an unspecified U.S.-authorized or approved mRNA COVID-19 vaccine product administered as either the primary series or as a booster or additional primary dose.

The findings in this report are subject to at least five limitations. First, the use of a composite measure for coverage and absence of information on the immunocompromise status of vaccine recipients limits the conclusions that can be drawn from the analysis and might also have resulted in underestimation of the eligible population because immunocompromised persons who completed a primary series after May 19, 2021, could not be identified. Second, identification of booster or additional primary dose recipients depends on linkage between vaccination records in jurisdiction-specific immunization information systems or other data systems. Persons who received a booster or additional primary dose in a different jurisdiction from that of their primary series, or who for other reasons were not able to be linked back to their primary series, might not be represented in these results. Third, restricting the source population to persons aged ≥65 years at the time of primary series completion might have excluded some valid recipients, including those who reached age 65 years between

Summary

What is already known about this topic?

Although COVID-19 vaccines are highly effective, vaccine effectiveness wanes over time, and adults aged ≥65 years are at increased risk for severe COVID-19–associated illness. Booster and additional primary vaccine doses increase protection.

What is added by this report?

During August 13–November 19, 2021, 18.7 million persons aged ≥65 years received a booster or additional primary dose of COVID-19 vaccine, constituting 44.1% of eligible persons aged ≥65 years. Coverage differed by primary series vaccine product and race/ethnicity.

What are the implications for public health practice?

Strategic efforts are needed to encourage eligible persons aged ≥18 years, especially those aged ≥65 years and those who are immunocompromised, to receive a booster and/or additional primary dose to ensure maximal protection against COVID-19.

completion of the primary series and administration of the booster or additional primary dose, and persons with a missing, incorrect, or incomplete date of birth[†††] that resulted in a calculated age of <65 years. Fourth, the eligible source population was defined using the minimum recommended interval since primary series completion, which might have lowered coverage because not all persons, such as those who became eligible for a booster dose on the last day of the analysis period, had the same amount of time to receive a booster dose. Finally, approximately 29% of the vaccine administration records used to determine coverage were missing information on race or ethnicity, which could bias these estimates.

A booster or additional primary dose of COVID-19 vaccine provides a robust immune response (*3*) and protects against COVID-19 illness, hospitalization, and death. CDC now recommends that all persons aged ≥18 years receive a COVID-19 booster dose after the minimum recommended interval since primary series completion (*9*). Completing the primary COVID-19 vaccination series remains a critical frontline tool for ending the pandemic; however, strategic efforts are still needed to encourage eligible persons aged ≥18 years, especially those with elevated risk including persons aged ≥65 years and those with an immunocompromise status, to receive a booster and/or additional primary dose to ensure maximal protection against COVID-19.

[†††] As of December 6, 2021, nine jurisdictions report only year of birth and five jurisdictions report only the month and year of birth to CDC.

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Trends in and Characteristics of Drug Overdose Deaths Involving Illicitly Manufactured Fentanyls — United States, 2019–2020

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During May 2020–April 2021, the estimated number of drug overdose deaths in the United States exceeded 100,000 over a 12-month period for the first time, with 64.0% of deaths involving synthetic opioids other than methadone (mainly illicitly manufactured fentanyls [IMFs], which include both fentanyl and illicit fentanyl analogs).* Introduced primarily as adulterants in or replacements for white powder heroin east of the Mississippi River (*1*), IMFs are now widespread in white powder heroin markets, increasingly pressed into counterfeit pills resembling oxycodone, alprazolam, or other prescription drugs, and are expanding into new markets, including in the western United States† (*2*). This report describes trends in overdose deaths involving IMFs (IMF-involved deaths) during July 2019–December 2020 (29 states and the District of Columbia [DC]), and characteristics of IMF-involved deaths during 2020 (39 states and DC) using data from CDC's State Unintentional Drug Overdose Reporting System (SUDORS). During July 2019–December 2020, IMF-involved deaths increased sharply in midwestern (33.1%), southern (64.7%), and western (93.9%) jurisdictions participating in SUDORS. Approximately four in 10 IMF-involved deaths also involved a stimulant. Highlighting the need for timely overdose response, 56.1% of decedents had no pulse when first responders arrived. Injection drug use was the most frequently reported individual route of drug use (24.5%), but evidence of snorting, smoking, or ingestion, but not injection drug use was found among 27.1% of decedents. Adapting and expanding overdose prevention, harm reduction, and response efforts is urgently needed to address the high potency (*3*), and various routes of use for IMFs. Enhanced treatment for substance use disorders is also needed to address the increased risk for overdose (*4*) and treatment complications (*5*) associated with using IMFs with stimulants.

Death certificate data, postmortem toxicology testing results, and death scene and witness findings from medical examiner or coroner reports are entered into SUDORS for unintentional drug overdose deaths and those of undetermined intent in 48 participating jurisdictions, providing comprehensive details about overdose deaths across jurisdictions not available from other data sources (*6*). IMFs§ were identified using toxicology and scene evidence (*7*). Monthly trends in IMF-involved deaths during July 1, 2019–December 31, 2020, were stratified by geographic region¶ among 30 jurisdictions with complete data (26 reported all overdose deaths in the jurisdiction and four reported deaths from subsets of counties).** Differences in the proportions of overdose deaths that involved IMFs (comparing July–December 2019 with July–December 2020) were assessed using z-tests, with p-values <0.05 considered statistically significant. Decedent demographics, overdose characteristics, and other drug co-involvement, were examined among 40 jurisdictions using 2020 data (35 reported all overdose deaths in the jurisdiction and five reported deaths from subsets of counties), stratified by region.†† Analyses were performed using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and conducted consistent with applicable federal law and CDC policy.§§

* https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm (Accessed November 29, 2021).

† https://www.dea.gov/sites/default/files/2021-02/DIR-008-21%202020%20National%20Drug%20Threat%20Assessment_WEB.pdf

§ Fentanyl was classified as likely illicitly manufactured using toxicology, scene, and witness evidence. In the absence of sufficient evidence to classify fentanyl as illicit or prescription (<12% of deaths involving fentanyl), fentanyl was classified as illicit because the vast majority of fentanyl overdose deaths involve illicit fentanyl. All fentanyl analogs except alfentanil, remifentanil, and sufentanil (which have legitimate human medical use) were included as illicitly manufactured fentanyls.

¶ U.S. Census regions were used to stratify jurisdictions into geographic regions: https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf. Not all jurisdictions in each region are included in analyses: trend analyses include eight of nine jurisdictions in the Northeast region, five of 12 jurisdictions in the Midwest region, eight of 17 jurisdictions in the South region, and nine of 13 jurisdictions in the West region; analyses of overdose characteristics include eight of nine jurisdictions in the Northeast region, nine of 12 jurisdictions in the Midwest region, 13 of 17 jurisdictions in the South region, and 10 of 13 jurisdictions in the West region.

** Jurisdictions included: Alaska, Arizona, Colorado, Connecticut, Delaware, District of Columbia, Georgia, Illinois, Kansas, Maine, Massachusetts, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, and West Virginia. Illinois, Missouri, Pennsylvania, and Washington reported deaths from counties that accounted for ≥75% of drug overdose deaths in the state in 2017, per SUDORS funding requirements; all other jurisdictions reported deaths from the full jurisdiction.

†† Jurisdictions included: Alaska, Arizona, Arkansas, Colorado, Connecticut, Delaware, District of Columbia, Georgia, Hawaii, Illinois, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, and West Virginia. Illinois, Louisiana, Missouri, Pennsylvania, and Washington reported deaths from counties that accounted for ≥75% of drug overdose deaths in the state in 2017, per SUDORS funding requirements; all other jurisdictions reported deaths from the full jurisdiction. Jurisdictions were included if data were available for January–June, July–December 2020, or both.

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

IMF-involved deaths increased from July–December 2019 to July–December 2020 across regions: Northeast (3.5% relative increase; from 5,019 to 5,194 deaths), Midwest (33.1%; 1,510 to 2,010), South (64.7%; 2,636 to 4,342), and West (93.9%; 955 to 1,852) (Figure 1). The proportions of drug overdose deaths involving IMFs increased significantly in midwestern (12.2% relative increase; from 62.9% to 70.6%), southern (24.1%; 54.3% to 67.4%), and western (45.7%; 30.2% to 44.0%) jurisdictions, while remaining stable in the Northeast (1.3% increase; 79.8% to 80.8%).

Across regions, more IMF-involved deaths co-involved stimulants (40.1%–45.2%) than co-involved opioids other than IMFs (19.2%–31.6%) (Figure 2). Cocaine (25.5%–35.1%) and heroin (16.6%–22.3%) were the most commonly co-involved stimulant and opioid other than IMFs, respectively, among IMF-involved deaths in all regions except the West, where methamphetamine (25.3%) and prescription opioids (12.0%) were most common. Substantial proportions of IMF-involved deaths involved no other opioid or stimulant (Northeast: 39.7%; Midwest: 40.6%; South: 37.1%; West: 49.5%). Benzodiazepines, gabapentin, and xylazine, all nonopioids with sedative or hypnotic properties, were involved in 12.3%–15.5%, 2.7%–5.2%, and 0.1%–5.5% of IMF-involved deaths, respectively, across all regions.

Most IMF-involved deaths (73.0%) were among males (Table). In western jurisdictions, 21.8% of decedents were aged <25 years, whereas in other regions, 5.9%–8.7% of decedents were in this age group. Injection drug use was the most commonly reported route of drug use among all IMF-involved deaths in all regions (22.7%–30.6%), except the West (11.7%). Evidence of snorting, smoking, or ingestion, but not injection drug use, was reported in 57.1% of deaths in western jurisdictions and 19.2%–26.4% of deaths in other regions. For 48.3% of IMF-involved deaths, no evidence of route of drug use was documented. Counterfeit pill evidence[¶¶] was documented among 13.3% of deaths in the West and <1.0% in other regions. Approximately one half of decedents (56.1%) had no pulse when first responders arrived. Most deaths occurred at the decedent's own home (64.2%) or in a house or apartment belonging to someone else (14.8%). Approximately one third (34.7%) of deaths occurred with a potential bystander[***] present who did not respond to the overdose, most commonly because of spatial separation from the decedent (e.g., in a different room of the same house).

Discussion

This report highlights four main findings regarding IMF-involved deaths: 1) deaths increased sharply in midwestern, southern, and western jurisdictions during 2019–2020; 2) approximately four in 10 deaths also involved stimulants; 3) approximately one half of decedents had no pulse when first responders arrived; and 4) evidence of injection was the most frequently documented route of drug use, but substantial percentages of deaths likely involved other routes, especially in the West. Rapid increases in IMF-involved deaths during 2019–2020, which accelerated during the COVID-19 pandemic,[†††] suggest increases in IMF distribution and exposure, consistent with law enforcement drug supply data (*8*), with evidence of plateauing of IMF-involved deaths only in the Northeast. Lower but increasing percentages of IMF-involved overdoses in southern and western jurisdictions, versus high percentages in northeastern and midwestern jurisdictions, and increases in IMF supply during 2020 (*8*) raise concerns about the potential for continued increases in IMF-involved deaths in jurisdictions in these regions.

Substantial stimulant co-involvement in IMF-involved deaths reflects recent trends in concurrent IMF and stimulant use (*4*,*6*), which can complicate substance use disorder treatment (*5*) and increase overdose risk (*4*). IMF-involved deaths involving any stimulant and those involving no other opioids or stimulants were more common than were those involving another opioid, suggesting that IMFs are well-established in many drug markets, independent of heroin. Co-involvement of benzodiazepines, gabapentin, and xylazine in some IMF-involved deaths is particularly dangerous because their sedative or hypnotic properties do not respond to naloxone.[§§§] Overdose response messaging must emphasize calling 9-1-1 and seeking further treatment, even after naloxone administration.

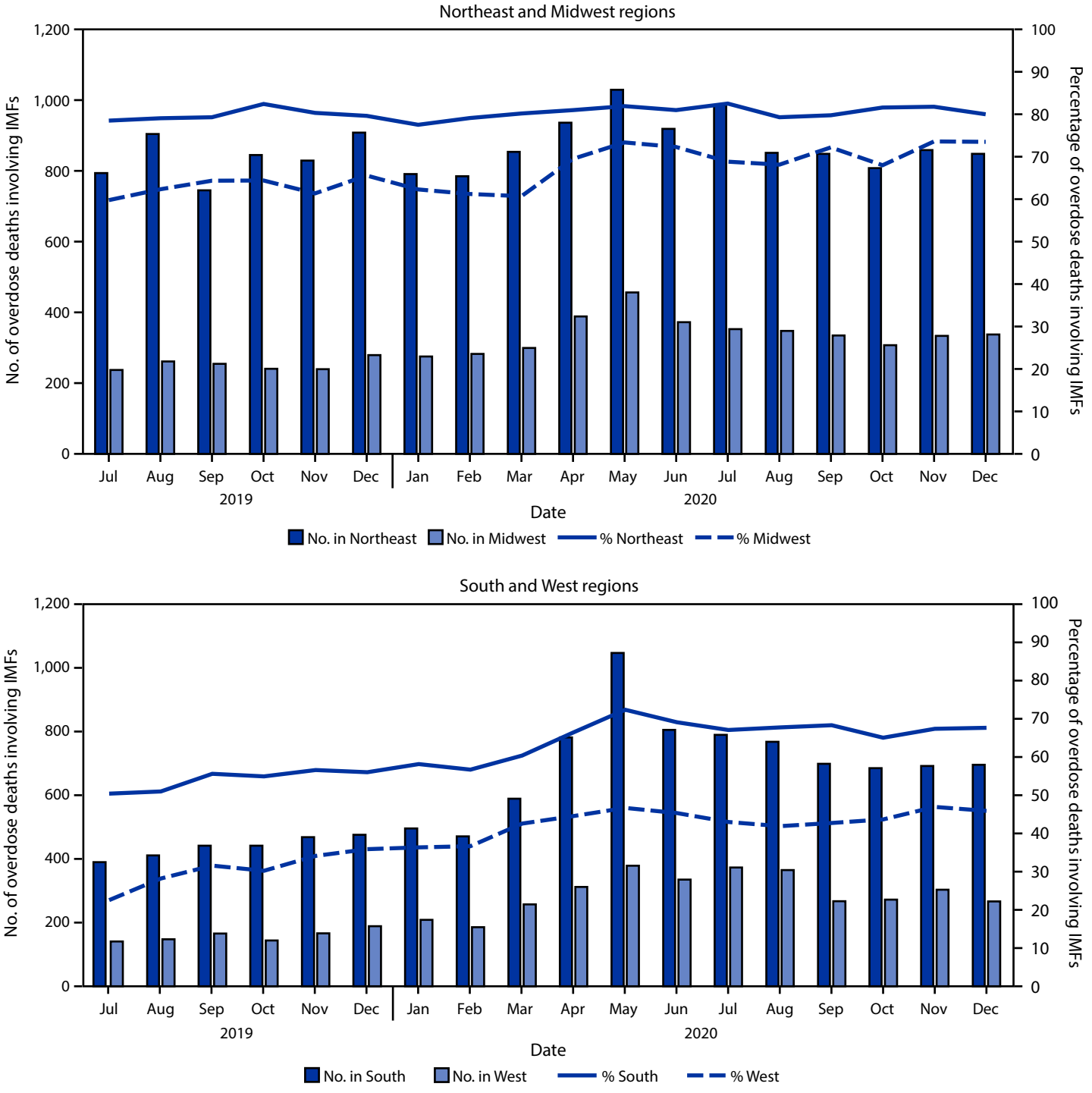
[¶¶] Counterfeit pill evidence included evidence that potential counterfeit pills were found at the scene of the fatal overdose or were consumed by the decedent (according to witness report). Evidence consistent with counterfeit pills included unmarked pills; pills marked with M30 or otherwise appearing like oxycodone pills, with no oxycodone detected by postmortem toxicology testing; pills appearing like alprazolam pills, with no alprazolam detected; pills noted to be counterfeit or potentially counterfeit in the medical examiner or coroner report; and pills noted to have contained fentanyl or tested positive for fentanyl. Detail about potential counterfeit pills in medical examiner or coroner reports varies widely, and some evidence was likely included in error and some evidence missed. It is also possible that counterfeit pills were on scene but not consumed by the decedent.

[***] For SUDORS, a potential bystander is defined as a person aged ≥11 years who was physically nearby either during or shortly preceding a drug overdose and potentially had an opportunity to intervene or respond to the overdose. This includes any persons in the same structure (e.g., same room or same building, but different room) as the decedent during that time. For example, the family member of an opioid overdose decedent who was in another room during the fatal incident would be considered a potential bystander if that person might have had an opportunity to provide life-saving measures such as naloxone administration, if adequate resources were available and the family member was aware that an overdose event could occur. This does not include, however, persons in different self-contained parts of larger buildings (e.g., a person in a different apartment in the same apartment building would not be considered a potential bystander).

[†††] https://emergency.cdc.gov/han/2020/han00438.asp

[§§§] https://www.cdc.gov/mmwr/volumes/70/wr/mm7034a4.htm

FIGURE 1. Number and percentage of drug overdose deaths involving illicitly manufactured fentanyls,* by month and geographic region† — State Unintentional Drug Overdose Reporting System, 30 jurisdictions,§ July 2019–December 2020



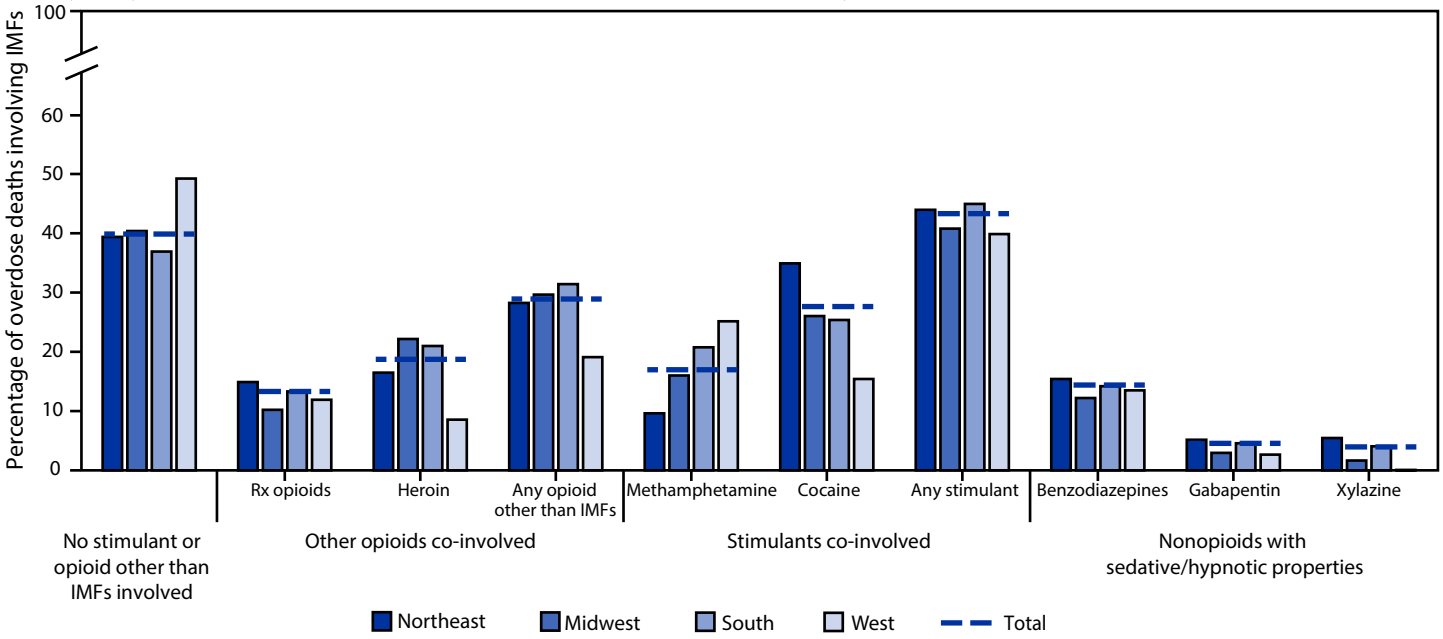
Abbreviations: IMFs = illicitly manufactured fentanyls; SUDORS = State Unintentional Drug Overdose Reporting System.

* Includes illicitly manufactured fentanyl and fentanyl analogs.

† *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Rhode Island, and Vermont; *Midwest*: Illinois, Kansas, Minnesota, Missouri, and South Dakota; *South*: Delaware, District of Columbia, Georgia, North Carolina, Oklahoma, Tennessee, Virginia, and West Virginia; *West*: Alaska, Arizona, Colorado, Montana, Nevada, New Mexico, Oregon, Utah, and Washington.

§ Illinois, Missouri, Pennsylvania, and Washington reported deaths from counties that accounted for ≥75% of drug overdose deaths in the state in 2017, per SUDORS funding requirements; all other jurisdictions reported deaths from the full jurisdiction.

FIGURE 2. Co-involvement of other opioids, stimulants, and other psychoactive substances in drug overdose deaths involving illicitly manufactured fentanyls,* by geographic region† — State Unintentional Drug Overdose Reporting System, 40 jurisdictions,§ 2020¶,,††**



Abbreviations: IMFs = illicitly manufactured fentanyls; Rx = prescription; SUDORS = State Unintentional Drug Overdose Reporting System.

* Includes illicitly manufactured fentanyl and fentanyl analogs.

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

§ Illinois, Louisiana, Missouri, Pennsylvania, and Washington reported deaths from counties that accounted for ≥75% of drug overdose deaths in the state in 2017, per SUDORS funding requirements; all other jurisdictions reported deaths from the full jurisdiction. Jurisdictions included if data were available for January–June or July–December 2020, or both.

¶ Deaths in the "no stimulant or opioid other than IMFs involved" category could have involved drugs other than opioids and stimulants. The "any opioids other than IMFs" category includes heroin, prescription opioids, and other illicit synthetic opioids (e.g., isotonitazene, U-47700). The "any stimulant" category includes cocaine, amphetamines, cathinones, and other central nervous system stimulants (e.g., atomoxetine, caffeine).

** Buprenorphine and methadone are included as prescription opioids; however, they are used both for treatment of pain and for treatment of opioid use disorder. Fewer than 3% of deaths involved buprenorphine, and fewer than 4% of deaths involved methadone, across jurisdictions.

†† Co-involvement of gabapentin and xylazine in IMF deaths is likely underestimated because of lack of routine postmortem toxicology testing for these drugs across jurisdictions.

A challenge in responding to IMF overdoses is that approximately one half of decedents had no pulse when first responders arrived, reducing their chance of survival. This statistic highlights both the high potency of IMFs (*3*) and the potential for rapid overdose¶¶¶ and underscores the need to enhance harm reduction efforts, including improving naloxone access and distribution for persons who use drugs (and their family members and friends) to ensure timely response to IMF overdoses. In the approximately one third of deaths where potential bystanders provided no response, common barriers were spatial separation, lack of awareness of drug use, and inability to recognize a drug overdose. Thus, expanding education about drug use signs and overdose recognition and response, and the importance of regularly checking on family or friends who potentially use drugs, might reduce mortality. Efforts to reduce fatal overdoses at home (e.g., encouragement of testing drug products with fentanyl test strips, having naloxone available, and avoidance of using drugs alone) are needed, because most IMF-involved deaths occurred in the decedent's own home.

Although injection was the most commonly reported route of drug use among IMF-involved deaths, in approximately one quarter of deaths, including approximately one half of deaths in western jurisdictions, there was evidence of snorting, smoking, or ingestion, but not injection. A September 2021 Drug Enforcement Administration public safety alert described rapid increases in counterfeit pill availability and variety,**** and this might help explain the relatively high percentage of decedents with no documented injection drug use. Evidence of counterfeit pills (which can be ingested orally or prepared for snorting, injecting, or smoking) was found in <1% of IMF-involved deaths overall but in 13.3% of IMF-involved deaths in western jurisdictions. This statistic is, however, likely a significant underestimation of counterfeit pill involvement because identification of pills as counterfeit on the basis of

¶¶¶ https://www.cdc.gov/mmwr/volumes/66/wr/mm6614a2.htm

**** https://www.dea.gov/onepill

TABLE. Demographics and characteristics of drug overdose deaths involving illicitly manufactured fentanyls,* by geographic region† — State Unintentional Drug Overdose Reporting System, 40 jurisdictions,§ 2020

Characteristic	No. (%)				
	Northeast	Midwest	South	West	Total
Among all decedents					
Total	**10,502**	**7,350**	**12,304**	**3,540**	**33,696**
Gender¶					
Male	7,872 (75.0)	5,303 (72.1)	8,816 (71.7)	2,609 (73.7)	**24,600 (73.0)**
Female	2,630 (25.0)	2,047 (27.9)	3,488 (28.3)	931 (26.3)	**9,096 (27.0)**
Unknown/Missing	0 (—)	0 (—)	0 (—)	0 (—)	**0 (—)**
Age group, yrs¶					
Median (IQR)	40 (32–51)	39 (31–51)	39 (31–50)	33 (26–43)	**39 (31–50)**
<15	—**	—**	13 (0.1)	21 (0.6)	**47 (0.1)**
15–24	623 (5.9)	636 (8.7)	971 (7.9)	750 (21.2)	**2,980 (8.8)**
25–34	2,791 (26.6)	2,052 (27.9)	3,474 (28.2)	1,110 (31.4)	**9,427 (28.0)**
35–44	2,914 (27.8)	1,863 (25.4)	3,379 (27.5)	833 (23.5)	**8,989 (26.7)**
45–54	2,210 (21.0)	1,474 (20.1)	2,396 (19.5)	470 (13.3)	**6,550 (19.4)**
55–64	1,620 (15.4)	1,065 (14.5)	1,724 (14.0)	305 (8.6)	**4,714 (14.0)**
≥65	338 (3.2)	250 (3.4)	345 (2.8)	50 (1.4)	**983 (2.9)**
Unknown/Missing	—**	—**	—**	—**	—**
Race/Ethnicity¶					
White, non-Hispanic	7,297 (70.4)	4,599 (62.9)	8,444 (69.2)	1,905 (54.3)	**22,245 (66.6)**
Black, non-Hispanic	1,622 (15.6)	2,010 (27.5)	3,072 (25.2)	289 (8.2)	**6,993 (20.9)**
AI/AN, non-Hispanic	23 (0.2)	92 (1.3)	103 (0.8)	154 (4.4)	**372 (1.1)**
A/OPI, non-Hispanic	65 (0.6)	38 (0.5)	60 (0.5)	45 (1.3)	**208 (0.6)**
Multiple races, non-Hispanic	49 (0.5)	63 (0.9)	71 (0.6)	60 (1.7)	**243 (0.7)**
Hispanic	1,316 (12.7)	504 (6.9)	455 (3.7)	1,054 (30.1)	**3,329 (10.0)**
Unknown/Missing	130	44	99	33	**306**
Among decedents with data from coroner or medical examiner reports					
Total	**9,840**	**7,067**	**10,959**	**3,505**	**31,371**
Drug use history††					
Illicit opioids	2,746 (27.9)	2,689 (38.1)	3,695 (33.7)	915 (26.1)	**10,045 (32.0)**
Prescription opioids	462 (4.7)	522 (7.4)	889 (8.1)	832 (23.7)	**2,705 (8.6)**
Unspecified opioids	657 (6.7)	389 (5.5)	473 (4.3)	223 (6.4)	**1,742 (5.6)**
Cocaine	923 (9.4)	804 (11.4)	1,282 (11.7)	355 (10.1)	**3,364 (10.7)**
Methamphetamine	229 (2.3)	392 (5.5)	572 (5.2)	441 (12.6)	**1,634 (5.2)**
Other	3,684 (37.4)	2,222 (31.4)	3,916 (35.7)	1,150 (32.8)	**10,972 (35.0)**
Route of drug use§§					
Injection	2,238 (22.7)	1,691 (23.9)	3,353 (30.6)	411 (11.7)	**7,693 (24.5)**
No injection reported; snorting, smoking, or ingestion reported	1,887 (19.2)	1,865 (26.4)	2,756 (25.1)	2,002 (57.1)	**8,510 (27.1)**
No injection; snorting	1,017 (10.3)	931 (13.2)	1,520 (13.9)	835 (23.8)	**4,303 (13.7)**
No injection; smoking	628 (6.4)	628 (8.9)	962 (8.8)	987 (28.2)	**3,205 (10.2)**
No injection; ingestion	467 (4.7)	774 (11.0)	914 (8.3)	1,012 (28.9)	**3,167 (10.1)**
No reported route of drug use	5,708 (58.0)	3,507 (49.6)	4,841 (44.2)	1,087 (31.0)	**15,143 (48.3)**
Evidence of counterfeit pills	23 (0.2)	63 (0.9)	46 (0.4)	466 (13.3)	**598 (1.9)**
Documentation of no pulse at first responder arrival¶	4,789 (48.8)	2,832 (40.3)	7,410 (69.4)	2,354 (67.8)	**17,385 (56.1)**
Potential bystander present¶	4,262 (43.3)	2,931 (41.5)	6,053 (55.2)	2,234 (63.7)	**15,480 (49.3)**
Potential bystander present but no documented overdose response efforts¶¶	2,860 (29.1)	2,271 (32.1)	4,212 (38.4)	1,528 (43.6)	**10,871 (34.7)**
Did not recognize abnormalities	230 (8.0)	288 (12.7)	293 (7.0)	209 (13.7)	**1,020 (9.4)**
Recognized abnormalities but not as overdose	226 (7.9)	205 (9.0)	361 (8.6)	207 (13.5)	**999 (9.2)**
Bystander also using drugs or drinking	223 (7.8)	284 (12.5)	416 (9.9)	110 (7.2)	**1,033 (9.5)**
Spatial separation	1,189 (41.6)	1,055 (46.5)	1,860 (44.2)	901 (59.0)	**5,005 (46.0)**
Unaware decedent was using drugs	231 (8.1)	370 (16.3)	635 (15.1)	330 (21.6)	**1,566 (14.4)**
Drug use witnessed¶	644 (6.5)	612 (8.7)	1,142 (10.4)	463 (13.2)	**2,861 (9.1)**
Overdose at home¶	6,267 (66.2)	4,249 (62.6)	6,068 (61.9)	2,348 (68.3)	**18,932 (64.2)**
Overdose in house or apartment; not own home¶	1,200 (12.8)	1,134 (16.7)	1,610 (16.3)	409 (12.0)	**4,353 (14.8)**

See table footnotes on next page.

TABLE (*Continued*). Demographics and characteristics of drug overdose deaths involving illicitly manufactured fentanyls,* by geographic region† — State Unintentional Drug Overdose Reporting System, 40 jurisdictions,§ 2020

Abbreviations: AI/AN = American Indian or Alaska Native; A/OPI = Asian or Other Pacific Islander; IMFs = illicitly manufactured fentanyls; SUDORS = State Unintentional Drug Overdose Reporting System.

* Includes illicitly manufactured fentanyl and fentanyl analogs.

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

§ Illinois, Louisiana, Missouri, Pennsylvania, and Washington reported deaths from counties that accounted for ≥75% of drug overdose deaths in the state in 2017, per SUDORS funding requirements; all other jurisdictions reported deaths from the full jurisdiction. Jurisdictions included if data were available for January–June or July–December 2020, or both. Data for July–December 2020 for one state (816 deaths) only included in section for all decedents, because the overall percentage of decedents with a medical examiner or coroner report was <75%, which is the cut-off used in SUDORS for inclusion in analyses of overdose circumstances.

¶ Missing values were excluded from calculations of percentages. Percentages might not sum to 100% because of rounding.

** Data suppressed because cell contained <10 deaths or to prevent calculation of another suppressed cell.

†† Drug use history categories are not mutually exclusive; a decedent could have a documented history of use or misuse of more than one type of drug. Illicit opioid use history includes history of use of IMFs or heroin. Other drug use history includes history of benzodiazepine misuse, history of cannabis use, history of unspecified drug use, and other drug use history (with specific drugs written in).

§§ Route of drug use cannot be directly linked to specific drugs if more than one drug detected and more than one route reported (e.g., if there was evidence of injection and snorting, both would be documented; if more than one drug was detected, it cannot be determined which was injected and which was snorted). Percentages for all rows in this section calculated out of the region total. Categories for no injection/snorting, no injection/smoking, and no injection/ingestion are not mutually exclusive; a death could have evidence of more than one of these routes. Other routes of drug use (transdermal, suppository, sublingual, buccal) were each reported for <0.5% of deaths in each region so these routes were not included but account for why the totals for "injection," "no injection reported; snorting, smoking, or ingestion reported," and "no reported route of drug use" do not sum to the regional totals.

¶¶ Reasons for lack of bystander response are presented with percentages calculated out of deaths with evidence of a potential bystander present, but with no evidence that any bystander response was made (e.g., no naloxone administered and no cardiopulmonary resuscitation performed). Reasons for no response are not mutually exclusive; more than one reason could be reported per death.

appearance can be difficult, and testing of pills found at the scene is rarely done; documenting counterfeit pill evidence is therefore challenging. IMF availability in pill form is likely contributing to its increased use across the United States, especially in western drug markets where white powder heroin is uncommon (*9*). Coupled with local reports,†††† the finding of counterfeit pill evidence in IMF-involved deaths highlights the need for enhanced surveillance for overdoses involving counterfeit pills and education about counterfeit pills containing IMFs, as persons might be unaware that they contain IMFs or even opioids (e.g., if using counterfeit pills designed to look like nonopioid medications such as alprazolam). One western city reported a shift from injecting opioids to smoking IMFs (*9*); however, the extent to which this shift is occurring elsewhere is unknown. Investigating the higher proportion of IMF-involved deaths among young persons in the West and whether and how these deaths are linked to counterfeit pills and other routes of use is needed. Persons using IMFs by routes other than injection might not use traditional harm reduction services such as syringe services programs, or might be newer to drug use (*10*), and therefore might be harder to reach than persons injecting drugs. Expanding the focus of interventions within and beyond such traditional avenues to reach persons using IMFs by other routes, while enhancing existing efforts to address risks associated with injecting IMFs, could help prevent overdoses.

Summary

What is already known about this topic?

Synthetic opioids, including illicitly manufactured fentanyls (IMFs), were involved in 64% of >100,000 estimated U.S. drug overdose deaths during May 2020–April 2021.

What is added by this report?

During 2019–2020, IMF-involved overdose deaths increased sharply in midwestern, southern, and western jurisdictions. During 2020, approximately 40% of IMF-involved deaths also involved stimulants, and 56% of decedents had no pulse when first responders arrived. Injection drug use was reported in 25% of deaths, and noninjection routes of drug use in 27% of deaths.

What are the implications for public health practice?

Adapting overdose prevention and response efforts to address risk factors associated with IMFs and using innovative approaches to address the endemic nature of IMFs, various routes of IMF use, and frequent polysubstance use could slow increases in IMF-involved deaths.

The findings in this report are subject to at least three limitations. First, the jurisdictions included (30 in trend analyses and 40 in descriptive analyses) are not nationally representative, and some jurisdictions report data from subsets of counties; therefore, these findings might not be able to be extrapolated to other areas. Second, death investigation differs across and within jurisdictions and might contribute to regional differences. Also, difficulties in obtaining overdose characteristic evidence for some deaths (e.g., those with no witnesses) can lead to underestimation (e.g., drug use route was unknown

†††† Additional information is available from local reports: San Diego, California (https://www.dea.gov/press-releases/2020/08/06/alarming-spike-fentanyl-related-overdose-deaths-leads-officials-issue); Multnomah County, Oregon (https://www.multco.us/multnomah-county/news/health-officials-warn-rise-deaths-counterfeit-pills); Anchorage, Alaska (https://local.nixle.com/alert/7943584/?sub_id); King County, Washington (https://publichealthinsider.com/2021/08/17/thirty-four-king-county-residents-died-from-fentanyl-drug-overdose-in-july-how-our-community-can-take-action/).

for approximately one half of deaths). Finally, there is no standard for postmortem toxicology testing or drug involvement determination, potentially resulting in failure to detect IMFs or other drugs.

Urgent action is needed to slow and reverse rapid increases in drug overdose deaths involving IMFs and other drugs, including enhancing access to substance use disorder treatment (e.g., medications for opioid use disorder) and expanding harm reduction approaches that address risk factors associated with IMFs (e.g., improving and expanding distribution of naloxone to persons who use drugs and their friends and family,[§§§§] distributing fentanyl test strips to test drug products for fentanyl, and increasing overdose education and access to comprehensive syringe services programs). Innovative approaches are needed to address the endemic nature of IMF-involved overdoses, noninjection routes of IMF use, and frequent polysubstance use, in particular, the rising use of opioids and stimulants.

[§§§§] September 2021 Model Expanded Access to Emergency Opioid Antagonists Act: https://legislativeanalysis.org/model-expanded-access-to-emergency-opioid-antagonists-act/

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Notes from the Field

Mucormycosis Cases During the COVID-19 Pandemic — Honduras, May–September 2021

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On July 15, 2021, the Secretary of Health of Honduras (SHH) was notified of an unexpected number of mucormycosis cases among COVID-19 patients. SHH partnered with the Honduras Field Epidemiology Training Program, the Executive Secretariat of the Council of Ministers of Health of Central America and the Dominican Republic (SE-COMISCA), Pan American Health Organization (PAHO), and CDC to investigate mucormycosis cases at four geographically distinct hospitals in Honduras.

Mucormycosis is a severe, often fatal disease caused by infection with angioinvasive molds belonging to the order Mucorales. Risk factors for mucormycosis include certain underlying medical conditions (e.g., hematologic malignancy, stem cell or solid organ transplantation, or uncontrolled diabetes) and the use of certain immunosuppressive medications (*1*). COVID-19 might increase mucormycosis risk because of COVID-19–induced immune dysregulation or associated medical treatments, such as systemic corticosteroids and other immunomodulatory drugs (e.g., tocilizumab), which impair the immune response against mold infections (*2*). In India, an apparent increase in mucormycosis cases (which was referred to by the misnomer "black fungus") was attributed to COVID-19 (*3*).

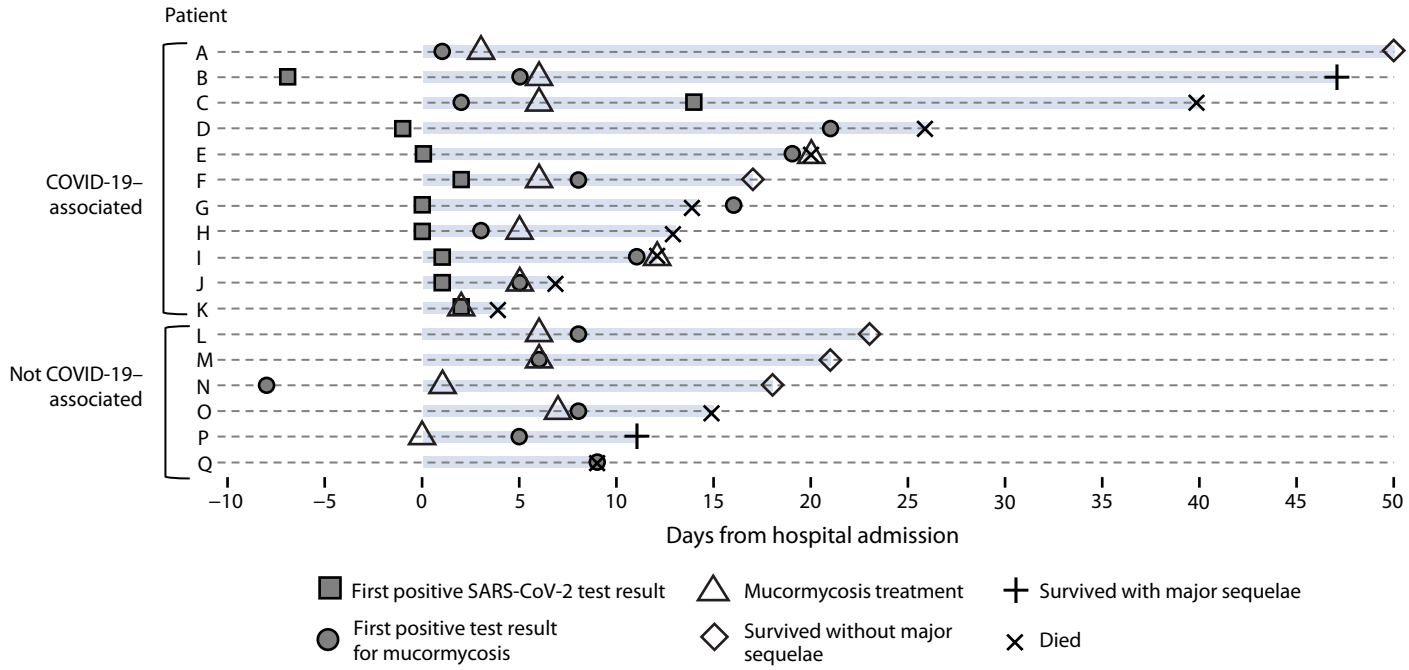
For this investigation, a mucormycosis case was defined as laboratory identification of Mucorales by direct microscopy, culture, or histopathology in a patient with a clinical diagnosis of mucormycosis.[§] Cases were considered COVID-19–associated if the patient received a positive test result for SARS-CoV-2 (the virus that causes COVID-19) or a COVID-19 diagnosis[¶] during the period 60 days before to 14 days after mucormycosis diagnosis. Investigators traveled to the four hospitals (three public, and one private) during August 30–September 10, 2021, to ascertain mucormycosis cases and abstract medical record data using a standardized Epi Info (version 7.2.3.1; CDC) case report form. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[**]

Seventeen persons received a diagnosis of mucormycosis during May 5–September 6, 2021; these included 11 persons with COVID-19–associated cases (Figure). Mucormycosis was confirmed by direct microscopy (16 cases), fungal culture (13 cases), or histopathology (three cases). The demographic features, underlying conditions, and mucormycosis clinical signs and symptoms were similar between patients with and without COVID-19. Most patients were male (nine); the median age was 54 years (IQR = 32–68 years). Diabetes was the most common underlying condition (12 patients), and two patients had hematologic malignancies; no other underlying immunosuppressive medical conditions were noted. During hospitalization, none of the patients with diabetes experienced diabetic ketoacidosis. The most frequent mucormycosis clinical signs and symptoms were rhino-orbital (12 patients) and cutaneous (four patients). The median interval between hospital admission and first positive test result for mucormycosis was 7 days (range = −8 to 21 days). Among the 11 patients with COVID-19–associated mucormycosis cases, nine were unvaccinated against COVID-19; the median interval between COVID-19 diagnosis and the first positive test result for mucormycosis was 11 days (range = −12 to 58 days). Seven COVID-19 patients received supplemental oxygen therapy, nine received corticosteroids, and four received tocilizumab.

Ten of the 17 patients died during hospitalization, including eight of the 11 with COVID-19–associated mucormycosis; three patients remained hospitalized at the time of medical chart abstraction. Two of the seven surviving patients experienced major sequelae from mucormycosis, including facial disfiguration and limb loss.

* These authors contributed equally to this report.
† These authors contributed equally to this report.
§ Signs and symptoms of mucormycosis vary by the affected body site. Rhino-orbital-cerebral mucormycosis signs and symptoms frequently include unilateral facial swelling, headache, sinus congestion, and necrotic lesions of the nasal bridge or palate. Cutaneous mucormycosis signs and symptoms frequently include blisters or ulcers that become necrotic, and pain, erythema, or swelling around a wound. Pulmonary mucormycosis signs and symptoms frequently include cough, chest pain, and shortness of breath. https://www.cdc.gov/fungal/diseases/mucormycosis/symptoms.html
¶ A COVID-19 case was defined as receipt of a positive SARS-CoV-2 reverse transcription–polymerase (RT-PCR) chain reaction or antigen test result, or a clinical diagnosis of COVID-19 in a patient who received a positive serologic test result (RT-PCR or antigen testing was not available in some areas).
** 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE. Time line of diagnosis, treatment, and outcomes for patients hospitalized with mucormycosis (N = 17) — Honduras, May–September 2021*



* Additional patient information: patient A's COVID-19 diagnosis date (not included) occurred 58 days before the date of the first positive mucormycosis test result; patients B, F, and M remained hospitalized on the date of data abstraction; and patient K's date of first positive mucormycosis test result was unavailable.

The findings in this report are subject to at least two limitations. First, the actual extent of COVID-19–associated mucormycosis in Honduras is likely underrepresented because case investigations involved only four hospitals in the country. Second, because mucormycosis reporting is not required in Honduras, it is difficult to determine whether the cases described in this report represent an increase over the country's baseline mucormycosis incidence, which is unknown. The primary laboratory for mycology in Honduras (population approximately 9,900,000)[††] usually identifies approximately two mucormycosis cases annually (S. Montoya, Hospital Escuela, personal communication, October 2021). By comparison, the 17 mucormycosis cases described in this report occurred during approximately 4 months (May 5–September 6, 2021), coinciding with Honduras's mid-year COVID-19 surge.[§§,¶¶] This apparent increase in laboratory-identified mucormycosis cases might be related to the COVID-19 surge because of COVID-19–induced immune dysregulation or associated medical treatments (*2*). Alternatively, it might reflect the use of an active case-finding strategy during the investigation period. Increased case detection might also be related to higher clinician awareness and testing for mucormycosis, prompted by educational webinars held by SHH, SE-COMISCA, PAHO, and CDC after the initial detection of COVID-19–associated mucormycosis cases in Honduras.

Given the severe outcomes associated with mucormycosis, clinicians should remain vigilant for this disease during the COVID-19 pandemic, including in immunocompetent patients. Early mucormycosis diagnosis is possible, even in resource-limited settings (*4*). Mucormycosis treatment guidelines recommend prompt antifungal therapy[***] and surgical intervention to reduce mortality (*4*). Prevention of COVID-19 through vaccination, maintenance of glycemic control in patients with diabetes, and judicious use of steroids[†††,§§§] for COVID-19 treatment might help decrease the risk for mucormycosis associated with COVID-19 (*2*). Because of these reported cases, SHH and partners are conducting clinician outreach and education to improve prevention, diagnosis, and treatment of mucormycosis.

[††] https://population.un.org/wpp/Download/Standard/Population/
[§§] https://covid19.who.int/region/amro/country/hn (Accessed December 9, 2021).
[¶¶] http://covid19honduras.org/(Accessed December 9, 2021).

[***] Antifungal drugs that are effective against mucormycosis include amphotericin B, posaconazole, and isavuconazole. Other antifungal drugs, including fluconazole, voriconazole, and echinocandins, are not effective for treating mucormycosis.
[†††] https://www.who.int/publications/i/item/WHO-2019-nCoV-Corticosteroids-2020.1
[§§§] https://www.covid19treatmentguidelines.nih.gov/management/clinical-management/hospitalized-adults--therapeutic-management/

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Notes from the Field

COVID-19–Associated Mucormycosis — Arkansas, July–September 2021

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During September 17–24, 2021, three clinicians independently notified the Arkansas Department of Health (ADH) of multiple patients with mucormycosis after a recent diagnosis of COVID-19. To provide data to guide clinical and public health practice, ADH coordinated a statewide call on October 11, 2021 to infection preventionists for COVID-19–associated mucormycosis cases.

Mucormycosis is an uncommon but severe invasive fungal infection caused by molds in the order Mucorales. Mucormycosis typically affects persons with immunocompromising conditions such as a hematologic malignancy, stem cell or solid organ transplantation, or uncontrolled diabetes (*1*). The emergence of COVID-19–associated mucormycosis has been described in other parts of the world, particularly in India, but has been infrequently reported in the United States (*2–4*). COVID-19 might increase mucormycosis risk because of COVID-19–induced immune dysregulation or associated treatments such as corticosteroids and immunomodulatory drugs (e.g., tocilizumab or baricitinib) that impair host defenses against molds (*5*).

A case of mucormycosis was defined as laboratory identification of Mucorales by culture, histopathology, or polymerase chain reaction in a patient with a clinical diagnosis of invasive mucormycosis.† Cases were considered COVID-19–associated if the patient received a positive reverse transcription–polymerase chain reaction or antigen test result for SARS-CoV-2 (the virus that causes COVID-19) during the 60 days preceding the mucormycosis diagnosis. Cases were reported to ADH using a standardized case report form, medical records, or oral report. Data were stored using Research Electronic Data Capture software (version 10.6.18; Vanderbilt University) (*6*) and linked to state vital records and state immunization and COVID-19 registries. Patient demographic characteristics, underlying conditions, clinical course, treatment, and clinical outcomes were examined. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.§

Ten COVID-19–associated mucormycosis cases that occurred during July 12–September 28, 2021, were reported to ADH by six hospitals.¶ Nine patients lived in Arkansas, with patients representing each of the state's five public health unit regions; one patient lived in a bordering state. Among all 10 patients, the median age was 57 years (range = 17–78 years), all patients were non-Hispanic White persons, seven were male, one had a history of solid organ transplantation, and one had a history of recent traumatic injury at the body site where mucormycosis later developed. Eight patients had diabetes; among these, the median hemoglobin A1c was 8.6% (range = 6.0%–14.3% [normal <5.7%]).** During hospitalization, three patients with diabetes experienced diabetic ketoacidosis. Mucormycosis clinical signs and symptoms included those that were rhino-orbital (four patients, including three with cerebral involvement), pulmonary (three), disseminated (two), and gastrointestinal (one).

The median interval from COVID-19 diagnosis to the first positive test result for mucormycosis was 18.5 days (range = 6–52 days). None of the patients had been vaccinated against COVID-19. COVID-19 treatment included supplemental oxygen therapy (eight patients), invasive mechanical ventilation (five), corticosteroids (nine), tocilizumab (two), and baricitinib (two). Five patients received surgical treatment to excise mucormycosis-affected tissue. Six of the 10 patients died during hospitalization or within 1 week of discharge.

The findings in this report are subject to at least two limitations. First, cases were identified using passive reporting, which could have missed some mucormycosis cases. Second, the definition of COVID-19–associated cases was limited to positive tests within 60 days preceding mucormycosis diagnosis, which could have missed some cases occurring outside this period.

* These authors contributed equally to this report.

† Signs and symptoms of mucormycosis vary by the affected body site. Rhino-orbital-cerebral mucormycosis signs and symptoms frequently include fever, unilateral facial swelling, headache, sinus congestion, vision loss, proptosis, and necrotic lesions of the nasal bridge or palate. Cutaneous mucormycosis signs and symptoms frequently include fever, blisters or ulcers that become necrotic, and pain, erythema, or swelling around the wound. Pulmonary mucormycosis signs and symptoms frequently include fever, cough, chest pain, and shortness of breath. Gastrointestinal mucormycosis signs and symptoms frequently include fever, abdominal pain, nausea, vomiting, and gastrointestinal bleeding. https://www.cdc.gov/fungal/diseases/mucormycosis/symptoms.html

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

¶ Three additional potential cases were reported to ADH but were excluded from this report, two because the patients lacked clinical evidence of invasive mucormycosis and the other because the interval from COVID-19 diagnosis and mucormycosis diagnosis exceeded 60 days.

** One patient did not have a recent hemoglobin A1c result available. https://www.cdc.gov/diabetes/managing/managing-blood-sugar/a1c.html

The 10 reported COVID-19–associated mucormycosis cases occurred during a 79-day period (July 12–September 28, 2021) coinciding with a statewide surge in COVID-19 cases caused by the highly transmissible SARS-CoV-2 B.1.617.2 (Delta) variant.[††] By comparison, nine mucormycosis cases per year might be expected in Arkansas (population approximately 3,000,000)[§§] based on the estimated U.S. incidence of mucormycosis hospitalizations (approximately three per 1,000,000 persons annually) (*7*). The reported COVID-19–associated mucormycosis cases might have occurred because of COVID-19–induced immune dysregulation or medical treatments (*5*).

Because of the severity of mucormycosis, it is important that clinicians maintain a high index of suspicion for COVID-19–associated mucormycosis, including in patients without severe immunocompromising conditions. Mucormycosis treatment guidelines recommend prompt antifungal therapy[¶¶] and surgical intervention to improve outcomes (*8*). Maintenance of glycemic control in patients with diabetes, guideline-based use of corticosteroids for COVID-19 treatment,[***] and vaccination against COVID-19 should be encouraged. As a result of these reported cases, ADH sent an update on the statewide Health Alert Network (October 21, 2021) and nationwide Epi-X listserv (October 22, 2021) to improve mucormycosis prevention, diagnosis, and treatment. COVID-19–associated mucormycosis surveillance and case investigations are ongoing.

[††] https://www.healthy.arkansas.gov/programs-services/topics/novel-coronavirus

[§§] https://www.census.gov/quickfacts/AR

[¶¶] Antifungal drugs that are effective against mucormycosis include amphotericin B, posaconazole, and isavuconazole. Other antifungal drugs, including fluconazole, voriconazole, and echinocandins, are not effective for treating mucormycosis. https://www.cdc.gov/fungal/diseases/mucormycosis/treatment.html

[***] https://www.covid19treatmentguidelines.nih.gov/management/clinical-management/hospitalized-adults--therapeutic-management/

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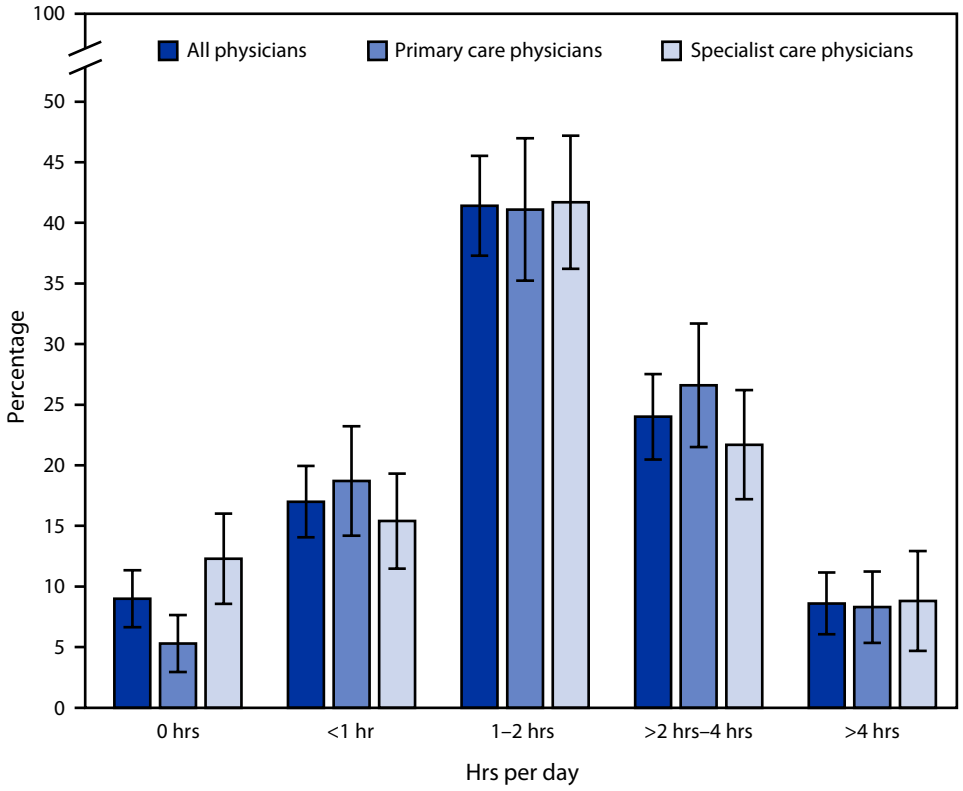
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Distribution* of Hours per Day That Office-Based Primary Care and Specialist Care Physicians Spent Outside Normal Office Hours Documenting Clinical Care in Their Medical Record System† — United States, 2019



* With 95% CIs indicated with error bars.
† Defined as average hours per day spent outside of normal office hours documenting clinical care. Medical record system includes paper-based and electronic health record systems.

In 2019, 91.0% of office-based physicians spent time outside normal office hours documenting clinical care: 17.0% spent <1 hour, 41.4% spent 1–2 hours, 24.0% spent >2 hours–4 hours, and 8.6% spent >4 hours per day. The percentage of primary care physicians who spent no hours per day documenting clinical care (5.3%) was lower than the percentage of specialist care physicians (12.3%) who spent no hours per day documenting clinical care. In other time categories, there was no statistically significant difference between primary care and specialist care physicians.

Source: National Center for Health Statistics, National Electronic Health Records Survey, 2019. National Electronic Health Records Survey public use file national weighted estimates, 2019. https://www.cdc.gov/nchs/data/nehrs/2019NEHRS-PUF-weighted-estimates-508.pdf

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