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Progress Toward Poliomyelitis Eradication — Pakistan, January 2020–July 2021

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When the Global Polio Eradication Initiative began in 1988, wild poliovirus (WPV) transmission was occurring in 125 countries; currently, only WPV type 1 (WPV1) transmission continues, and as of August 2021, WPV1 transmission persists in only two countries (*1*,*2*). This report describes Pakistan's progress toward polio eradication during January 2020–July 2021 and updates previous reports (*3*,*4*). In 2020, Pakistan reported 84 WPV1 cases, a 43% reduction from 2019; as of August 25, 2021, Pakistan has reported one WPV1 case in 2021. Circulating vaccine-derived poliovirus (cVDPV) emerges as a result of attenuated oral poliovirus vaccine (OPV) virus regaining neurovirulence after prolonged circulation in underimmunized populations and can lead to paralysis. In 2019, 22 cases of cVDPV type 2 (cVDPV2) were reported in Pakistan, 135 cases were reported in 2020, and eight cases have been reported as of August 25, 2021. Because of the COVID-19 pandemic, planned supplementary immunization activities (SIAs)* were suspended during mid-March–June 2020 (*3*,*5*). Seven SIAs were implemented during July 2020–July 2021 without substantial decreases in SIA quality. Improving the quality of polio SIAs, vaccinating immigrants from Afghanistan, and implementing changes to enhance program accountability and performance would help the Pakistan polio program achieve its goal of interrupting WPV1 transmission by the end of 2022.

Immunization Activities

Essential (routine) immunization. For 2020, the World Health Organization (WHO) and UNICEF estimated Pakistan's national coverage with 3 doses of OPV and 1 dose of inactivated poliovirus vaccine by age 12 months at 83% and 85%, respectively (*6*). A 2021 survey sponsored by WHO and Gavi, the Vaccine Alliance, indicated that the proportion of fully immunized children aged 12–23 months, by province, ranged from 37.5% in Balochistan to 88.9% in Punjab. None of the districts in the provinces of Balochistan, Khyber Pakhtunkhwa, and Sindh achieved ≥80% coverage among

* SIAs are mass house-to-house vaccination campaigns targeting children aged <5 years with OPV, regardless of the child's vaccination history.

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children aged 12–23 months, including the core WPV1 reservoir districts (i.e., districts with persistent, intractable poliovirus circulation) in Quetta (45.5% coverage), Peshawar (76.6%), and Karachi (63.9%). In comparison, 31 of 36 (86%) districts in Punjab province achieved ≥80% coverage.

Supplementary immunization activities. Pakistan was among 155 OPV-using countries that ceased all use of OPV type 2 in 2016; the standard product for outbreak response to confirmed cVDPV2 outbreaks is monovalent OPV type 2 (mOPV2; containing Sabin-strain type 2) (*7*). The Global Polio Eradication Initiative authorized restarting the filling of stocks of trivalent OPV (tOPV; containing Sabin-strain types 1, 2, and 3) for programs to use in SIAs where WPV1 and cVDPV2 cocirculate, for efficiency in scheduling and implementation. During 2020, four national immunization days (NIDs) and two subnational immunization days (SNIDs) targeting children aged <5 years were conducted using bivalent OPV (bOPV; containing Sabin-strain types 1 and 3) and, in areas with cVDPV2 transmission, either mOPV2 or tOPV. Suspension of SIAs during March–June 2020 was related to control measures for the COVID-19 pandemic, including procurement of personal protective equipment for vaccination teams. SIAs resumed in July 2020 with a small-scale mOPV2 case-response vaccination campaign, followed by a broader mOPV2 SNID in August, a tOPV SNID in October, and bOPV NIDs in September and November 2020.

The overall percentage of missed children who were identified (i.e., targeted children who were not vaccinated during SIAs) in 2020 increased from 1.2% during the February 2020 NIDs to 1.8% during the NIDs in September 2020. Although the proportion of missed children has remained low nationwide, substantial gaps in identifying missed children persist at the subnational level, especially in the core WPV1 reservoirs, with several districts reporting >5% of children aged <5 years missed during NIDs. Collectively, hundreds of thousands of children are repeatedly being missed among approximately 40 million children targeted during each NID. Lot quality assurance sampling (LQAS) survey[†] results have indicated performance gaps at union councils (subdistricts) identified to be at highest risk for poliovirus transmission in 2020, with 12%–43% of these union councils' SIAs failing to achieve the 90% LQAS pass threshold.

In 2021, two NIDs have been conducted to date: one using tOPV in January and another in March using bOPV or tOPV, depending upon the area. Combined bOPV and tOPV SNIDs

[†] LQAS uses a small sample size to assess the quality of vaccination activities after SIAs in union councils (referred to as "lots"). LQAS surveys seek evidence of vaccination (finger marking) by random selection of 60 children within each lot. If the number of unvaccinated persons in the sample exceeds three, then the union council SIA is classified as having failed at a threshold of ≥90%, and additional vaccination activities in those areas are recommended. If the threshold of ≥90% (three or fewer unvaccinated children) is met, the union council SIA is classified as having passed.

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were conducted in June and August; bOPV NIDs are planned for September and December. Smaller, targeted case-response vaccination activities have also been completed during 2020–2021. Approximately 1.4% of 40 million children targeted were reported as missed following the January 2021 NIDs, including 471,743 who were not available at the time of the campaigns and 125,087 whose caregivers refused to have their eligible children vaccinated.

Poliovirus Surveillance

Acute flaccid paralysis surveillance. Pakistan reported a national nonpolio acute flaccid paralysis (AFP)[§] rate of 15.3 cases per 100,000 persons aged <15 years in 2020 (Table); provincial rates ranged from 8.8 to 15.6. As of June 27, 2021, the annualized 2021 nonpolio AFP rate is 10.3, and stool adequacy[¶] rates during 2020 and 2021 exceeded ≥80% nationally and in each province.

Environmental surveillance. Routine sewage sampling at designated sites augments AFP surveillance to enhance timely detection of poliovirus circulation. Pakistan has 68 environmental surveillance sampling sites. During 2020, among 768 tested sewage samples, 53% (407) tested positive for WPV1 compared with 47% of 786 samples tested in 2019. In 2021, to date, 12% (61) of 513 samples have tested positive for WPV1 compared with 55% of 566 samples during the same period in 2020. The geographic distribution of positive samples and the detection of orphan viruses (those that are ≥1.5% divergent from their closest genetic match, indicating gaps in AFP surveillance sensitivity) across several provinces indicate persistent widespread circulation of WPV1 outside the core reservoirs. Further, 136 sewage samples (18%) were positive for cVDPV2 in 2020, compared with 40 (5%) in 2019, and 32 (6%) in 2021 to date.

Epidemiology of poliovirus cases. During 2020, 84 WPV1 cases were reported in Pakistan, a 43% reduction from the 147 cases reported in 2019. As of August 25, 2021, a single WPV1 case (Killa Abdullah, Balochistan province) has been reported in 2021, compared with 71 cases from 33 districts during the same period in 2020. Among the 85 cases reported during January 2020–July 2021 (Figure 1), 27 (32%) were in Balochistan, 22 (26%) in Sindh, 22 (26%) in Khyber Pakhtunkhwa, and 14 (16%) in Punjab (Figure 2).

The WPV1 patients' ages ranged from 3 months to 13 years (median = 18 months); 58% had never received OPV, 19% had received 1–2 doses through essential immunization, and 23% had received ≥3 OPV doses. Genetic analysis indicated that seven clusters (groups of polioviruses sharing ≥95% sequence identity in the region coding the VP1 capsid protein) were identified from WPV1 cases and environmental surveillance isolates during January 2020–June 2021; only two of these clusters have been detected in 2021 to date.

Ongoing cVDPV2 transmission from several emergences in Pakistan has resulted in 165 cVDPV2 cases during July 2019–July 2021 (22 cases in 2019, 135 in 2020, and eight in 2021 to date), with the most recent case onset on April 23, 2021 (Figure 1). Of the 165 cVDPV2 cases, 59 (36%) were

[§] AFP cases that are discarded as not having laboratory or other proof of poliovirus as the cause are called nonpolio AFP cases. The expected background rate of nonpolio AFP illnesses is ≥2 per 100,000 children aged <15 years per year, the standard WHO performance indicator target for sufficiently sensitive detection. The standard WHO stool specimen indicator target is adequate stool specimen collection from ≥80% of AFP cases.

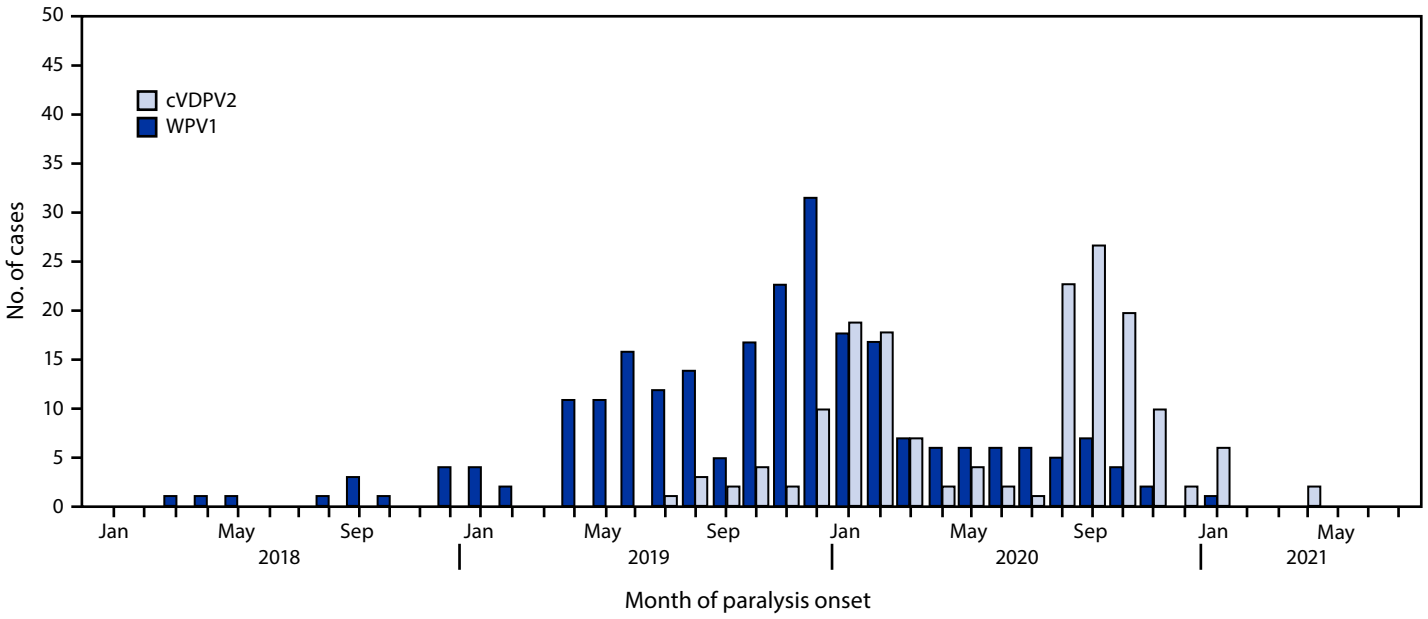
[¶] Stool specimens are considered adequate if two specimens are collected ≥24 hours apart within 14 days of paralysis onset and arrive at a WHO-accredited laboratory with reverse cold chain maintained and without leakage or desiccation.

TABLE. Acute flaccid paralysis surveillance indicators, number of wild poliovirus cases reported, and number of circulating vaccine-derived poliovirus type 2 cases reported, by region and period — Pakistan, January 2020–July 2021

	AFP surveillance indicators				Poliovirus cases							
	No. of AFP cases (nonpolio AFP rate*)		% with adequate stool specimens†		Reported WPV1 cases				Reported cVDPV2 cases			
Region	2020	2021§	2020	2021	Jan–Jun 2020	Jul–Dec 2020	Jan–Jun 2021	Total	Jan–Jun 2020	Jul–Dec 2020	Jan–Jun 2021	Total
Azad Jammu and Kashmir	212 (11.3)	91 (9.9)	90.1	93.4	0	0	0	0	0	0	0	**0**
Gilgit-Baltistan	106 (15.6)	58 (17.2)	85.9	81.0	0	0	0	0	0	0	0	**0**
Islamabad	120 (12.0)	62 (12.7)	85.0	88.7	0	0	0	0	0	0	0	**0**
Khyber Pakhtunkhwa	2,732 (15.4)	1,212 (11.5)	82.3	85.3	21	1	0	22	42	0	1	**43**
Punjab	5,744 (11.1)	2,415 (9.6)	84.9	87.7	4	10	0	14	6	19	1	**26**
Balochistan	547 (8.8)	248 (8.5)	84.8	90.7	15	11	1	27	1	22	4	**27**
Sindh	2,511 (11.0)	975 (8.8)	88.6	92.1	20	2	0	22	3	42	2	**47**
Total	**11,972 (15.3)**	**5,061 (10.3)**	**85.4**	**88.3**	**60**	**24**	**1**	**85**	**52**	**83**	**8**	**143**

Abbreviations: AFP = acute flaccid paralysis; cVDPV2 = circulating vaccine-derived poliovirus type 2; WHO = World Health Organization; WPV1 = wild poliovirus type 1.
* Nonpolio AFP cases per 100,000 persons aged <15 years.
† Defined as two stool specimens collected ≥24 hours apart within 14 days of paralysis onset and arriving at a WHO-accredited laboratory with reverse cold chain maintained and without leakage or desiccation.
§ Annualized.

FIGURE 1. Wild poliovirus type 1 and circulating vaccine-derived poliovirus type 2 cases, by month — Pakistan, January 2018–July 2021



Abbreviations: cVDPV2 = circulating vaccine-derived poliovirus type 2; WPV1 = wild poliovirus type 1.

in Khyber Pakhtunkhwa, 47 (29%) in Sindh, 27 cases (16%) each in Punjab and Balochistan, four (2%) in Gilgit-Baltistan, and one (1%) in Islamabad (Figure 2). The ages of the children with cVDPV2 cases ranged from 2 months to 12 years (median = 18 months).

Discussion

After a series of setbacks in 2019, fewer WPV1 cases have been reported in Pakistan during 2020–2021 to date, with a concomitant reduction in the proportion of WPV1-positive environmental surveillance samples. These findings are associated with implementation of planned improvements in program management and accountability (*8*) that began before the COVID-19 pandemic and have continued during the pandemic. In contrast, the cVDPV2 outbreak that began in July 2019 intensified in 2020. Transmission of cVDPV2 has decreased considerably in 2021 after large-scale, type 2–containing OPV SIAs.

Although the number of WPV1 cases declined substantially during 2020, the geographic distribution of cases, continued isolation of orphan viruses in sewage samples, and persistent WPV1 circulation in the core reservoirs could signal that efforts to interrupt the circulation of polioviruses in Pakistan are in jeopardy as the high transmission season in the last quarter of the year approaches. Notably, the observed changes in poliovirus detections occurred in the face of the challenges that the COVID-19 pandemic posed to effective immunization activities, but these observations might also be related to a decrease in community interactions during the pandemic.

Despite meeting critical AFP surveillance indicator benchmarks at the national and provincial levels in 2020, the overall number of AFP cases detected declined by approximately 20% from 2019, coincident with the disruption of active AFP surveillance activities and field investigations and repurposing of personnel and resources in response to the COVID-19 pandemic (*3*). However, environmental surveillance findings suggest levels of poliovirus circulation declined during the reporting period.

Summary

What is already known about this topic?

Pakistan is one of two countries (including Afghanistan) where wild poliovirus type 1 (WPV1) transmission has never been interrupted.

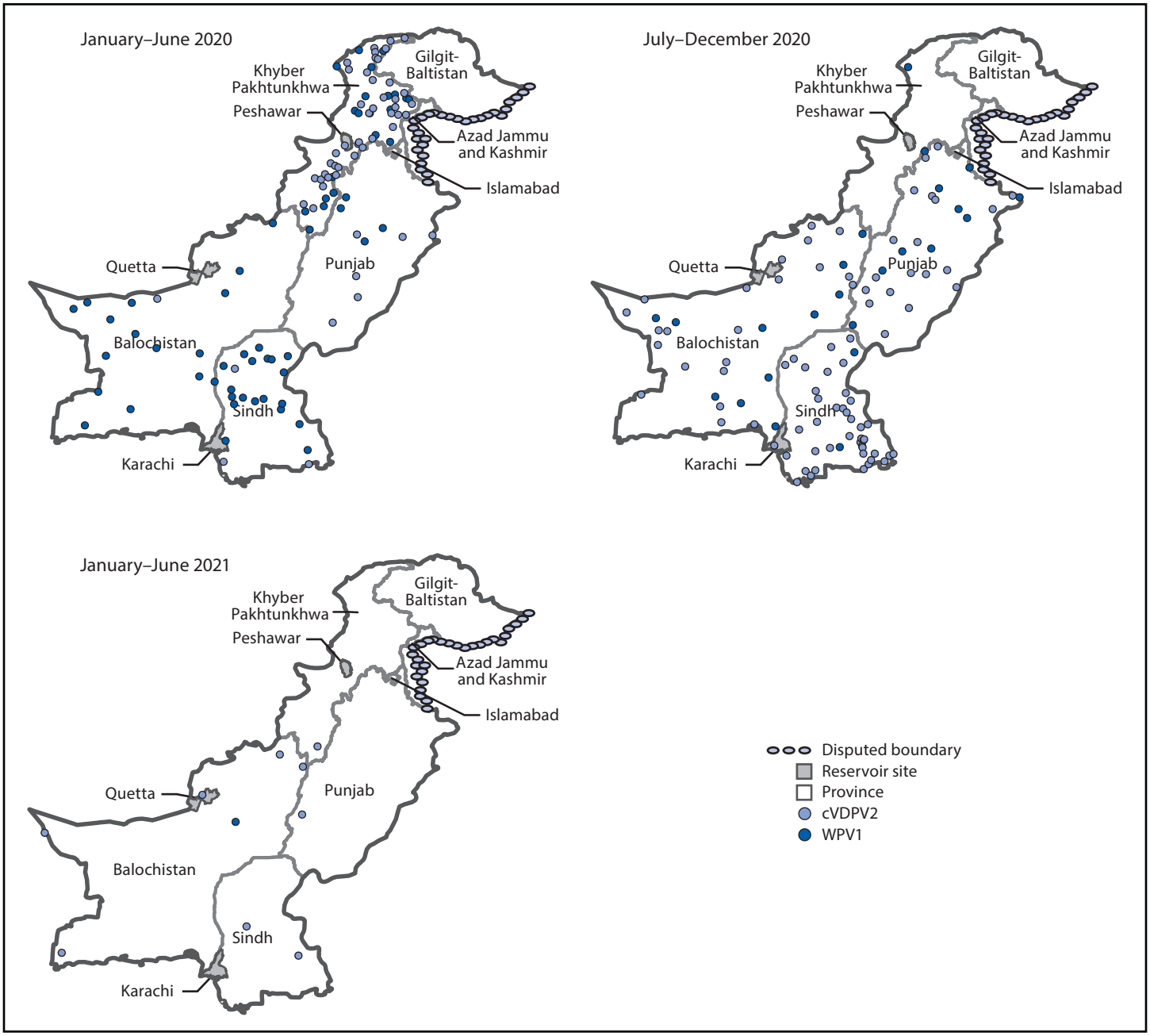
What is added by this report?

WPV1 cases in Pakistan declined by 43% from 2019 to 2020, and only one case has been reported to date in 2021. A circulating vaccine-derived poliovirus type 2 (cVDPV2) outbreak that began in 2019 has slowed substantially in 2021 following implementation of large-scale type 2–containing oral poliovirus vaccination campaigns.

What are the implications for public health practice?

For WPV1 and cVDPV2 transmission to be eliminated, efforts are warranted by the Pakistan polio program to reduce the number of persistently missed children and ensure vaccination of children migrating into Pakistan because of political instability in Afghanistan.

FIGURE 2. Location of cases of wild poliovirus type 1 and circulating vaccine-derived poliovirus type 2, by province and period — Pakistan, January 2020–June 2021



Abbreviations: cVDPV2 = circulating vaccine-derived poliovirus type 2; WPV1 = wild poliovirus type 1.

Recurrent challenges with vaccination campaign quality could undercut efforts to interrupt virus transmission. To achieve the dual goals of eliminating WPV1 and halting cVDPV2 transmission, efforts are warranted to increase the quality of polio SIAs by further decreasing the number of children who were repeatedly missed in the WPV1 reservoirs. In light of the increasing political instability in Afghanistan, enhanced efforts and contingency plans are critical to ensure vaccination of children of families migrating into Pakistan.

To increase vaccine acceptance and community engagement, the Pakistan polio program should consider focusing ancillary initiatives (e.g., integrated health and clean water service delivery) on the highest priority areas and tailor them to the perceived needs of communities (*9*). Accelerated implementation of the proposed program transformation would improve

management and accountability at all levels of the program. This includes prioritizing the recruitment and training of frontline workers who are empowered to provide culturally relevant leadership that is accepted by the local communities. The program must act with urgency to take advantage of the opportunity presented by the slowing of poliovirus circulation in 2021 to eliminate all virus transmission from the country by the end of 2022 (*9*,*10*).

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Disparities in COVID-19 Vaccination Status, Intent, and Perceived Access for Noninstitutionalized Adults, by Disability Status — National Immunization Survey Adult COVID Module, United States, May 30–June 26, 2021

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Estimates from the 2019 American Community Survey (ACS) indicated that 15.2% of adults aged ≥18 years had at least one reported functional disability (*1*). Persons with disabilities are more likely than are those without disabilities to have chronic health conditions (*2*) and also face barriers to accessing health care (*3*). These and other health and social inequities have placed persons with disabilities at increased risk for COVID-19–related illness and death, yet they face unique barriers to receipt of vaccination (*4*,*5*). Although CDC encourages that considerations be made when expanding vaccine access to persons with disabilities,* few public health surveillance systems measure disability status. To describe COVID-19 vaccination status and intent, as well as perceived vaccine access among adults by disability status, data from the National Immunization Survey Adult COVID Module (NIS-ACM) were analyzed. Adults with a disability were less likely than were those without a disability to report having received ≥1 dose of COVID-19 vaccine (age-adjusted prevalence ratio [aPR] = 0.88; 95% confidence interval [CI] = 0.84–0.93) but more likely to report they would definitely get vaccinated (aPR = 1.86; 95% CI = 1.43–2.42). Among unvaccinated adults, those with a disability were more likely to report higher endorsement of vaccine as protection (aPR = 1.29; 95% CI = 1.16–1.44), yet more likely to report it would be or was difficult to get vaccinated than did adults without a disability (aPR = 2.69; 95% CI = 2.16–3.34). Reducing barriers to vaccine scheduling and making vaccination sites more accessible might improve vaccination rates among persons with disabilities.

Data from noninstitutionalized adults aged ≥18 years were collected in the NIS-ACM by telephone interview during May 30–June 26, 2021 using a random-digit–dialed sample of cellular telephone numbers, stratified by locality.† Although the current U.S. Department of Health and Human Services (HHS) minimum standard for measuring disability in surveys relies on six questions (*6*), during the COVID-19 emergency response, data collection opportunities were limited. To assess COVID-19 vaccination status for this demographic group, CDC added a single question to the NIS-ACM: "Do you have serious difficulty seeing, hearing, walking, remembering, making decisions, or communicating?" Respondents who answered "yes" were considered to have a disability, and those who answered "no" were categorized as having no disability. Among all respondents (56,749; 18.9% final response rate), 5,361 (9.4%) reported having a disability, and 51,253 (90.3%) reported no disability. Disability status was missing for 135 (0.2%) respondents, and these respondents were excluded from all analyses. Respondents were also asked a series of questions on perceived COVID-19 risk, current COVID-19 vaccination status, and attitudes and perceived barriers to getting vaccinated.§

All percentages were weighted to represent the noninstitutionalized U.S. adult population. Survey weights were calibrated to state-level vaccine administration data reported to CDC as of June 15, 2021.¶ T-tests were performed to detect differences in percentages between groups. Unadjusted and age-adjusted vaccination prevalence ratios (PRs) comparing percentages of adults with a disability with those without a disability were calculated using logistic regression and predictive marginals. T-tests and PRs were considered statistically significant if p-values were <0.05. All analyses were performed using SAS (version 9.4; SAS Institute) and SUDAAN (version 11.0.3; Research Triangle Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.**

Among all respondents, 9.4% reported having a disability. In age-adjusted analyses, adults with a disability were less likely than were those without a disability to report having received ≥1 dose of a COVID-19 vaccine (aPR = 0.88; 95% CI = 0.84–0.93) (Table) but more likely to report they would definitely get vaccinated (aPR = 1.86; 95% CI = 1.43–2.42) (Supplementary Table 1,

* COVID-19 Vaccine Recommendations and Guidelines of the Advisory Committee on Immunization Practices, CDC. https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/covid-19.html

† The NIS-ACM cellular telephone sample was stratified by state, the District of Columbia, five local jurisdictions (Bexar County, Texas; Chicago, Illinois; Houston, Texas; New York City, New York; and Philadelphia County, Pennsylvania), and Guam, Puerto Rico, and the U.S. Virgin Islands.

§ https://www.cdc.gov/vaccines/imz-managers/nis/downloads/NIS-ACM-Questionnaire-Q2-2021_508.pdf

¶ Additional information about the NIS-ACM is available at https://www.cdc.gov/vaccines/imz-managers/nis/about.html#current-surveys.

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

TABLE. COVID-19 vaccination status* of adults aged ≥18 years, by respondent characteristic and disability status† — National Immunization Survey Adult COVID Module, United States, May 30–June 26, 2021

Respondent group/Characteristic	With a disability†		Without a disability		Prevalence ratio§ (95% CI)	
	No.	%¶ Vaccinated* (95% CI)	No.	%¶ Vaccinated* (95% CI)	Unadjusted	Age-adjusted
Total	**5,345**	**66.7 (63.9–69.3)**	**51,106**	**64.5 (63.5–65.4)**	**1.03 (0.99–1.08)**	**0.88 (0.84–0.93)****
Age group, yrs						
18–24 (Ref)	198	33.5 (23.8–44.7)	5,015	46.4 (43.9–49.0)	0.72 (0.52–0.99)**	NA
25–29	162	35.5 (22.9–50.6)	4,203	49.8 (46.7–52.9)	0.71 (0.48–1.07)	NA
30–39	372	48.8 (40.2–57.5)††	8,817	52.9 (50.8–55.0)††	0.92 (0.77–1.11)	NA
40–49	559	54.4 (46.2–62.3)††	8,050	60.8 (58.4–63.1)††	0.89 (0.77–1.04)	NA
50–64	1,783	62.8 (57.6–67.7)††	14,246	71.9 (70.1–73.6)††	0.87 (0.80–0.95)**	NA
65–74	1,260	82.7 (77.4–87.0)††	7,069	88.6 (86.6–90.4)††	0.93 (0.88–0.99)**	NA
≥75	953	88.2 (83.7–91.6)††	2,827	90.0 (87.5–92.1)††	0.98 (0.93–1.03)	NA
Sex						
Male (Ref)	2,542	66.4 (62.2–70.5)	25,297	61.9 (60.6–63.2)	1.07 (1.00–1.15)**	0.91 (0.85–0.99)**
Female	2,747	67.3 (63.6–70.7)	25,457	67.0 (65.7–68.3)††	1.00 (0.95–1.06)	0.86 (0.80–0.92)**
Race/Ethnicity§§						
White (Ref)	2,993	69.0 (65.4–72.4)	30,871	66.6 (65.5–67.7)	1.04 (0.98–1.09)	0.88 (0.82–0.94)**
Hispanic	822	67.2 (59.8–73.7)	6,613	61.8 (59.2–64.3)††	1.09 (0.97–1.22)	0.94 (0.84–1.05)
Black	726	60.1 (52.8–67.1)††	5,748	56.3 (53.6–58.9)††	1.07 (0.94–1.22)	0.84 (0.73–0.97)**
AI/AN	105	38.2 (23.6–55.2)††	538	39.2 (31.8–47.1)††	0.97 (0.81–1.56)	0.85 (0.56–1.30)
Asian	127	74.7 (46.5–90.9)	3,015	85.5 (81.5–88.8)††	0.87 (0.64–1.19)	0.86 (0.67–1.12)
NHPI	113	71.1 (27.8–94.0)	974	59.1 (47.0–70.2)	1.20 (0.68–2.13)	0.78 (0.32–1.91)
Multiple race/Other	294	55.6 (43.0–67.6)††	1,797	49.2 (43.9–54.5)††	1.13 (0.88–1.45)	0.85 (0.62–1.18)
Urbanicity¶¶						
MSA, principal city (Ref)	1,387	68.7 (62.8–74.0)	14,609	68.0 (66.2–69.7)	1.01 (0.93–1.10)	0.88 (0.79–0.97)**
MSA, nonprincipal city	2,697	67.4 (63.7–70.9)	26,796	65.1 (63.9–66.3)††	1.04 (0.98–1.10)	0.89 (0.84–0.95)**
Non-MSA	1,261	61.4 (55.4–67.2)	9,701	54.4 (52.0–56.7)††	1.13 (1.02–1.26)	0.88 (0.77–1.01)
SVI of county of residence***						
Low (Ref)	1,225	68.0 (62.3–73.2)	14,066	69.9 (68.2–71.6)	0.97 (0.89–1.06)	0.84 (0.76–0.93)**
Moderate	1,687	68.6 (63.6–73.2)	17,064	65.1 (63.5–66.6)††	1.05 (0.98–1.14)	0.90 (0.83–0.99)**
High	1,520	64.8 (59.8–69.4)	11,864	60.4 (58.6–62.2)††	1.07 (0.99–1.16)	0.89 (0.82–0.98)**
Poverty status and household income†††						
Above poverty, ≥$75k (Ref)	798	78.0 (70.3–84.1)	19,539	72.5 (71.0–73.9)	1.08 (0.98–1.17)	0.97 (0.87–1.07)
Above poverty, <$75k	1,911	68.9 (64.5–73.1)††	15,528	61.1 (59.4–62.7)††	1.13 (1.05–1.21)**	0.94 (0.86–1.03)
Below poverty	1,137	55.5 (49.4–61.5)††	4,410	48.6 (45.6–51.7)††	1.14 (1.01–1.30)**	0.95 (0.83–1.07)
Unknown income	1,499	66.6 (61.3–71.4)††	11,629	64.3 (62.4–66.2)††	1.03 (0.95–1.12)	0.89 (0.81–0.98)**

See table footnotes on the next page.

https://stacks.cdc.gov/view/cdc/109902). Among unvaccinated adults, those with a disability were more likely than those without a disability to report they were very or moderately concerned about getting COVID-19 (aPR = 1.61; 95% CI = 1.37–1.89), thought the vaccine is very or somewhat important for protection (aPR = 1.29; 95% CI = 1.16–1.44), reported many or almost all friends and family members as vaccinated (aPR = 1.19; 95% CI = 1.03–1.38), and had a health care provider recommend the vaccine (aPR = 1.27; 95% CI = 1.08–1.51) (Figure 1) (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/109903).

Overall, adults with a disability were more likely than were those without a disability to report that it would be or was somewhat or very difficult to get vaccinated (aPR = 1.19; 95% CI = 1.05–1.36), and this observation was more pronounced among the unvaccinated (aPR = 2.69; 95% CI = 2.16–3.34) (Figure 2). Among unvaccinated adults, those with a disability were more likely than were those without a disability to report having the following difficulties associated with getting the vaccine: getting an appointment online (aPR = 2.14; 95% CI = 1.48–3.10), not knowing where to get vaccinated (aPR = 1.95; 95% CI = 1.36–2.79), getting to vaccination sites (aPR = 3.43; 95% CI = 2.53–4.67), and vaccination sites not being open at convenient times (aPR = 1.69; 95% CI = 1.23–2.33).

Discussion

COVID-19 vaccination coverage was lower among U.S. adults with a disability than among those without a disability, even though adults with a disability reported less hesitancy to getting vaccinated. Unvaccinated adults with disabilities were more likely than were those without a disability to report thinking that the vaccine is important protection, indicating that there might be potential for increasing vaccination coverage in this group. However, adults with a disability anticipated or experienced more difficulty obtaining a COVID-19 vaccination than did those without a disability. Reducing barriers to

TABLE. (*Continued*) COVID-19 vaccination status* of adults aged ≥18 years, by respondent characteristic and disability status† — National Immunization Survey Adult COVID Module, United States, May 30–June 26, 2021

Respondent group/Characteristic	With a disability†		Without a disability		Prevalence ratio§ (95% CI)	
	No.	%¶ Vaccinated* (95% CI)	No.	%¶ Vaccinated* (95% CI)	Unadjusted	Age-adjusted
Education level						
College graduate (Ref)	1,338	80.2 (74.6–84.9)	23,844	79.2 (78.0–80.5)	1.01 (0.95–1.08)	0.89 (0.81–0.99)**
Some college	1,652	66.0 (61.2–70.5)††	13,590	62.2 (60.5–63.9)††	1.06 (0.98–1.14)	0.94 (0.87–1.03)
High school graduate or less	2,175	62.6 (58.4–66.6)††	12,231	53.8 (52.1–55.5)††	1.16 (1.08–1.25)**	0.93 (0.86–1.01)
Health insurance						
Insured (Ref)	4,803	69.4 (66.5–72.1)	45,472	67.6 (66.6–68.6)	1.03 (0.98–1.07)	0.88 (0.83–0.93)**
Not insured	363	40.2 (31.7–49.3)††	4,205	42.1 (39.2–45.1)††	0.95 (0.76–1.20)	0.87 (0.72–1.05)
Mental health						
Excellent, very good, or good (Ref)	3,866	70.7 (67.4–73.7)	46,379	64.8 (63.9–65.8)	1.09 (1.04–1.11)**	0.92 (0.86–0.98)**
Fair or poor	1,398	56.5 (51.2–61.7)††	4,405	61.5 (58.2–64.6)††	0.92 (0.83–1.02)	0.79 (0.72–0.88)**
Comorbidities§§§						
No (Ref)	2,087	62.2 (57.8–66.4)	37,054	60.2 (59.2–61.3)	1.03 (0.96–1.11)	0.89 (0.83–0.96)**
Yes	3,120	71.0 (67.5–74.3)††	13,577	76.6 (74.9–78.2)††	0.93 (0.88–0.98)**	0.82 (0.77–0.88)**
Ever had COVID-19						
No (Ref)	4,496	68.6 (65.6–71.5)	43,223	68.1 (67.1–69.1)	1.01 (0.96–1.06)	0.86 (0.81–0.91)**
Yes	776	59.1 (52.3–65.5)††	7,234	49.1 (46.9–51.4)††	1.20 (1.06–1.96)**	1.05 (0.93–1.18)
Received any vaccine that was not a COVID-19 vaccine in the past 2 years						
Yes (Ref)	3,224	81.1 (78.0–83.9)	29,282	80.7 (79.6–81.7)	1.01 (0.97–1.05)	0.90 (0.85–0.95)**
No	2,078	48.1 (43.8–52.4)††	21,534	47.5 (46.2–48.8)††	1.01 (0.92–1.11)	0.86 (0.78–0.95)**

Abbreviations: AI/AN = American Indian or Alaska Native; CI = confidence interval; MSA = metropolitan statistical area; NA = not applicable; NHPI = Native Hawaiian or Other Pacific Islander; Ref = referent group; SVI = social vulnerability index.

* At least 1 dose of any of the approved COVID-19 vaccines (Pfizer-BioNTech, Moderna, or Janssen [Johnson & Johnson]).

† Disability was defined as an affirmative response to the following survey question: "Do you have serious difficulty seeing, hearing, walking, remembering, making decisions, or communicating?"

§ Prevalence ratio comparing vaccination rates among persons with a disability with rates among persons without a disability.

¶ Weighted percentage. Respondents missing either vaccination or disability status were excluded (298).

** p<0.05 for prevalence ratio.

†† p<0.05 by t-test for comparisons of proportions with the indicated reference level.

§§ White, Black, AI/AN, Asian, NHPI, and multiple-race persons were non-Hispanic; Hispanic persons could be of any race.

¶¶ Urbanicity derived based on the centroid of the zip code of residence.

*** CDC and Agency for Toxic Substances and Disease Registry Social Vulnerability Index use 15 U.S. Census variables to help officials identify communities that might need support before, during, or after disasters. https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

††† 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.

§§§ Based on response to the question, "Do you have a health condition that may put you at higher risk for COVID-19?"

scheduling and making vaccination sites more accessible might improve vaccination rates among persons with disabilities (*7*).

Much work has been done to adapt COVID-19 health messages into more accessible formats††; however, more effort is necessary to increase health equity for persons with disabilities. A recent exploratory analysis of official state and territorial COVID-19 vaccination registration websites found substantial variability and suboptimal compliance with basic accessibility recommendations (*8*). Information is available for developers of online health information resources and scheduling systems to make web content more accessible.§§ Further, online scheduling systems can provide call lines for persons who need assistance making an appointment or requesting assistance getting to a vaccination site. CDC recently provided funding to the Administration for Community Living (ACL) to create a national Disability Information and Access Line (DIAL) to assist persons with disabilities obtain a COVID-19 vaccination.¶¶

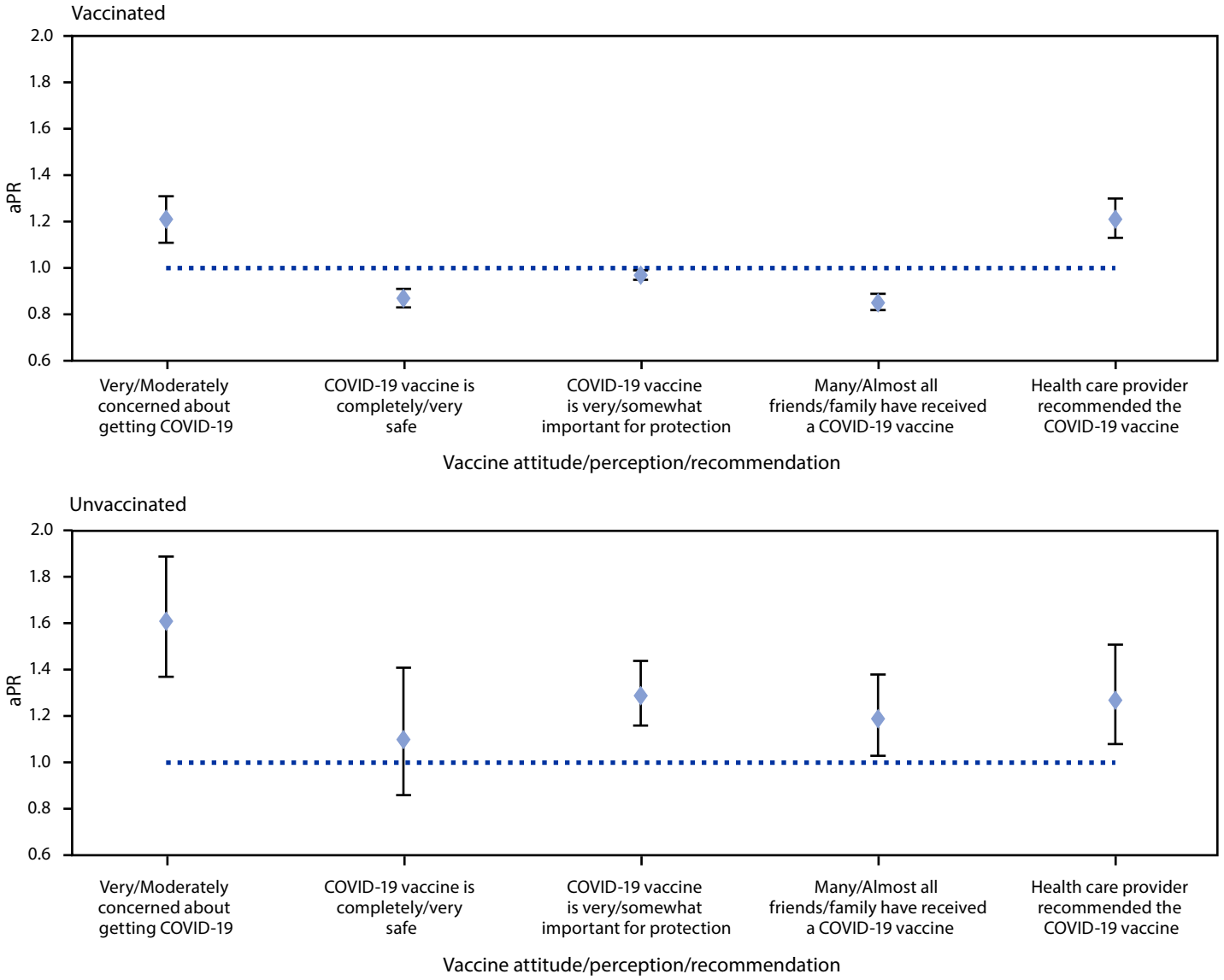
Even if vaccination locations are identified and appointments are secured, vaccination sites might vary in their accessibility options. All vaccination sites are required to be compliant with the Americans with Disabilities Act; however, regulations do not require that sites have American Sign Language (ASL) interpreters or providers trained to work with persons with intellectual or other developmental disabilities (*9*). Transportation to a vaccination site might be particularly challenging for persons with a disability who depend on another person to take them or who need accessible vehicles or public transportation. To help overcome some of these challenges,

†† Accessible COVID-19 vaccine messages adapted from CDC's full guidance are available at https://cidi.gatech.edu/covid.

§§ The Web Accessibility Initiative provides information on making web content accessible. https://www.w3.org/WAI/standards-guidelines/wcag/

¶¶ Persons with a disability seeking assistance in getting a COVID-19 vaccine can call 888-677-1199, Monday–Friday from 9:00 a.m. to 8:00 p.m. EST or can email DIAL@n4a.org.

FIGURE 1. Age-adjusted prevalence ratios* of COVID-19 vaccine attitudes, perceptions, and recommendations† among adults aged ≥18 years with a disability§ compared with adults without a disability, by COVID-19 vaccination status¶ — National Immunization Survey Adult COVID Module, United States, May 30–June 26, 2021



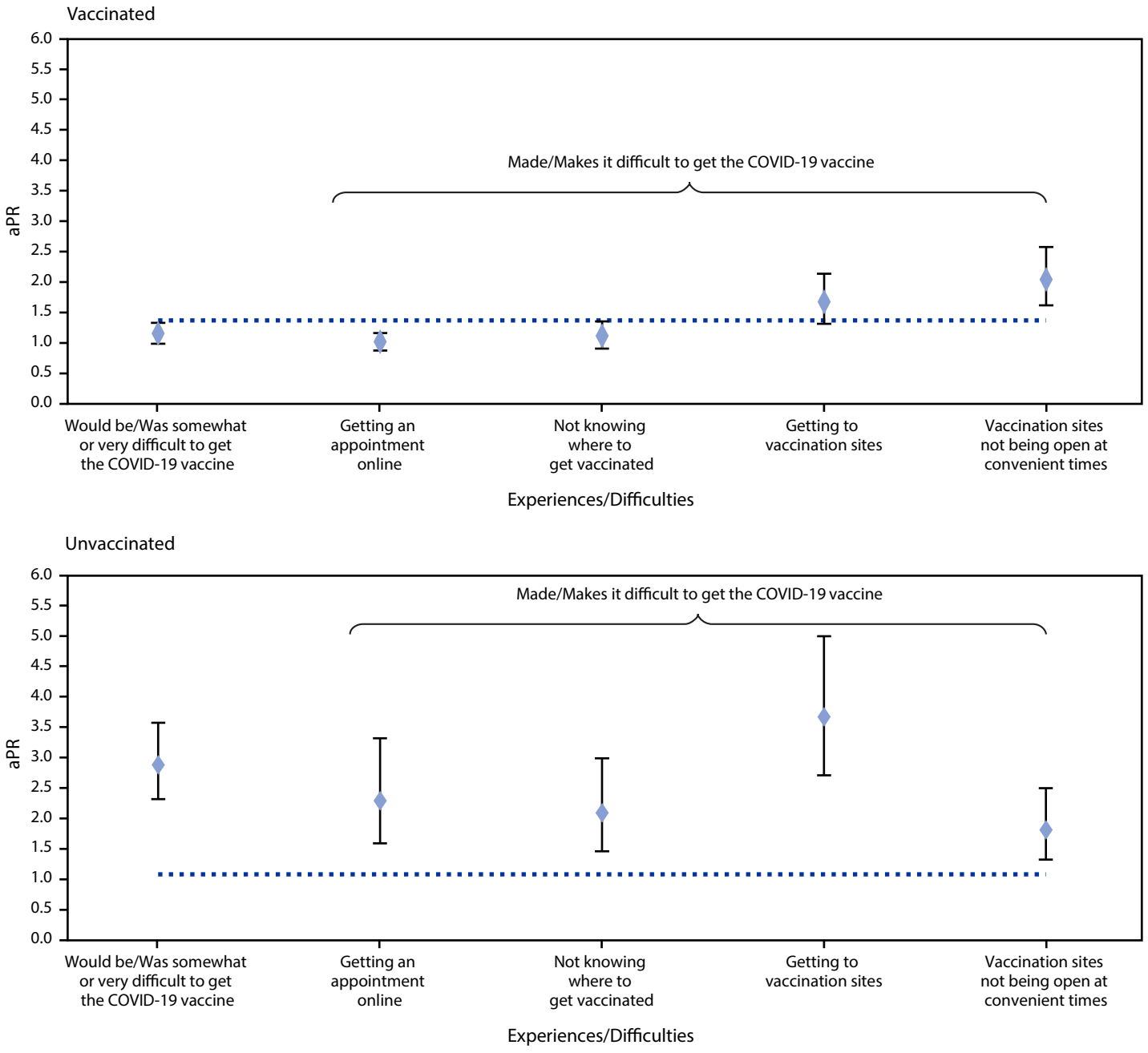
Abbreviation: aPR = age-adjusted prevalence ratio.
* 95% confidence intervals indicated with error bars.
† Prevalence ratio p<0.05 for all groups except "unvaccinated: thinks a COVID-19 vaccine is completely/very safe."
§ Disability was defined as an affirmative response to the following survey item: "Do you have serious difficulty seeing, hearing, walking, remembering, making decisions, or communicating?"
¶ Respondents were considered vaccinated if they reported having received at least 1 dose of any of the approved COVID-19 vaccines (Pfizer-BioNTech, Moderna, or Janssen [Johnson & Johnson]).

CDC recently provided funding to ACL to provide grants to aging and disability networks in every U.S. state and territory to expand access to COVID-19 vaccination among older adults and persons with disabilities.*** These grants aid with scheduling vaccination appointments, providing direct support services needed to attend appointments, providing transportation to vaccination sites, and connecting persons who cannot leave their homes independently to in-home vaccination options.

The findings in this report are subject to at least four limitations. First, the low response rate and exclusion of persons

*** https://www.hhs.gov/about/news/2021/03/29/hhs-to-expand-access-to-covid-19-vaccines-for-older-adults-and-people-with-disabilities.html

FIGURE 2. Age-adjusted prevalence ratios* of experiences and difficulties with getting the COVID-19 vaccine† among adults aged ≥18 years with a disability§ compared with adults without a disability, by COVID-19 vaccination status¶ — National Immunization Survey Adult COVID Module, United States, May 30–June 26, 2021



Abbreviation: aPR = age-adjusted prevalence ratio.

* 95% confidence intervals indicated with error bars.

† Prevalence ratio $p<0.05$ for all groups except "vaccinated: getting to vaccination sites."

§ Disability was defined as an affirmative response to the following survey item: "Do you have serious difficulty seeing, hearing, walking, remembering, making decisions, or communicating?"

¶ Respondents were considered vaccinated if they reported having received at least 1 dose of any of the approved COVID-19 vaccines (Pfizer-BioNTech, Moderna, or Janssen [Johnson & Johnson]).

living in institutionalized settings and phoneless or landline-only households introduces the possibility for selection bias. Estimates of COVID-19 vaccination coverage might differ from vaccine administration and other data reported at https://covid.cdc.gov/covid-data-tracker/#vaccinations.[†††] Second, the question assessing disability status is new and has not been validated or cognitively tested. Approximately 9% of respondents in the NIS-ACM reported a disability based on the new question, which is lower than the 15% 2019 ACS estimate for adults using the HHS minimum standard six-question set; this variation is likely attributable to multiple factors, including differences in eligibility criteria, survey methods, and questionnaire language. However, even with differing disability prevalence estimates on various national surveys, observed health disparities remain consistent among persons with disabilities (*10*). Third, attempting to measure this heterogenous demographic group with a single question limits the ability to consider functional type or severity of different disabilities and might obscure differences in access and perceptions of some subgroups. Finally, statistical power is lower to detect differences for persons with a disability than for persons without a disability because of smaller sample sizes.

Public health efforts that make COVID-19 vaccination information, scheduling, and sites more easily accessible for persons with disabilities might help to address health inequities and increase vaccination demand and coverage (*7*). These include making health messages and vaccination information available in ASL, braille, and easy-to-read formats, making all vaccination sites more accessible to persons of all ability types, including persons with intellectual disabilities and sensory disabilities, and making COVID-19 vaccination available to those who are unable to leave their homes easily or independently. These efforts would be relevant to the reduction of health disparities related to disability beyond the COVID-19 pandemic. Further, regular collection of disability status as a demographic variable in public health surveillance systems can facilitate ongoing monitoring of health disparities among persons with disabilities and help guide understanding of the contextual factors underlying health inequities.

[†††] Estimates of COVID-19 vaccination and intent are also available at https://covid.cdc.gov/covid-data-tracker/#vaccinations-disability-status using data from the Census Bureau Household Pulse Survey, and might differ from NIS-ACM estimates. Both data sources indicate lower COVID-19 vaccination coverage among persons with disabilities compared with those without a disability.

Summary

What is already known about this topic?

Persons with disabilities are at increased risk for COVID-19–related illness and death.

What is added by this report?

Analysis of the National Immunization Survey Adult COVID Module found that, compared with adults without a disability, those with a disability had a lower likelihood of having received COVID-19 vaccination, despite being less likely to report hesitancy about getting vaccinated. Adults with a disability reported more difficulties obtaining a COVID-19 vaccine than did persons without a disability.

What are the implications for public health practice?

Reducing barriers to scheduling and making vaccination sites more accessible might improve vaccination coverage among persons with disabilities.

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Association Between K–12 School Mask Policies and School-Associated COVID-19 Outbreaks — Maricopa and Pima Counties, Arizona, July–August 2021

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CDC recommends universal indoor masking by students, staff members, faculty, and visitors in kindergarten through grade 12 (K–12) schools, regardless of vaccination status, to reduce transmission of SARS-CoV-2, the virus that causes COVID-19 (*1*). Schools in Maricopa and Pima Counties, which account for >75% of Arizona's population (*2*), resumed in-person learning for the 2021–22 academic year during late July through early August 2021. In mid-July, county-wide 7-day case rates were 161 and 105 per 100,000 persons in Maricopa and Pima Counties, respectively, and 47.6% of Maricopa County residents and 59.2% of Pima County residents had received at least 1 dose of a COVID-19 vaccine. School districts in both counties implemented variable mask policies at the start of the 2021–22 academic year (Table). The association between school mask policies and school-associated COVID-19 outbreaks in K–12 public noncharter schools open for in-person learning in Maricopa and Pima Counties during July 15–August 31, 2021, was evaluated.

A school was considered to have a mask requirement if all persons, regardless of vaccination status, were required to wear a mask indoors in school. An early mask requirement was one that was in place when the school year began, and a late mask requirement was one that was implemented any time after school began. Mask policies were abstracted from publicly available school COVID-19 mitigation plans, which must be posted online per Executive Order 2020–51.† A school-associated outbreak was defined as the occurrence of two or more laboratory-confirmed COVID-19 cases§ among students or staff members at the school within a 14-day period and at least 7 calendar days after school started, and that was otherwise consistent with the Council for State and Territorial Epidemiologists 2020 outbreak definition¶ and Arizona's school-associated outbreak definition.** In Arizona, school-associated outbreaks are required to be reported to the local public health agency within 24 hours; data are stored in Arizona's Medical Electronic Disease Surveillance Intelligence System. School characteristics, including county of location, grade levels present,†† enrollment, and Title I status§§ (a measure of a school population's socioeconomic status) were obtained from the Arizona Department of Education. Crude and adjusted logistic regression analyses with 95% confidence intervals (CIs) were performed in Stata (version 15; StataCorp) and adjusted for school county, enrollment size, grade levels present, Title I status, and 7-day COVID-19 case rate in the school's zip code during the week school commenced. Schools with late mask requirements were excluded from these analyses because of their mixed exposure status during the sampling time frame (e.g., schools might have enacted mask requirements after an outbreak). Vaccination coverage for staff members and students was not available at the school level.

Data were available for 1,020 of 1,041 (98.0%) K–12 public noncharter schools in Maricopa and Pima counties. Twenty-one (2.0%) schools had outbreaks reported <7 days after school began and were excluded from the analyses. Among the 999 (96.0%) schools included in the analysis, 210 (21.0%) had an early mask requirement, 309 (30.9%) had a late mask requirement enacted a median of 15 days after school started (interquartile range = 9–17 days), and 480 (48.0%) had no mask requirement (Table). During July 15–August 31, 2021, 191 school-associated outbreaks occurred, 16 (8.4%) in schools with early mask requirements, 62 (32.5%) in schools with late mask requirements, and 113 (59.2%) in schools without a mask requirement.

In the crude analysis, the odds of a school-associated COVID-19 outbreak in schools with no mask requirement were 3.7 times higher than those in schools with an early mask requirement (odds ratio [OR] = 3.7; 95% CI = 2.2–6.5). After adjusting for potential described confounders, the odds of a school-associated COVID-19 outbreak in schools without a mask requirement were 3.5 times higher than those in schools with an early mask requirement (OR = 3.5; 95% CI = 1.8–6.9).

CDC recommends universal indoor masking in K–12 schools (*1*); however, masking requirements in K–12 schools vary by school district, county, and state. In the two largest Arizona counties, with variable K–12 school masking policies at the onset of the 2021–22 academic year, the odds of a school-associated COVID-19 outbreak were 3.5 times higher in schools with no mask requirement than in those with a mask requirement implemented at the time school started. Lapses in universal masking contribute to COVID-19

* These authors contributed equally to this report.
† https://azgovernor.gov/sites/default/files/executive_order_2020-51.pdf
§ Defined as a SARS-CoV-2–positive reverse transcription–polymerase chain reaction or nucleic acid amplification test or antigen test.
¶ https://preparedness.cste.org/wp-content/uploads/2020/08/Educational-Outbreak-Definition.pdf
** Emergency Measure 2020–03. https://www.azdhs.gov/covid19/documents/emergency-measure-2020-03.pdf

†† The variable for grade levels present was included within the model as three separate indicator variables, corresponding to elementary, middle, and high school.
§§ https://www2.ed.gov/programs/titleiparta/index.html

TABLE. School-associated COVID-19 outbreaks and school characteristics among K–12 public noncharter schools, by school mask policy — Maricopa and Pima Counties, Arizona, July–August 2021

Characteristic	All schools no. (%) (N = 999)	School mask requirements no. of schools (%) None* (n = 480)	Early* (n = 210)	Late* (n = 309)	p-value*
School-associated outbreak†					<0.001
No	808 (81)	367 (76)	194 (92)	247 (80)	
Yes	191 (19)	113 (24)	16 (8)	62 (20)	
County					<0.001
Maricopa	782 (78)	444 (93)	100 (48)	238 (77)	
Pima	217 (22)	36 (8)	110 (52)	71 (23)	
Grades present§					NC§
Elementary (K–5)	678 (68)	296 (62)	136 (65)	246 (80)	
Middle (6–8)	656 (66)	336 (70)	110 (52)	210 (68)	
High (9–12)	251 (25)	160 (33)	58 (28)	33 (11)	
7-day case rate in school zip code¶					0.002
<10	3 (0.3)	3 (0.6)	0 (—)	0 (—)	
10 to <50	4 (0.4)	4 (0.8)	0 (—)	0 (—)	
50 to <100	36 (4)	14 (3)	19 (9)	3 (1)	
>100	956 (96)	459 (96)	191 (91)	306 (99)	
Title I status**					<0.001
Not Title I	359 (36)	216 (45)	45 (21)	98 (32)	
Title I eligible	81 (8)	48 (10)	5 (2)	28 (9)	
Any Title I participation	559 (56)	216 (45)	160 (76)	183 (59)	
No. of students enrolled					<0.001
<850	243 (24)	60 (13)	109 (52)	74 (24)	
850–1,199	248 (25)	108 (23)	32 (15)	108 (35)	
1,200–1,649	255 (26)	156 (33)	32 (15)	67 (22)	
≥1,650	253 (25)	156 (33)	37 (18)	60 (19)	

Abbreviations: K–12 = kindergarten through grade 12; NC = not calculated.

* Chi-square and Fisher's exact tests were used to calculate p-values between schools with early mask requirements (mask requirement in place at the start of the school year) and those with no mask requirements, which are included in logistic regression analyses. Schools with late mask requirements instituted mask requirements at any time after the start of the school year.

† During July 15–August 31, 2021.

§ Defined as the presence or absence of grades taught at the school. Categories are not mutually exclusive, and p-value was not calculated. Three separate indicator variables were used to capture presence of these grade levels in the multivariate model.

¶ Calculated as all new confirmed and probable COVID-19 cases per 100,000 population occurring in each zip code containing a school included in this analysis during the surveillance week in which the school's academic year started. Categories presented are based on CDC community transmission metrics, included as a continuous variable in the multivariate model.

** Under Title I, financial assistance is provided to local educational agencies and schools with high numbers or high percentages of students from low-income families.

outbreaks in school settings (*3*); CDC K–12 school guidance recommends multiple prevention strategies. Given the high transmissibility of the SARS-CoV-2 B.1.617.2 (Delta) variant, universal masking, in addition to vaccination of all eligible students, staff members, and faculty and implementation of other prevention measures, remains essential to COVID-19 prevention in K–12 settings (*1*).

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COVID-19–Related School Closures and Learning Modality Changes — United States, August 1–September 17, 2021

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Beginning in January 2021, the U.S. government prioritized ensuring continuity of learning for all students during the COVID-19 pandemic (*1*). To estimate the extent of COVID-19–associated school disruptions, CDC and the Johns Hopkins University Applied Physics Laboratory used a Hidden Markov Model (HMM) (*2*) statistical approach to estimate the most likely actual learning modality based on patterns observed in past data, accounting for conflicting or missing information and systematic Internet searches (*3*) for COVID-19–related school closures. This information was used to assess how many U.S. schools were open, and in which learning modalities, during August 1–September 17, 2021. Learning modalities included 1) full in-person learning, 2) a hybrid of in-person and remote learning, and 3) full remote learning.

Multiple data sources were combined to estimate the learning modality for public and public charter school districts in the United States using HMM; sources included Burbio,* MCH Strategic Data,† American Enterprise Institute–Return to Learn,§ and state dashboards.¶ Weekly learning modalities (full in-person, hybrid, and full remote) during August 1, 2020–July 31, 2021 were used to select the optimal weights for each reported modality in order to infer the most likely actual learning modality. The trained HMM was applied weekly during August 1–September 17, 2021. In addition to using HMM, since February 2020, CDC has also tracked district and individual public and private school closures attributed to COVID-19 and estimated the number of students and teachers affected by these closures. School closure data were obtained via daily systematic Internet searches, as described previously (*3*), which identified publicly announced COVID-19–related closures lasting ≥1 day. School or district closure was defined as a transition from being open to being closed for in-person instruction. Fully in-person and hybrid (i.e., latter includes both in-person and remote) learning modalities were classified as open; fully remote learning modalities (if stated as offered during closure) were classified as closed. Closure dates and reasons were recorded and linked to publicly available education data.** HMM was fitted using the Pomegranate module (version 0.14.3) for Python (version 3.7.6). COVID-SC data were imported into SAS (version 9.4; SAS Institute) for analysis. These activities were reviewed by CDC and were conducted consistent with applicable federal law and CDC policy.††

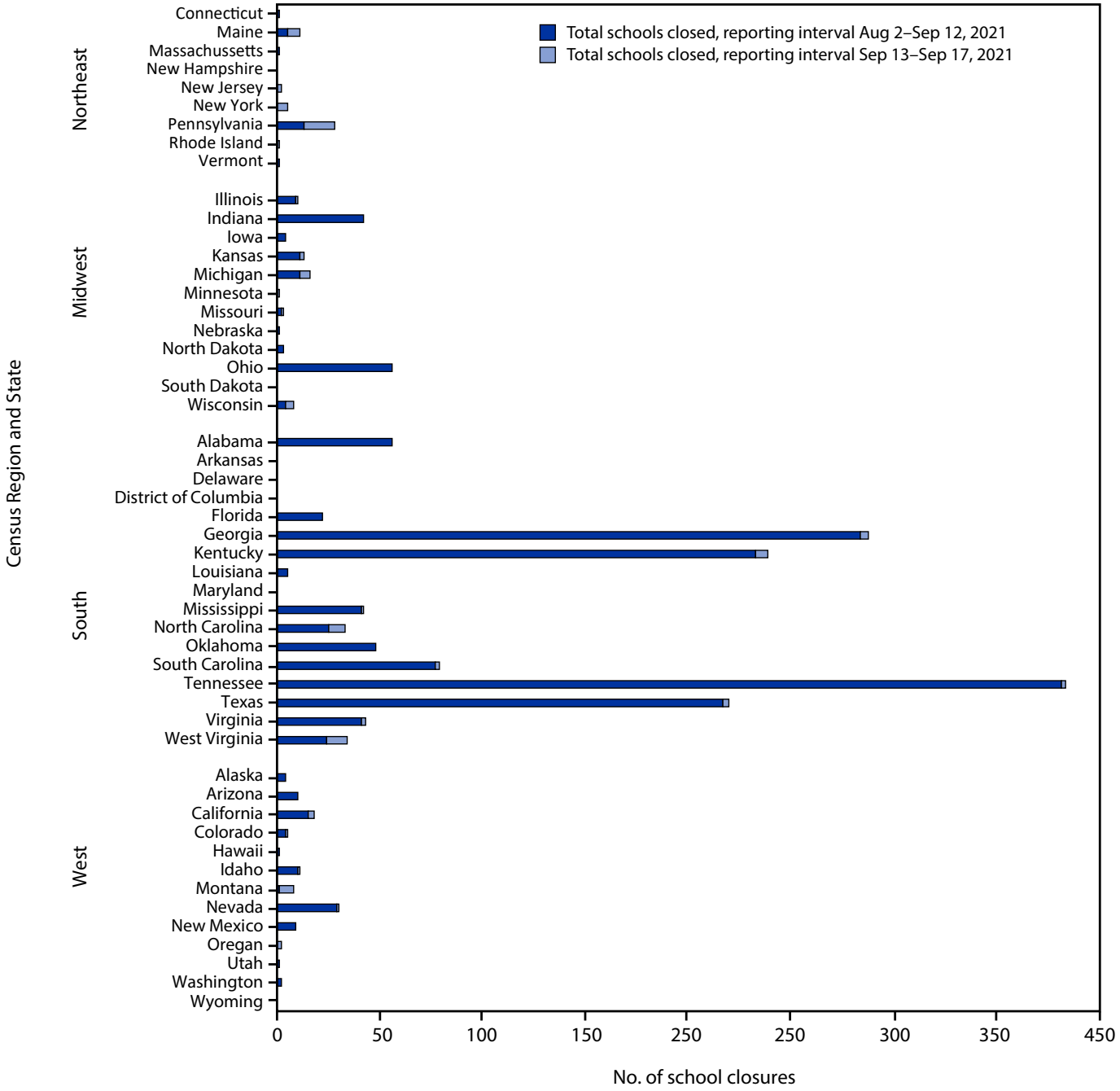
For the week ending September 17, 2021, HMM data were available for 73% of kindergarten through grade 12 public school students in 8,700 districts nationwide and varied by state (Supplementary Figure, https://stacks.cdc.gov/view/cdc/109969). Among these districts, 8,343 (96%) were offering full in-person learning, 322 (4%) were offering hybrid learning, and 35 (0.4%) were offering full remote learning. The largest number of districts with full remote learning (14) were in the West Census Region, followed by the South (11). Seven Midwest and two Northeast districts offered full remote learning. During August 2–September 17, 2021, systematic Internet searches identified announcements of 248 public districtwide closures and 384 individual school closures for ≥1 day attributable to COVID-19. Closures affected 1,801 schools (1.5% of all schools), 933,913 students, and 59,846 teachers in 44 states (Figure). The number of closures was highest in the South.

The findings in this report are subject to at least five limitations. First, both HMM and daily Internet searches were informed by passive collection of available information obtained through school and district surveys, public-facing website pages, and media reports; therefore, they are likely not inclusive of all school districts nationwide. Second, HMM did not account for the possibility of serial errors in sources (i.e., sources that are incorrect week after week). Third, districts included in HMM were larger than those excluded, thus limiting generalizability. Fourth, HMM is based on the assumption that probabilities for subsequent weeks are determined exclusively by the modality for the current week with no change in these probabilities over time or from district to district, both of which might not always be true. The results do not speak directly to level of impact because districts and

* https://cai.burbio.com/school-opening-tracker/
† https://www.mchdata.com/covid19/schoolclosings
§ https://www.returntolearntracker.net/
¶ Colorado, Connecticut, Hawaii, Idaho, Illinois, Louisiana, Minnesota, Missouri, New Mexico, North Carolina, Ohio, Oregon, South Carolina, Tennessee, Vermont, Virginia, and Washington.

** https://nces.ed.gov/ccd/districtsearch/
†† 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE. COVID-19–related kindergarten through grade 12 school closures, by region and state — United States, August 2–September 17, 2021



schools may have different thresholds for closure or change in modality. Finally, regional differences must be interpreted cautiously. The timing of return to school likely accounts for some regional variation in school closures because longer in-session time increases opportunities for COVID-19 cases to appear in schools. Many districts in the South returned to school in early August compared with late August or early September return dates in other regions (*4*).

Federal public health and education agencies are using HMM model information and systematic Internet searches to identify districts and schools most affected by COVID-19–related disruptions. Examination of prevention activities in those with and without disruption can suggest modifications to COVID-19 prevention activities. CDC is currently making findings from these activities available to state and local public health and education agencies.

Most (96%) public and private schools have remained open for full in-person learning. However, an estimated 1,800 schools have had school closures attributable to COVID-19 outbreaks, affecting the education and well-being of 933,000 students. To prevent COVID-19 outbreaks in schools, CDC recommends multicomponent prevention strategies, including vaccination, universal indoor masking, screening testing, and physical distancing (*5*).

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Pediatric COVID-19 Cases in Counties With and Without School Mask Requirements — United States, July 1–September 4, 2021

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Consistent and correct mask use is a critical strategy for preventing the transmission of SARS-CoV-2, the virus that causes COVID-19 (*1*). CDC recommends that schools require universal indoor mask use for students, staff members, and others in kindergarten through grade 12 (K–12) school settings (*2*). As U.S. schools opened for the 2021–22 school year in the midst of increasing community spread of COVID-19, some states, counties, and school districts implemented mask requirements in schools. To assess the impact of masking in schools on COVID-19 incidence among K–12 students across the United States, CDC assessed differences between county-level pediatric COVID-19 case rates in schools with and without school mask requirements.

Using data from July 1–September 4, 2021, counties that met the following criteria were included in the analysis: 1) a valid school start date, and MCH Strategic Data* included a known school mask requirement for at least one district; 2) in districts with known school mask requirements, a uniform mask requirement for all students or no students; and 3) at least 3 weeks with 7 full days of case data since the start of the 2021–22 school year. For counties with multiple school districts, the median school start date was used. Counties with conflicting school mask requirements were excluded from this analysis; only those counties with the same known mask requirements for all schools were included. Among the 3,142 U.S. counties included in the initial sample, 16.5% (520) were included in the final analysis after applying the selection criteria. County-specific pediatric COVID-19 rates (number of cases per 100,000 population aged <18 years) from CDC's COVID Data Tracker† were tabulated and aggregated by school start week. To account for the variation in the weeks each county started school, weeks were numbered from −3 to 2; the school start date was the beginning of week 0. Aggregated pediatric COVID-19 case counts and rates were calculated; average weekly changes were compared for counties with and without school mask requirements using a one-sided t-test. To further assess the association between pediatric COVID-19 cases and school mask requirements, a multiple linear regression was constructed that adjusted for age, race and ethnicity,§ pediatric COVID-19 vaccination rate, COVID-19 community transmission, population density, social vulnerability index score,¶ COVID-19 community vulnerability index score,** percentage uninsured, and percentage living in poverty. Statistical analyses were completed using SciPY (version 1.2.1) and Statsmodels (version 0.11) analysis modules for Python (version 3.7.6; Python Software Foundation). Statistical significance was defined as $p<0.05$ for all analyses. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.††

Counties without school mask requirements experienced larger increases in pediatric COVID-19 case rates after the start of school compared with counties that had school mask requirements ($p<0.001$) (Figure). The average change from week −1 (1–7 days before the start of school) to week 1 (7–13 days after the start of school) for counties with school mask requirements (16.32 cases per 100,000 children and adolescents aged <18 years per day) was 18.53 cases per 100,000 per day lower than the average change for counties without school mask requirements (34.85 per 100,000 per day) ($p<0.001$). Comparisons between pediatric COVID-19 case rates during the weeks before (weeks −3, −2, and −1) and after (weeks 0, 1, and 2) the start of school indicate that counties without school mask requirements experienced larger increases than those with school mask requirements ($p<0.05$). After controlling for covariates, school mask requirements remained associated with lower daily case rates of pediatric COVID-19 ($\beta = -1.31$; 95% confidence interval = −1.51 to −1.11) ($p<0.001$).

The findings in this report are subject to at least four limitations. First, this was an ecologic study, and causation cannot be inferred. Second, pediatric COVID-19 case counts and rates

* MCH Strategic Data are obtained from a weekly phone survey of public, private, and independent U.S. school districts. MCH surveys schools from the school districts with student enrollment >10,000 (largest districts), 5,000–10,000 (large districts), 1,000–4,999 (medium districts), and <1,000 (small districts). https://www.mchdata.com/covid19/schoolclosings

† https://covid.cdc.gov/covid-data-tracker/#demographicsovertime

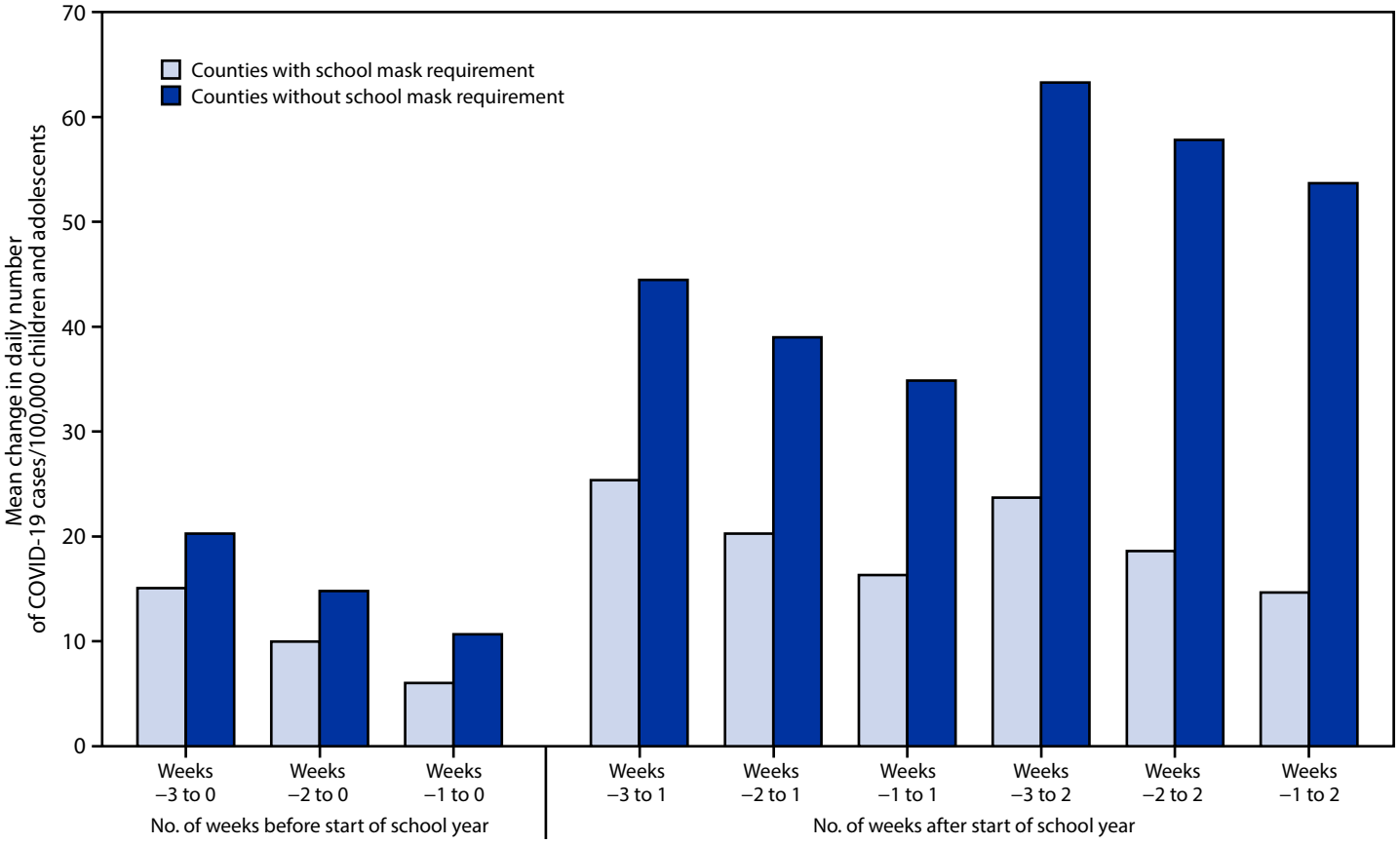
§ Age, race, ethnicity, population density, percent uninsured, and percentage in poverty data are from 2019 U.S. Census estimates (https://www.census.gov/data/datasets/time-series/demo/popest/2010s-counties-total.html) and the 2018 American Community Survey (https://www.census.gov/acs/www/data/data-tables-and-tools/geographic-comparison-tables/).

¶ The social vulnerability index score is a percentile ranking in which a value of 1 indicates the highest risk level. https://svi.cdc.gov/

** The COVID-19 community vulnerability index score is a percentile ranking in which a value of 1 indicates the highest risk level. https://precisionforcovid.org/ccvi

†† 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.0 Sect.552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE. Mean county-level change in daily number of COVID-19 cases per 100,000 children and adolescents aged <18 years in counties (N = 520) with and without school mask requirements* before and after the start of the 2021–22 school year — United States, July 1–September 4, 2021



* Among 520 counties, 198 (38%) had a school mask requirement and 322 (62%) did not have a school mask requirement.

included all cases in children and adolescents aged <18 years; later analyses will focus on cases in school-age children and adolescents. Third, county-level teacher vaccination rate and school testing data were not controlled for in the analyses; later analyses will control for these covariates. Finally, because of the small sample size of counties selected for the analysis, the findings might not be generalizable.

The results of this analysis indicate that increases in pediatric COVID-19 case rates during the start of the 2021–22 school year were smaller in U.S. counties with school mask requirements than in those without school mask requirements. School mask requirements, in combination with other prevention strategies, including COVID-19 vaccination, are critical to reduce the spread of COVID-19 in schools (*2*).

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Safety Monitoring of an Additional Dose of COVID-19 Vaccine — United States, August 12–September 19, 2021

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On August 12, 2021, the Food and Drug Administration (FDA) amended Emergency Use Authorizations (EUAs) for the Pfizer-BioNTech and Moderna COVID-19 vaccines to authorize administration of an additional dose after completion of a primary vaccination series to eligible persons with moderate to severe immunocompromising conditions (*1*,*2*). On September 22, 2021, FDA authorized an additional dose of Pfizer-BioNTech vaccine ≥6 months after completion of the primary series among persons aged ≥65 years, at high risk for severe COVID-19, or whose occupational or institutional exposure puts them at high risk for COVID-19 (*1*). Results from a phase 3 clinical trial conducted by Pfizer-BioNTech that included 306 persons aged 18–55 years showed that adverse reactions after receipt of a third dose administered 5–8 months after completion of a 2-dose primary mRNA vaccination series were similar to those reported after receipt of dose 2; these adverse reactions included mild to moderate injection site and systemic reactions (*3*). CDC developed v-safe, a voluntary, smartphone-based safety surveillance system, to provide information on adverse reactions after COVID-19 vaccination. Coincident with authorization of an additional dose for persons with immunocompromising conditions, the v-safe platform was updated to allow registrants to enter information about additional doses of COVID-19 vaccine received. During August 12–September 19, 2021, a total of 22,191 v-safe registrants reported receipt of an additional dose of COVID-19 vaccine. Most (97.6%) reported a primary 2-dose mRNA vaccination series followed by a third dose of the same vaccine. Among those who completed a health check-in survey for all 3 doses (12,591; 58.1%), 79.4% and 74.1% reported local or systemic reactions, respectively, after dose 3, compared with 77.6% and 76.5% who reported local or systemic reactions, respectively, after dose 2. These initial findings indicate no unexpected patterns of adverse reactions after an additional dose of COVID-19 vaccine; most of these adverse reactions were mild or moderate. CDC will continue to monitor vaccine safety, including the safety of additional doses of COVID-19 vaccine, and provide data to guide vaccine recommendations and protect public health.

V-safe is a voluntary, smartphone-based U.S. safety surveillance system; vaccinated persons eligible to receive authorized or licensed vaccine product may register in v-safe. The v-safe platform allows existing registrants to report receiving an additional dose of COVID-19 vaccine and new registrants to enter information about all doses of COVID-19 vaccine received. V-safe health surveys are sent during days 0–7 after each dose of vaccine and include questions about local injection site and systemic reactions and health impacts.* Surveys are sent for the most recent dose entered.† Staff members from the Vaccine Adverse Event Reporting System (VAERS) contact registrants who indicate that medical attention was sought after vaccination and encourage or facilitate completion of a VAERS report, if indicated.§

Among v-safe registrants who reported receipt of an additional COVID-19 vaccine dose during August 12–September 19, 2021, demographic data, local and systemic reactions, and health impacts reported during days 0–7 were described by pattern of vaccination (i.e., manufacturer of vaccine received for each dose). Persons who reported receiving a primary series from different manufacturers or a manufacturer that was unknown or unavailable in the United States, or 2 doses of vaccine after receipt of a Janssen (Johnson & Johnson) single-dose vaccine (150) were excluded from the analysis of adverse reactions after receipt of the additional dose. Time elapsed from completion of the primary vaccination series to receipt of an additional dose was described by pattern of vaccination. Adverse event profiles after doses 2 and 3 were compared for registrants who received mRNA vaccine from the same manufacturer for all 3 doses.¶ SAS software (version 9.4; SAS Institute) was used to conduct all

* V-safe registrants self-report the severity of their symptoms, defined as mild (noticeable, but not problematic), moderate (limit normal daily activities), or severe (make daily activities difficult or impossible). Health impacts include whether the vaccine recipient was unable to perform normal daily activities, missed school or work, or received care (i.e., telehealth, clinic or emergency department visit, or hospitalization) from a medical professional because of new symptoms or conditions.

† Additional health surveys are sent weekly through 6 weeks after vaccination and 3, 6, and 12 months after vaccination.

§ VAERS is a passive vaccine safety surveillance system comanaged by CDC and FDA that monitors adverse events after vaccination. VAERS accepts reports from anyone, including health care providers, vaccine manufacturers, and members of the public. https://vaers.hhs.gov/reportevent.html

¶ The odds of reporting an event after dose 2 and 3 were compared using a multivariable generalized estimating equations model that accounted for the correlation between registrants and adjusted for demographic variables; p-values <0.05 were considered statistically significant.

analyses. These surveillance activities were reviewed by CDC and conducted consistent with applicable federal law and CDC policy.**

During August 12–September 19, 2021, a total of 22,191 v-safe registrants reported receipt of an additional dose of COVID-19 vaccine after completing the primary series (Table 1). Among these, 14,048 (63.3%) were female, and approximately 30% each were aged 18–49, 50–64, and 65–74 years. Most registrants (21,662; 97.6%) reported that they received a third dose from the same manufacturer as their primary mRNA vaccine series, including 98.6% of Moderna recipients and 98.2% of Pfizer-BioNTech recipients. Few registrants (341; 1.5%) reported a primary mRNA vaccine series followed by an additional dose of mRNA vaccine from a different manufacturer, a dose of Janssen vaccine after receipt of a primary mRNA vaccination series (10; 0.05%), or an additional dose of COVID-19 vaccine from any manufacturer after Janssen vaccine (178; 0.8%).

Among the 22,191 v-safe registrants, the median interval from completion of the primary COVID-19 vaccination series to receipt of an additional dose was 182 days (interquartile range [IQR] = 160–202 days) (Table 2). Among those who received 2 doses of Janssen vaccine, the median interval between doses was shorter (84 days; IQR = 16–136 days).

Local (16,615; 74.9%) and systemic (15,503; 69.9%) reactions were frequently reported during the week after an additional dose of COVID-19 vaccine, most commonly on the day after vaccination. Frequently reported reactions were injection site pain (15,761; 71.0%), fatigue (12,429; 56.0%), and headache (9,636; 43.4%).

Among 22,191 additional dose recipients, a total of 7,067 (31.8%) reported health impacts, and approximately 28.3% (6,287) reported they were unable to perform normal daily activities, most commonly on the day after vaccination. Medical care was sought by 401 (1.8%) registrants, and thirteen (0.1%) were hospitalized. Reasons for receiving medical care or hospitalization were not identified in the v-safe survey; however, registrants who indicate that medical attention was sought after vaccination are contacted by VAERS staff and encouraged to complete a VAERS report.

Among 21,658 v-safe registrants who received the same mRNA vaccine for all 3 doses, 12,591 (58.1%) completed at least one health check-in survey on days 0–7 after all 3 doses; 79.4% and 74.1% reported local or systemic reactions, respectively, after dose 3, compared with 77.6% and 76.5% who reported local or systemic reactions, respectively, after dose 2. Among registrants who received 3 doses of Moderna (6,283), local reactions were reported more frequently after dose 3 than dose 2 (5,323; 84.7% and 5,249; 83.5%; p-value = 0.03) (Figure). Systemic reactions were reported less frequently after dose 3 than dose 2 (4,963; 79.0% and 5,105; 81.3%; p-value < 0.001). Among registrants who received 3 doses of Pfizer-BioNTech (6,308), local reactions were reported more frequently after dose 3 than dose 2 (4,674; 74.1% and 4,523; 71.7%; p-value <0.001). Systemic reactions were reported less frequently after dose 3 than dose 2 (4,363; 69.2% and 4,524; 71.7%; p-value <0.001). Among those who reported pain after dose 3 of an mRNA vaccine, most reactions were mild (4,909; 51.4%) or moderate (4,000; 41.9%); severe pain (defined as pain that makes daily activities difficult or impossible) was reported by 637 (6.7%).

Discussion

As of September 19, 2021, approximately 2.21 million persons in the United States had received additional doses of COVID-19 vaccines†† after completion of a primary series. During August 12–September 19, 2021, no unexpected patterns of adverse reactions were observed among 22,191 v-safe registrants who received an additional dose of COVID-19 vaccine. Most reported local and systemic reactions were mild to moderate, transient, and most frequently reported the day after vaccination. Most registrants who received an additional dose reported a primary mRNA vaccination series followed by a third dose from the same manufacturer. The Pfizer-BioNTech clinical trial, which included 306 persons aged 18–55 years, showed that reactions after dose 3 were comparable to those reported after dose 2 (*3*). However, this analysis of v-safe data found the local reactions were slightly more common and systemic reactions less common after dose 3 of Pfizer-BioNTech. The patterns of adverse reactions observed after dose 3 of Moderna vaccine or Pfizer-BioNTech were consistent with previously described reactions after receipt of dose 2 (*4*).

The number of registrants who indicated that they received 2 doses of Janssen vaccine or received their additional dose from a manufacturer different from that of their primary series was small, limiting any conclusions. Data on the safety or effectiveness of vaccination with COVID-19 vaccine products from different manufacturers are limited; the Advisory Committee on Immunization Practices (ACIP) recommends that persons with moderately to severely immunocompromising conditions receive a third dose of mRNA COVID-19 vaccine from the same manufacturer as their primary series (*5*). CDC recommendations for an additional dose do not currently include persons who received Janssen vaccine.

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

†† https://covid.cdc.gov/covid-data-tracker/#datatracker-home

TABLE 1. Demographic characteristics of persons who received an additional dose of COVID-19 vaccine (N = 22,191)* and completed at least one v-safe health check-in survey on days 0–7 after vaccination, by primary vaccination series and manufacturer of subsequent dose received — United States, August 12–September 19, 2021

	Moderna, %† (n = 10,601)			Pfizer-BioNTech, %† (n = 11,412)			Janssen, %†,§ (n = 178)			
Characteristic	Dose 3 Moderna (n = 10,453; 98.6%)	Dose 3 Pfizer-BioNTech (n = 144; 1.4%)	Dose 3 Janssen (n = 4; 0.04%)	Dose 3 Pfizer-BioNTech (n = 11,209; 98.2%)	Dose 3 Moderna (n = 197; 1.7%)	Dose 3 Janssen (n = 6; 0.1%)	Dose 2 Janssen (n = 48; 27.0%)	Dose 2 Moderna (n = 64; 36.0%)	Dose 2 Pfizer-BioNTech (n = 66; 37.1%)	Total (N = 22,191)
Sex										
Female	63.8	63.9	50.0	63.0	63.5	33.3	39.6	57.8	59.1	**63.3**
Male	35.1	34.0	50.0	36.1	36.0	66.7	60.4	42.2	40.9	**35.7**
Unknown	1.0	2.1	0	0.9	0.5	0	0	0	0	**1.0**
Age group, yrs										
0–17	0.0	0.7	0.0	0.6	0.0	0.0	0.0	0.0	0.0	**0.3**
18–49	25.7	36.1	25.0	31.5	42.6	50.0	54.2	60.9	57.6	**29.1**
50–64	28.4	27.1	50.0	31.1	29.9	0.0	33.3	34.3	30.3	**29.8**
65–74	33.9	27.1	0.0	27.8	21.3	50.0	10.4	4.7	9.1	**30.5**
75–84	10.9	9.0	25.0	8.3	5.6	0.0	2.1	0.0	3.0	**9.5**
≥85	1.1	0.0	0.0	0.7	0.5	0.0	0.0	0.0	0.0	**0.9**
Ethnicity										
Hispanic/Latino	8.0	15.3	0	8.2	5.6	0	25.0	6.3	10.6	**8.2**
Non-Hispanic/ Latino	87.7	81.9	100	87.6	90.9	100	54.2	89.1	89.4	**87.6**
Unknown	4.3	2.8	0	4.2	3.6	0	20.8	4.7	0	**4.2**
Race										
AI/AN	0.5	0.7	0	0.5	0.5	0	2.1	0	0	**0.5**
Asian	4.9	5.6	0	6.1	7.1	0	2.1	14.1	13.6	**5.6**
Black	5.6	3.5	0	6.2	1.5	16.7	6.3	6.3	9.1	**5.9**
NHPI	0.2	0	0	0.3	0.5	0	4.2	0	0	**0.3**
White	82.6	82.6	100	80.4	85.8	66.7	56.3	71.9	69.7	**81.4**
Multiracial	1.9	2.1	0	1.8	1.5	16.7	4.2	4.7	3.0	**1.9**
Other	2.1	4.2	0	2.1	0.5	0	6.3	1.6	3.0	**2.1**
Unknown	2.3	1.4	0	2.5	2.5	0	18.8	1.6	1.5	**2.4**

Abbreviations: AI/AN = American Indian/Alaska Native; NHPI = Native Hawaiian or other Pacific Islander.
* Percentage of registrants who completed at least one v-safe health check-in survey on days 0–7 after vaccination.
† Primary vaccination series.
§ Includes persons who received a primary Janssen single-dose and 1 additional dose of vaccine from the listed manufacturers.

During the period covered by this study, ACIP recommendations for an additional dose of COVID-19 vaccine were limited to persons with moderately to severely immunocompromising conditions who had received 2 doses of an mRNA vaccine.[§§] A study conducted among immunocompromised hemodialysis patients reported that local and systemic reactions after dose 3 of Pfizer-BioNTech vaccine were similar to those after dose 2.[¶¶] Recent reports of infections in vaccinated persons (*6*) and increases in the prevalence of infection with the B.1.617.2 (Delta) variant of SARS-CoV-2, the virus that causes COVID-19, among vaccinated persons (*7*) might have prompted some persons to seek an additional dose outside of recommendations. The median interval from completion of the primary series to receipt of an additional dose was approximately 6 months; therefore, persons prioritized during the rollout of COVID-19 vaccines, including health care workers and older adults, might have received an additional dose.

The findings in this report are subject to at least four limitations. First, enrollment in v-safe is voluntary and likely not representative of the vaccinated U.S. population; the majority of participants identified themselves as White and non-Hispanic. Second, during this study period, additional dose recommendations were limited to persons with immunocompromising conditions who completed a primary mRNA COVID-19 vaccination series; however, v-safe does not include information about immune status. Additional-dose recipients likely include persons with and without immunocompromising conditions. Third, a causal relationship between a vaccine and clinically serious adverse event reported after vaccination cannot be established using v-safe data. Finally, insufficient data were available to determine patterns of adverse reactions after receipt of an additional dose from a manufacturer different from the primary series or for the Janssen vaccine.

[§§] On August 13, 2021, ACIP recommended an additional dose of mRNA COVID-19 vaccine after completion of a primary series in persons with moderately to severely immunocompromising conditions. Information on clinical considerations is available at https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html
[¶¶] https://www.medrxiv.org/content/10.1101/2021.07.02.21259913v1

TABLE 2. Adverse reactions reported by persons who received an additional dose of COVID-19 vaccine (N = 22,191)* and completed at least one v-safe health check-in survey on days 0–7 after vaccination, by primary vaccination series and manufacturer of subsequent dose received — United States, August 12–September 19, 2021

	Moderna, %† (n = 10,477)			Pfizer-BioNTech, %† (n = 11,284)			Janssen, %†,§ (n = 174)			
Reaction	Dose 3 Moderna (n = 10,453; 98.6%)	Dose 3 Pfizer-BioNTech (n = 144; 1.4%)	Dose 3 Janssen (n = 4; 0.04%)	Dose 3 Pfizer-BioNTech (n = 11,209; 98.2%)	Dose 3 Moderna (n = 197; 1.7%)	Dose 3 Janssen (n = 6; 0.1%)	Dose 2 Janssen (n = 48; 27.0%)	Dose 2 Moderna (n = 64; 36.0%)	Dose 2 Pfizer-BioNTech (n = 66; 37.1%)	Total (N = 22,191)
Days since primary series, median (IQR)	182 (164–198)	183 (161–204)	173 (141–182)	183 (157–209)	186 (161–217)	123 (113–182)	84 (16–136)	156 (140–164)	150 (136–167)	**182 (160–202)**
Any injection site reaction	**80.9**	**64.6**	**75.0**	**69.4**	**81.7**	**83.3**	**25.0**	**70.3**	**80.3**	**74.9**
Itching	20.0	11.8	0	8.4	10.2	16.7	10.4	6.3	7.6	**13.9**
Pain	75.9	60.4	75.0	66.6	80.2	83.3	20.8	68.8	74.2	**71.0**
Redness	25.2	8.3	0	9.8	20.8	16.7	6.3	7.8	12.1	**17.1**
Swelling	33.6	17.4	0	16.8	30.5	16.7	6.3	12.5	18.2	**24.8**
Any systemic reaction	**75.2**	**59.7**	**50.0**	**65.1**	**76.1**	**100**	**31.3**	**68.8**	**63.6**	**69.9**
Abdominal pain	8.4	3.5	0	6.4	8.1	16.7	4.2	3.1	6.1	**7.3**
Myalgia	49.8	29.2	0	36.3	49.2	50.0	20.8	45.3	33.3	**42.7**
Chills	31.3	8.3	50.0	17.5	33.5	50.0	8.3	23.4	10.6	**24.1**
Diarrhea	9.9	7.6	0	9.0	9.6	16.7	8.3	6.3	9.1	**9.4**
Fatigue	61.8	44.4	0	51.0	60.9	83.3	14.6	48.4	50.0	**56.0**
Fever	36.4	20.1	50.0	22.2	37.1	50.0	6.3	37.5	12.1	**29.0**
Headache	49.0	31.1	0	38.4	49.7	83.3	18.8	35.9	40.9	**43.4**
Joint pain	33.0	18.8	0	23.0	31.0	33.3	16.7	20.3	19.7	**27.7**
Nausea	18.8	10.4	25.0	13.6	21.3	33.3	8.3	9.4	18.2	**16.1**
Rash	2.3	0.7	0	1.9	2.5	0	4.2	1.6	1.5	**2.1**
Vomiting	2.2	2.1	25.0	1.4	2.0	0	2.1	0	0	**1.7**
Any health impact	**39.2**	**19.4**	**0**	**25.2**	**39.1**	**33.3**	**16.7**	**28.1**	**24.2**	**31.8**
Unable to perform normal daily activities	35.2	18.1	0	22.1	33.0	33.3	10.4	25.0	15.2	**28.3**
Unable to work or attend school	13.7	4.9	0	9.0	21.3	16.7	10.4	6.3	13.6	**11.3**
Needed medical care	2.1	1.4	0	1.5	3.0	0	6.3	0	0	**1.8**
Telehealth	0.9	0.7	0	0.7	1.0	0	2.1	0	0	**0.8**
Clinic	0.7	0.7	0	0.6	0.5	0	4.2	0	0	**0.6**
Emergency visit	0.2	0	0	0.2	0	0	4.2	0	0	**0.2**
Hospitalization	0.05	0	0	0.1	0	0	0	0	0	**0.1**

Abbreviation: IQR = interquartile range.
* Percentage of registrants who completed at least one v-safe health check-in survey on days 0–7 after vaccination.
† Primary vaccination series.
§ Includes persons who received a primary Janssen single-dose and one additional dose of vaccine from the listed manufacturers.

An additional dose of mRNA COVID-19 vaccine is recommended for persons with moderately to severely immunocompromising conditions (*5*). CDC recommended an additional dose of Pfizer-BioNTech vaccine ≥6 months after completion of the primary vaccine series among persons aged ≥65 years, residents in long-term care settings, and 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 may receive an additional dose based on their individual benefits and risks (*8*). Initial analyses of safety data from >22,000 v-safe registrants shows that local reactions are slightly increased and systemic reactions are slightly decreased after dose 3 of an mRNA than after dose 2. No unexpected patterns of adverse reactions were identified; those reported were mild to moderate and transient. CDC will continue to monitor the safety of additional doses of COVID-19 vaccine. Additional data on adverse reactions associated with different combinations of vaccines and of time since completion of primary series will be important to guide public health recommendations.

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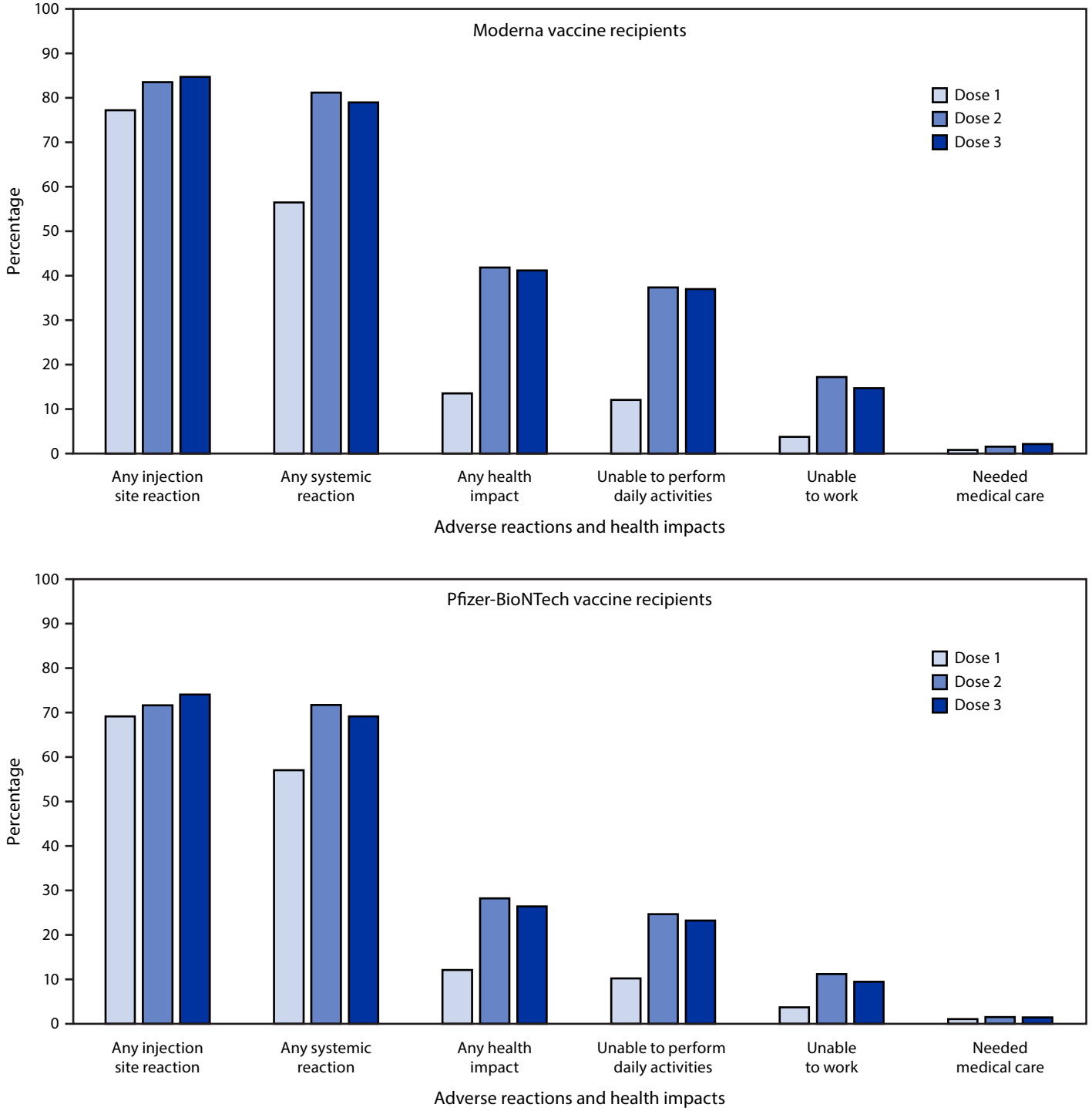
FIGURE. Adverse reactions and health impacts reported by persons who received 3 doses* of Moderna (N = 6,283) or Pfizer-BioNTech (N = 6,308) COVID-19 vaccine and completed at least one v-safe health check-in survey on days 0–7 after each dose, by dose number — United States, August 12–September 19, 2021



* The odds of reporting an event after dose 2 and 3 were compared using a multivariable generalized estimating equations model that accounted for the correlation between registrants and adjusted for demographic variables (receipt of care was not adjusted because of small numbers); p-values <0.05 were considered statistically significant. For Moderna recipients, all differences except any health impact and inability to perform daily activities were statistically significant. For Pfizer-BioNTech, all differences except the need for medical care were statistically significant.

Summary

What is already known about this topic?

Among 306 Pfizer-BioNTech clinical trial participants, adverse reactions after dose 3 were similar to those after dose 2.

What is added by this report?

During August 12–September 19, 2021, among 12,591 v-safe registrants who completed a health check-in survey after all 3 doses of an mRNA COVID-19 vaccine, 79.4% and 74.1% reported local or systemic reactions, respectively, after the third dose; 77.6% and 76.5% reported local or systemic reactions after the second dose, respectively.

What are the implications for public health practice?

Voluntary reports to v-safe found no unexpected patterns of adverse reactions after an additional dose of COVID-19 vaccine. CDC will continue to monitor vaccine safety, including for additional COVID-19 doses.

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.

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Notes from the Field

Deaths Related to Hurricane Ida Reported by Media — Nine States, August 29–September 9, 2021

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On August 29, 2021, Hurricane Ida made landfall near Port Fourchon, Louisiana, as a Category 4 hurricane with sustained winds of 150 mph, causing life-threatening storm surges, wind damage, heavy rainfall, and power outages that affected approximately one million homes and businesses along the U.S. Gulf Coast (*1*,*2*). The storm then traveled Northeast as a tropical depression, causing flash flooding, tornadoes, and power outages, before exiting offshore.* During Hurricane Ida's widespread geographic impact, collection and analysis of timely data were necessary to understand regional differences, such as causes and circumstances of death, and to guide public health messaging to promote action (*3*). In response to the disaster, CDC's Epidemiology Surveillance Task Force† (Epi/Surv Task Force) activated media mortality surveillance to track online reports of deaths related to Hurricane Ida using standardized key search terms from an internal standard operating procedure that outlines surveillance protocol. Team members compiled and coded the information from identified sources (e.g., news media articles, press releases, and social media posts) into a database, analyzed the compiled data, and shared results with emergency response leadership and health communicators to provide situational awareness and guide messaging.§

As of September 9, 2021, the media reported 91 deaths caused by Hurricane Ida across nine states, 56 (61.5%) of which occurred in the Northeast (Table). Among 71 (78.0%) decedents with known age, 29 (40.8%) were aged ≥65 years. By cause of death, the majority of deaths (55; 60.4%) occurred by drowning, most (52; 94.5%) of which occurred in the Northeast. Four reported deaths (4.4%) were work-related, either associated with the emergency response (three) or workplace (one). The top three circumstances of death were drowning (34; 37.4%), vehicular (22; 24.2%), and generator- or power outage–related (17; 18.7%). Cause of death is defined as the specific injury or condition that leads to death; circumstance of death is the determination of how the specific injury or condition leads to death. Among the vehicular deaths, 20 (90.9%) were drownings (e.g., submerged vehicles). The date of death was known for 60 (65.9%) reported deaths; among these, 51 (85.0%) were reported within 24 hours of the death and 34 (51.6%) were reported by media within 24 hours of regional storm impact. Hurricane Ida is the fourth most deadly hurricane the Epi/Surv Task Force has tracked in the contiguous United States since 2012; only Hurricane Harvey (2017) resulted in more reported drowning deaths (Supplementary Figure, https://stacks.cdc.gov/view/cdc/110013).

The type of surveillance described in this report can help reveal the diversity in outcomes from the same type of incident and allows CDC to respond quickly to specific public health threats. For example, during Hurricane Laura (2020), messaging focused on carbon monoxide exposures; during Hurricane Florence (2018), the primary concern was driving through floodwaters. During Hurricane Ida, the most recently reported deaths were discovered during wellness checks; therefore, messaging focused on checking on loved ones. Such evidence-based messaging, delivered through multiple channels to reach diverse audiences, is critical to saving lives, minimizing injury, and protecting public health. Leveraging the work of reporters on the ground who provide information about the current situation is important to this effort and facilitates the tracking of circumstances of death and helps target risk communication and messaging.

The findings in this report are subject to at least one limitation. Media reports are not official records and might not reflect all disaster-related deaths. CDC's Epi/Surv Task Force will continue to work with partners to help improve the accuracy and timeliness of official mortality data sources.

The media represent an immediate resource for timely information during an emergency response (*4*). CDC's Epi/Surv Task Force uses media reports of both confirmed and unconfirmed deaths to guide evidence-based public health messaging to help prevent further injury and death.¶ For example, reports of motor-vehicle involved drownings, whether confirmed or not, can help guide geographic targeting and timing for phase-based messages, such as avoiding driving in floodwaters, and can support existing coordination with state and local communicators (*5*). Continued use of media reports of both confirmed and unconfirmed deaths can guide evidence-based public health messaging to help prevent further injury and death.

* https://www.nhc.noaa.gov/archive/2021/al09/al092021.discus.015.shtml

† This is the formal name for the current Incident Management System for Hurricane Ida as well as previously activated CDC Emergency Operations Center hurricane response surveillance systems. https://www.cdc.gov/nceh/hsb/disaster/surveillance.htm

§ https://www.cdc.gov/disasters/hurricanes/index.html

¶ For emergency response purposes, media reports of deaths show what potential hazards and dangerous behaviors are occurring, which is vital for CDC's Epi/Surv Task Force's response-related public health messaging.

TABLE. Characteristics of reported deaths* related to Hurricane Ida — nine states, August 29–September 9, 2021

Characteristic	No. of deaths (%)†									
	Total	Louisiana	Mississippi	Alabama	New York§	New Jersey§	Pennsylvania§	Connecticut§	Virginia	Maryland
Total	**91 (100)**	**28 (30.8)**	**2 (2.2)**	**2 (2.2)**	**18 (19.8)**	**32 (35.2)**	**5 (5.5)**	**1 (1.1)**	**1 (1.1)**	**2 (2.2)**
Sex										
Female	**24 (26.4)**	6 (21.4)	0 (—)	0 (—)	9 (50.0)	8 (25.0)	1 (20.0)	0 (—)	0 (—)	0 (—)
Male	**49 (43.8)**	20 (71.4)	2 (100)	2 (100)	8 (44.4)	13 (40.6)	3 (60.0)	1 (100)	0 (—)	0 (—)
Unknown	**18 (19.8)**	2 (7.1)	0 (—)	0 (—)	1 (5.6)	11 (34.4)	1 (20.0)	0 (—)	1 (100)	2 (100)
Age group, yrs										
0–17	**1 (1.1)**	0 (—)	0 (—)	0 (—)	1 (5.6)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)
18–64	**41 (45.1)**	13 (46.4)	2 (100)	2 (100)	7 (38.9)	14 (43.8)	1 (20.0)	1 (100)	0 (—)	1 (50.0)
≥65	**29 (31.9)**	14 (50.0)	0 (—)	0 (—)	5 (27.8)	7 (21.9)	3 (60.0)	0 (—)	0 (—)	0 (—)
Unknown	**20 (22.0)**	1 (3.6)	0 (—)	0 (—)	5 (27.8)	11 (34.4)	1 (20.0)	0 (—)	1 (100)	1 (50.0)
Work-related										
No	**51 (56.0)**	25 (89.3)	0 (—)	0 (—)	12 (66.7)	9 (28.1)	3 (60.0)	0 (—)	0 (—)	2 (100)
Paid	**4 (4.4)**	1 (3.6)	0 (—)	2 (100)	0 (—)	0 (—)	0 (—)	1 (100)	0 (—)	0 (—)
Volunteer	**0 (—)**	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)
Unknown	**36 (39.6)**	2 (7.1)	2 (100)	0 (—)	6 (33.3)	23 (71.9)	2 (40.0)	0 (—)	1 (100)	0 (—)
Cause of death¶										
Drowning	**55 (60.4)**	2 (7.1)	0 (—)	0 (—)	18 (100)	28 (87.5)	3 (60.0)	1 (100)	1 (100)	2 (100)
Blunt force trauma	**5 (5.5)**	2 (7.1)	2 (100)	0 (—)	0 (—)	0 (—)	1 (20.0)	0 (—)	0 (—)	0 (—)
CO poisoning	**6 (6.6)**	6 (21.4)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)
Electrocution	**3 (3.3)**	0 (—)	0 (—)	2 (100)	0 (—)	1 (3.1)	0 (—)	0 (—)	0 (—)	0 (—)
Preexisting condition	**6 (6.6)**	6 (21.4)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)
Hyperthermia	**10 (11.0)**	10 (35.7)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)
Other/Unknown**	**6 (6.6)**	2 (7.1)	0 (—)	0 (—)	0 (—)	3 (9.4)	1 (20.0)	0 (—)	0 (—)	0 (—)
Circumstance of death††										
Drowning	**34 (37.4)**	1 (3.6)	0 (—)	0 (—)	14 (77.8)	15 (46.9)	1 (20.0)	0 (—)	1 (100)	2 (100)
Trauma (tree or building)	**1 (1.1)**	1 (3.6)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)
Generator/Power outage	**17 (18.7)**	17 (60.7)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)	0 (—)
Vehicular	**22 (24.2)**	1 (4.5)	2 (100)	0 (—)	4 (22.2)	12 (37.5)	2 (40.0)	1 (100)	0 (—)	0 (—)
Preparedness/Repair injury	**5 (5.5)**	1 (3.6)	0 (—)	2 (100)	0 (—)	2 (6.3)	0 (—)	0 (—)	0 (—)	0 (—)
Other	**7 (7.7)**	6 (21.4)	0 (—)	0 (—)	0 (—)	0 (—)	1 (20.0)	0 (—)	0 (—)	0 (—)
Unknown	**5 (5.5)**	1 (3.6)	0 (—)	0 (—)	0 (—)	3 (9.4)	1 (20.0)	0 (—)	0 (—)	0 (—)

Abbreviation: CO = carbon monoxide.

* The Epidemiology Surveillance Task Force scans media reports daily for confirmed and unconfirmed deaths using key search terms according to a standard operating procedure. https://www.cdc.gov/nceh/hsb/disaster/surveillance.htm

† Percentages might not sum to 100% because of rounding.

§ States in the Northeast that were affected by Hurricane Ida.

¶ Cause of death is the specific injury or condition that leads to death.

** Other/unknown includes alligator attack in floodwater and unknown cause of deaths (e.g., insufficient information at the time).

†† Circumstance of death is the determination of how the specific injury or condition leads to death.

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Notes from the Field

E-Cigarette Use Among Middle and High School Students — National Youth Tobacco Survey, United States, 2021

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Since 2014, e-cigarettes have been the most commonly used tobacco product among U.S. youths (*1*). In 2020, an estimated 3.6 million (13.1%) U.S. middle and high school students reported using e-cigarettes within the past 30 days (current use); more than 80% of current users reported flavored e-cigarette use (*2*). Whereas the most commonly used device type in 2019 and 2020 was a prefilled pod or cartridge,* disposable e-cigarette use increased significantly during this time among youths who currently used e-cigarettes in middle school (from 3.0% to 15.2%) and high school (from 2.4% to 26.5%) (*3*). CDC and the Food and Drug Administration (FDA) analyzed nationally representative data from the 2021 National Youth Tobacco Survey (NYTS), a school-based, cross-sectional, self-administered survey of U.S. middle school (grades 6–8) and high school (grades 9–12) students conducted during January 18–May 21, 2021 (20,413 students from 279 schools; overall response rate = 44.6%).† Because of the ongoing COVID-19 pandemic, data were collected online to allow participation of eligible students in remote learning settings.§ Current e-cigarette use was assessed overall, by frequency of use, device type, flavors, and usual brand. Weighted prevalence estimates and population totals¶ were calculated. This study was reviewed and approved by the CDC IRB.**

In 2021, 11.3% of high school students (1.72 million) and 2.8% (320,000) of middle school students reported current e-cigarette use (Table). Among current e-cigarette users, 43.6% of high school students and 17.2% of middle school students reported using e-cigarettes on ≥20 of the past 30 days; daily use was 27.6% among current high school e-cigarette users and 8.3% among current middle school e-cigarette users. Among both middle and high school current e-cigarette users, the most commonly used device type was disposables, followed by prefilled or refillable pods or cartridges and tanks or mod systems. Among high school current e-cigarette users, 26.1% reported that their usual brand was Puff Bar, followed by Vuse (10.8%), SMOK (9.6%), JUUL (5.7%), and Suorin (2.3%). Among middle school current users, 30.3% reported that their usual brand was Puff Bar, and 12.5% reported JUUL. Notably, 15.6% of high school users and 19.3% of middle school users reported not knowing the e-cigarette brand they usually used.

Among current youth e-cigarette users overall, 84.7% used flavored e-cigarettes, including 85.8% of high school users and 79.2% of middle school users. Among all current flavored e-cigarette users, the most commonly used flavor types among both middle and high school students were fruit, followed by candy, desserts, or other sweets; mint; and menthol. When examined by device type used, the most commonly used flavor types among current flavored disposable e-cigarette users were fruit (78.7%; 760,000); candy, desserts, or other sweets (34.3%; 330,000); mint (30.1%; 290,000); and menthol (21.5%; 200,000). The most commonly used flavor types among current flavored pod or cartridge users were fruit (57.9%; 270,000); menthol (46.3%; 210,000); mint (30.7%; 140,000); and candy, desserts, or other sweets (28.2%; 130,000). The most commonly used flavor types among current flavored tanks or mod systems users were fruit (70.9%; 100,000); candy, desserts, or other sweets (51.2%; 70,000); mint (34.5%; 50,000); and menthol (24.7%; 30,000). Among current flavored e-cigarette users, fruit was the most commonly reported flavor type overall, by school level, and across all e-cigarette devices.

The 2021 NYTS was fully conducted amid the global COVID-19 pandemic, during which time eligible students could participate in the survey in classrooms, at home, or

* There are a variety of different types of e-cigarette devices that are currently available. Disposable e-cigarettes come prefilled with e-liquid, and the entire device is designed to be discarded after a single use. Other devices have "pods" or "cartridges" that hold the e-liquid. Some pods or cartridges come pre-filled with e-liquid and are replaced after use, while others can be refilled by the user. Tank or mod-type devices can also be refilled by users, but are also usually customizable, allowing the user to change the temperature or voltage, nicotine concentrations, and add accessories to enhance the user experience.

† The final sample consisted of 508 schools, 279 (54.9%) of which participated; among 25,149 students, 20,413 (81.2%) students participated. The overall response rate (44.6%) is the product of the school-level and student-level participation rates. https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/index.htm

§ Because of state and local COVID-19 protocols (e.g., distance or hybrid learning, restrictive travel, or visitor access), the 2021 NYTS data collection was transitioned from an in-person, tablet-based administration to a fully online administration. Eligible students could participate in classrooms, at home, or in some other remote learning environment. Overall, 50.8% of students who completed the 2021 NYTS reported completing the survey in a school building or classroom and 49.2% at home or at some other place. Because of these differences in data collection procedures, the 2021 NYTS estimates should not be compared with previous NYTS survey waves that were primarily conducted on school campuses.

¶ Weighted population estimates were rounded down to the nearest 10,000 students.

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

TABLE. Prevalence of past 30-day e-cigarette use,* overall and by selected characteristics and school level — National Youth Tobacco Survey, United States, 2021

Characteristic	Overall		High school		Middle school	
	% (95% CI)	Estimated weighted no.†	% (95% CI)	Estimated weighted no.†	% (95% CI)	Estimated weighted no.†
Among all students						
Current use of e-cigarettes	7.6 (6.6–8.7)	2,060,000	11.3 (9.7–13.0)	1,720,000	2.8 (2.2–3.4)	320,000
Among current e-cigarette users						
Frequency of e-cigarette use						
1–19 days per month	60.6 (56.5–64.6)	1,240,000	56.4 (51.8–61.0)	970,000	82.8 (77.4–87.2)	270,000
20–30 days per month	39.4 (35.4–43.5)	810,000	43.6 (39.0–48.2)	750,000	17.2 (12.8–22.6)	50,000
Daily e-cigarette use§	24.6 (21.8–27.8)	500,000	27.6 (24.3–31.2)	470,000	8.3 (5.6–12.0)	20,000
Device type used¶						
Disposables	53.7 (48.7–58.6)	1,080,000	55.8 (50.8–60.7)	940,000	43.8 (34.0–54.1)	130,000
Prefilled or refillable pods or cartridges	28.7 (25.1–32.6)	570,000	28.9 (24.9–33.3)	480,000	27.8 (22.0–34.4)	80,000
Tanks or mod systems	9.0 (6.8–11.8)	180,000	7.5 (5.5–10.3)	120,000	15.6 (9.7–24.1)	40,000
Don't know	8.6 (6.7–11.0)	170,000	7.8 (5.7–10.4)	130,000	12.8 (8.0–19.9)	40,000
Usual brand**						
Puff Bar	26.8 (22.9–31.1)	520,000	26.1 (22.0–30.6)	430,000	30.3 (21.9–40.3)	90,000
Vuse	10.5 (6.9–15.6)	200,000	10.8 (7.1–16.2)	170,000	—††	—
SMOK (including NOVO)	8.6 (6.4–11.5)	160,000	9.6 (7.1–13.0)	150,000	—	—
JUUL	6.8 (4.9–9.3)	130,000	5.7 (3.8–8.5)	90,000	12.5 (8.3–18.4)	30,000
Suorin	2.1 (1.2–3.7)	40,000	2.3 (1.3–4.0)	30,000	—	—
No usual brand	2.4 (1.5–3.8)	40,000	2.5 (1.5–4.1)	40,000	—	—
Some other brand not listed	19.8 (15.7–24.6)	390,000	21.0 (16.5–26.3)	340,000	13.8 (8.6–21.3)	40,000
Don't know	16.1 (13.8–18.8)	310,000	15.6 (13.1–18.4)	250,000	19.3 (14.2–25.8)	60,000
Flavored e-cigarette use§§						
Yes	84.7 (81.4–87.5)	1,680,000	85.8 (82.3–88.7)	1,420,000	79.2 (69.1–86.6)	250,000
No	8.8 (6.9–11.2)	170,000	8.4 (6.5–10.7)	130,000	11.1 (6.4–18.7)	30,000
Don't know	6.5 (5.0–8.4)	120,000	5.9 (4.3–8.0)	90,000	9.7 (6.3–14.7)	30,000
Flavor type used¶¶						
Fruit	71.6 (67.8–75.1)	1,190,000	72.3 (68.1–76.1)	1,010,000	68.1 (58.7–76.1)	160,000
Candy, desserts, or other sweets	34.1 (30.3–38.2)	560,000	33.0 (29.2–37.1)	460,000	38.8 (30.0–48.3)	90,000
Mint	30.2 (26.9–33.7)	500,000	30.5 (27.0–34.2)	420,000	26.7 (19.5–35.4)	60,000
Menthol	28.8 (23.6–34.8)	470,000	29.8 (24.2–36.0)	410,000	23.1 (13.8–36.0)	50,000
Alcoholic drink	6.0 (4.3–8.2)	90,000	5.0 (3.4–7.5)	70,000	10.3 (5.9–17.3)	20,000
Chocolate	2.9 (1.9–4.5)	40,000	2.5 (1.4–4.4)	30,000	—	—
Clove or spice	2.1 (1.3–3.3)	30,000	—	—	—	—
Some other flavor not listed	10.4 (8.2–13.2)	170,000	9.8 (7.4–12.7)	130,000	13.8 (8.5–21.6)	30,000

Abbreviation: CI = confidence interval.

* Past 30-day use of e-cigarettes was determined by asking, "During the past 30 days, on how many days did you use e-cigarettes?" Current use was defined as use on ≥1 day during the past 30 days.

† Estimated total number of users was rounded down to the nearest 10,000 persons. Overall population totals might not sum to corresponding estimates by school level because of rounding or inclusion of students who did not self-report their grade level.

§ Daily e-cigarette use was defined as reported use on all 30 days during the past 30 days.

¶ Device type use among current e-cigarette users was determined by answers to the question, "Which of the following best describes the type of e-cigarette you have used in the past 30 days? If you have used more than one type, please think about the one you use most often." Response options were the following: "a disposable e-cigarette (for example, Puff Bar, STIG)," "an e-cigarette that uses pre-filled or refillable pods or cartridges (for example, JUUL, SMOK, or Suorin)," "an e-cigarette with a tank that you refill with liquids (including mod systems that can be customized by the user)," and "I don't know the type."

** Usual brand was determined by two questions. All current e-cigarette users were first asked, "During the past 30 days, what e-cigarette brands did you use? (Select one or more)." Response options were as follows: "blu," "Eonsmoke," "JUUL," "Leap," "Logic," "Mojo," "NJOY," "Posh," "Puff Bar," "SMOK (including NOVO)," "STIG," "Suorin," "Vuse," "Some other brand(s) not listed here," and "Not sure/I don't know the brand." Those who selected more than one option were then asked, "During the past 30 days, what brand of e-cigarettes did you usually use? (Choose only one answer)." The same response options as the first question were available with the additional response option of "I did not use a usual brand." If a single brand was selected in the first question, that brand was reported as their usual brand. Otherwise, the option selected in the second question was recorded as the usual brand. Those who selected "Some other brand(s) not listed here" could provide a write-in response; write-in responses corresponding to an original response option were recoded. Data for blu, Eonsmoke, Leap, Logic, Mojo, NJOY, Posh, and STIG are not shown because of statistically unreliable estimates resulting from an unweighted denominator <50 or a relative standard error >30% overall and at both school levels.

†† Dashes indicate data were statistically unreliable because of an unweighted denominator <50 or a relative standard error >30%.

§§ Flavored e-cigarette use was assessed by the question, "Were any of the e-cigarettes that you used in the past 30 days flavored to taste like menthol, mint, clove or spice, alcohol drinks, candy, fruit, chocolate, or any other flavor?" Responses were "yes," no," or "don't know."

¶¶ Flavor type use among current (past 30-day) users of flavored e-cigarettes was determined by answers to the question, "What flavors were the e-cigarettes that you have used in the past 30 days? (Select one or more)." Response options were "menthol," "mint," "clove or spice," "fruit," "chocolate," "alcoholic drinks (such as wine, margarita, or other cocktails)," "candy, desserts, or other sweets," and "some other flavor not listed here." Those who selected "some other flavor not listed here" could provide a write-in response; write-in responses corresponding to an original response option were recoded.

at some other place. Differences in tobacco use estimates by location[††] might be due to potential underreporting of tobacco use behaviors or other unmeasured characteristics among youths participating outside of the classroom. Thus, estimates from the 2021 NYTS should not be compared with previous NYTS survey waves that were primarily conducted on school campuses.

Approximately 2.06 million youths were estimated to be current e-cigarette users in 2021. Use of tobacco products by youths in any form, including e-cigarettes, is unsafe. Most e-cigarettes contain nicotine, and nicotine exposure during adolescence can harm the developing brain (*5*). Ongoing efforts to address youth e-cigarette use, including FDA's prioritized enforcement against certain unauthorized flavored, cartridge-based e-cigarettes in 2020, are critical (*4*). As the tobacco product landscape continues to evolve, sustained implementation of comprehensive tobacco control and prevention strategies at the national, state, and local levels, coupled with FDA regulation, can reduce and prevent tobacco product initiation and use among youths (*5*).

[††] Youths who reported participating in the 2021 NYTS in a school building or classroom reported a higher prevalence of e-cigarette use compared with youths participating at home or at some other place; 15.0% of high school students who took the survey in a school building or classroom reported currently using e-cigarettes compared with 8.1% of those who took the survey at home or at some other place ($p < 0.001$).

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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.

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Erratum

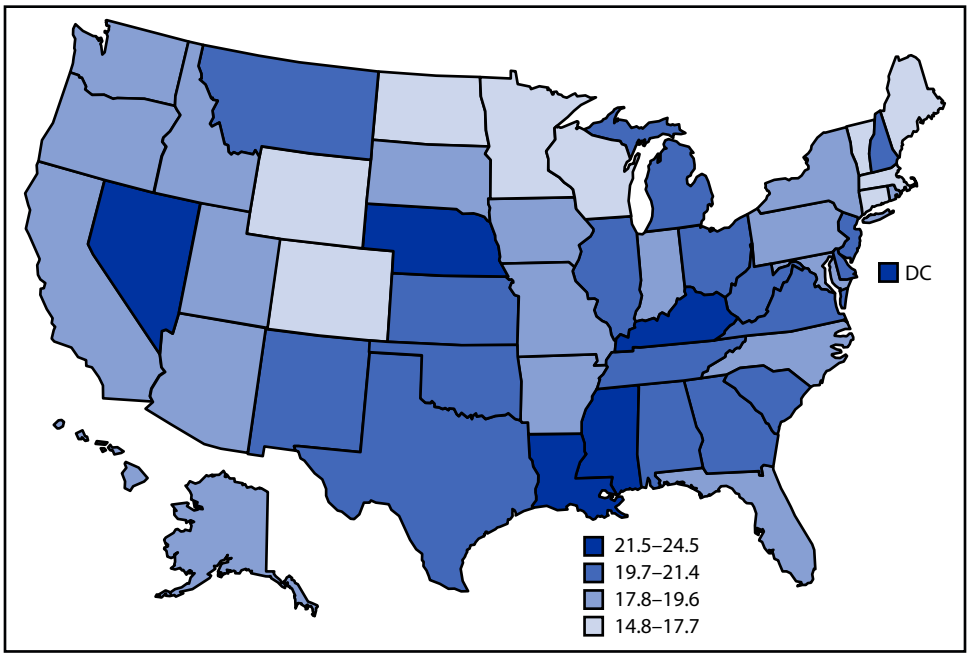
Vol. 70, No. 37

In the report "Post-Acute Sequelae of SARS-CoV-2 Infection Among Adults Aged ≥18 Years — Long Beach, California, April 1–December 10, 2020," on page 1276, in the first full paragraph the first sentence should have read, "In the **multivariable** regression model, the odds of experiencing symptoms 2 months after a positive SARS-CoV-2 test result were significantly higher among females (aOR = 2.83), persons with at least one preexisting condition (aOR = 2.17), and those aged 40–54 years (versus 25–39 years) (aOR = 1.86) (Table 3)."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Death Rates* for Female Breast Cancer,† by State — National Vital Statistics System, United States, 2019§



Abbreviation: DC = District of Columbia.

* Data were age-adjusted to the 2000 U.S. standard population. The 2019 U.S. breast cancer death rate was 19.4 per 100,000 population.

† Breast cancer deaths were those with *International Classification of Diseases, Tenth Revision* underlying cause of death code C50.

§ Rates are displayed by a Jenks classification for U.S. states and DC, which creates categories that minimize within-group variation and maximize between-group variation.

In 2019, the age-adjusted rate of female breast cancer deaths in the United States was 19.4 per 100,000 population. Jurisdictions in the highest category for breast cancer death rates were DC (24.5), Nevada (23.7), Nebraska (22.4), Kentucky (22.2), Louisiana (22.0), and Mississippi (22.0). Those in the lowest category were North Dakota (14.8), Massachusetts (15.3), Vermont (16.2), Connecticut (16.8), Wyoming (17.2), Minnesota (17.5), Colorado (17.6), Wisconsin (17.6), and Maine (17.7).

Source: National Vital Statistics System, Mortality, 2019. https://www.cdc.gov/nchs/nvss/deaths.htm

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