Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 70 / No. 18
May 7, 2021

Emergency Department Visits and Hospitalizations for Selected Nonfatal Injuries Among Adults Aged ≥65 Years — United States, 2018

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Approximately 60,000 older adults (aged ≥65 years) die from unintentional injuries each year; in 2019 these included 34,000 fall deaths, 8,000 traffic-related motor vehicle crash deaths, and 3,000 drug poisoning deaths (*1*). In addition, >9,000 suicide deaths occur among older adults each year (*1*). Deaths among older adults account for 33% of these unintentional injury deaths and 19% of suicide deaths among all age groups (*1*). Nonfatal injuries from these causes are more common in this age group and can lead to long-term health consequences, such as brain injury and loss of independence. This study included 2018 data from the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project (HCUP) to determine the prevalence of selected nonfatal injuries among older adults treated in emergency departments (EDs) and hospitals. Injury mechanisms among the leading causes of injury death in older adults were studied, including unintentional falls, unintentional traffic-related motor vehicle crashes, unintentional opioid overdoses, and self-harm (suicidal and nonsuicidal by any mechanism). In 2018, an estimated 2.4 million ED visits and >700,000 hospitalizations from these injuries occurred among adults aged ≥65 years. Unintentional falls accounted for >90% of the selected ED visits and hospitalizations. Injuries among older adults can be prevented (*2*). Educational campaigns, such as CDC's Still Going Strong* awareness campaign, that use positive messages can encourage older adults to take steps to prevent injuries. Health care providers can help prevent injuries by recommending that older patients participate in effective interventions, including referrals to physical therapy and deprescribing certain medications.†

Data from the 2018 HCUP Nationwide Emergency Department Sample (NEDS) and National Inpatient Sample (NIS) were analyzed for rates of nonfatal injuries resulting in ED visits and hospitalizations among adults aged ≥65 years.§ NEDS included data from 990 hospital EDs across 36 U.S. states and the District of Columbia. NIS included data from 47 participating states and the District of Columbia, which covered >97% of the U.S. population. ED visit diagnosis codes selected for analysis were *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) injury

* https://www.cdc.gov/StillGoingStrong
† https://www.cdc.gov/steadi/index.html
§ https://www.hcup-us.ahrq.gov/

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codes in any position[¶] and an ICD-10-CM code of one of the following injury mechanisms: unintentional falls,[**] unintentional traffic-related motor vehicle crashes,[††] or self-harm[§§] in any position. Hospitalizations were selected if the primary diagnosis was an injury (ICD-10-CM injury code) and one of the aforementioned injury mechanisms (ICD-10-CM code in any position).[¶¶] ED visits and hospitalizations were considered unintentional opioid overdose–related if ICD-10-CM codes or ICD-10 Procedure Coding System codes (used to collect inpatient procedures) for unintentional opioid overdoses[***] were present in any field (*3*). To identify the full effect of selected injuries on ED visits and hospitals, all encounter types (initial, subsequent, and sequalae) were included. Among the selected injuries, 98.4% of ED visits and 94.1% of hospitalizations were for an initial encounter. Overdose visits were limited to opioid overdose (prescription and heroin) because opioid use is related to the other injuries included in this study and opioids are frequently prescribed to older adults (*3*,*4*). ED visits and hospitalizations with missing sex or age data or those resulting in deaths were excluded, as were ED visits leading to patient hospitalizations to avoid overlap between data systems. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[†††]

ED visits and hospitalizations were weighted to represent the U.S. population using survey procedures in SAS statistical software (version 9.4; SAS Institute). Rates of ED visits and hospitalizations were age-adjusted to the 2000 U.S. standard population using the direct method. Injuries were analyzed by sex and age group (65–74, 75–84, and ≥85 years). T-tests were used for selected pairwise comparisons; p-values <0.05 were considered statistically significant.

In 2018, an estimated 2.4 million ED visits among adults aged ≥65 years (4,744 per 100,000) were associated with unintentional falls, unintentional motor vehicle crashes,

[¶] ICD-10-CM codes: M97, S00–S99; T07–T34, T36–T76 (T36–T50 with sixth character = 1–4, except T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9, with a fifth character = 1–4), and T79. Codes are seven characters long, with the last character representing the encounter type. HCUP-NEDS records include up to 35 diagnosis codes; HCUP-NIS contains up to 40 diagnosis codes for each visit.

[**] Unintentional fall ICD-10-CM codes: V00.11–V00.89 (with sixth character = 1), W00–W17 (W16 with sixth character = 2, except W16.4 and W16.9 with fifth character = 2), W18.1–W18.3, and W19.

[††] Unintentional motor vehicle-traffic-related crash injury ICD-10-CM codes: V02–V04 (0.1 or 0.9), V09.2, V09.3, V12–V14 (.3–.9), V19.4–V19.6, V19.9, V20–V28 (.3–.9), V29.4–V29.9, V30–V79 (.4–.9), V80.3–V80.5, V81.1, V82.1, V83–V86 (.0–.3), V87.0–V87.8, and V89.2.

[§§] Self-harm ICD-10-CM codes: T36–T65 with sixth character = 2 (except for T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, T49.9, T51.9, T52.9, T53.9, T54.9, T56.9, T57.9, T58.0, T58.1, T58.9, T59.9, T60.9, T61.0, T61.1, T61.9, T62.9, T63.9, T64.0, T64.8, and T65.9 with fifth character = 2), T71 with sixth character = 2, T14.91, and X71–X83.

[¶¶] https://resources.cste.org/Injury-Surveillance-Methods-Toolkit/Home/GeneralInjuryIndicators

[***] Unintentional opioid overdose ICD-10-CM/ICD-10-PCS codes: T40.0X1, T40.1X1, T40.2X1, T40.3X1, T40.4X1, T40.601, and T40.691.

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

The *MMWR* series of publications is published by the Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Report title]. MMWR Morb Mortal Wkly Rep 2021;70:[inclusive page numbers].

unintentional opioid overdoses, and self-harm (Table). Unintentional falls accounted for 91.8% of the selected injury-related ED visits, followed by unintentional crashes (7.8%). The rate of ED visits for unintentional fall injuries among women (5,003 per 100,000) was 41.7% higher than that among men (3,530 per 100,000). Rates of ED visits for unintentional fall injuries per 100,000 persons increased with age, from 2,678 among adults aged 65–75 years to 4,900 among adults aged 75–84 years and 9,867 among adults aged ≥85 years. Unintentional crash injury–related ED visits decreased with age; among adults aged 65–74, 75–84, and ≥85 years, ED visits per 100,000 persons were 401, 337, and 236, respectively. The rate of unintentional opioid overdose–related ED visits was higher among men (18 per 100,000) than among women (14 per 100,000). Compared with other older adults, those aged 65–74 years had the highest rates of visits for unintentional opioid overdose (20 per 100,000) and self-harm (13 per 100,000).

In 2018, >700,000 hospitalizations associated with unintentional falls, unintentional motor vehicle crashes, unintentional opioid overdoses, and self-harm occurred among older adults. Unintentional falls accounted for 91.3% of the selected injury-related hospitalizations followed by unintentional motor vehicle crashes (5.9%). The rate of hospitalizations for unintentional falls was higher among women (1,494 per 100,000) than among men (1,035 per 100,000), and increased with age; among adults aged 65–74, 75–84, and ≥85 years, hospitalization rates for unintentional fall–related injuries were 561, 1,504, and 3,857 per 100,000, respectively. Hospitalization rate of unintentional motor vehicle

TABLE. Rates* of injury-related emergency department visits† and hospitalizations§ for selected causes¶ among adults aged ≥65 years, by cause, sex, and age group — Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample and National Inpatient Sample, United States, 2018

	ED visits			Hospitalizations		
Cause, sex, and age group	Weighted no.	Rate	(95% CI)	Weighted no.	Rate	(95% CI)
All causes**						
Total††	**2,419,788**	**4,744.0**	**(4,623.1–4,864.8)**	**717,660**	**1,425.3**	**(1,404.2–1,446.3)**
Sex						
Male (ref)	844,954	3,904.1	(3,799.5–4,008.8)	244,890	1,160.5	(1,140.3–1,180.7)
Female	1,574,834	5,393.3§§	(5,257.1–5,529.6)	472,770	1,609.6§§	(1,585.5–1,633.7)
Age group, yrs						
65–74 (ref)	948,492	3,110.6	(2,951.3–3,269.9)	206,755	678.1	(657.3–698.8)
75–84	808,813	5,253.9§§	(4,966.0–5,541.9)	250,925	1,630.0§§	(1,582.6–1,677.4)
≥85	662,483	10,122.7§§	(9,505.9–10,739.6)	259,980	3,972.5§§	(3,851.4–4,093.6)
Unintentional falls¶¶						
Total††	**2,216,681**	**4,362.1**	**(4,249.3–4,474.9)**	**654,895**	**1,305.2**	**(1,285.6–1,324.8)**
Sex						
Male (ref)	755,836	3,529.8	(3,432.6–3,626.9)	215,540	1,034.6	(1,016.2–1,052.9)
Female	1,460,845	5,002.6§§	(4,875.0–5,130.2)	439,355	1,494.0§§	(1,471.3–1,516.8)
Age group, yrs						
65–74 (ref)	816,650	2,678.2	(2,541.9–2,814.6)	170,985	560.7	(543.8–577.7)
75–84	754,281	4,899.7§§	(4,630.7–5,168.7)	231,490	1,503.7§§	(1,460.6–1,546.9)
≥85	645,750	9,867.1§§	(9,265.2–10,468.9)	252,420	3,857.0§§	(3,739.6–3,974.4)
Unintentional motor vehicle crashes***						
Total††	**189,531**	**357.2**	**(345.9–368.4)**	**42,040**	**81.4**	**(78.7–84.2)**
Sex						
Male (ref)	82,493	347.7	(336.5–358.9)	20,880	90.8	(87.1–94.5)
Female	107,038	367.6§§	(355.3–379.8)	21,160	74.0§§	(71.0–76.9)
Age group, yrs						
65–74 (ref)	122,238	400.9	(375.9–425.8)	21,915	71.9	(67.3–76.5)
75–84	51,828	336.7§§	(315.6–357.7)	14,295	92.9§§	(86.6–99.1)
≥85	15,465	236.3§§	(218.6–254.0)	5,830	89.1§§	(82.0–96.1)
Unintentional opioid overdoses†††						
Total††	**8,767**	**16.0**	**(14.9–17.1)**	**14,440**	**27.1**	**(26.0–28.1)**
Sex						
Male (ref)	4,529	17.9	(16.0–19.8)	5,780	23.9	(22.5–25.4)
Female	4,238	14.2§§	(13.2–15.3)	8,660	29.6§§	(28.1–31.0)
Age group, yrs						
65–74 (ref)	6,204	20.3	(18.0–22.6)	9,510	31.2	(29.5–32.8)
75–84	1,730	11.2§§	(10.0–12.5)	3,730	24.2§§	(22.3–26.1)
≥85	834	12.7§§	(10.6–14.9)	1,200	18.3§§	(15.9–20.7)

See table footnotes on the next page.

TABLE. (*Continued*) Rates* of injury-related emergency department visits† and hospitalizations§ for selected causes¶ among adults aged ≥65 years, by cause, sex, and age group — Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample and National Inpatient Sample, United States, 2018

Cause, sex, and age group	ED visits			Hospitalizations		
	Weighted no.	Rate	(95% CI)	Weighted no.	Rate	(95% CI)
Self-harm§§§						
Total††	**5,782**	**10.6**	**(9.9–11.4)**	**8,420**	**15.7**	**(14.9–16.5)**
Sex						
Male (ref)	2,534	10.7	(9.7–11.6)	3,580	15.1	(14.0–16.2)
Female	3,248	10.8	(9.9–11.7)	4,840	16.4	(15.3–17.4)
Age group, yrs						
65–74 (ref)	3,908	12.8	(11.6–14.1)	5,490	18.0	(16.9–19.2)
75–84	1,289	8.4§§	(7.2–9.5)	2,065	13.4§§	(12.0–14.8)
≥85	585	8.9§§	(7.2–10.7)	865	13.2§§	(11.2–15.2)

Abbreviations: CI = confidence interval, ED = emergency department; ref = reference group.

* ED visits/hospitalizations per 100,000. Rates are age adjusted using the 2000 U.S. standard population except for the age group-specific rates.

† Records for patients who were hospitalized or died in the ED were excluded; weighted number estimates were weighted to be representative of the U.S. population.

§ Records were excluded if the patient died in the hospital; weighted number estimates were weighted to be representative of the United States.

¶ For all the selected injuries, observations were included for all encounters (initial, subsequent, and sequalae).

** All causes category represents the number of unique injury visits for unintentional falls, unintentional motor vehicle crashes, unintentional opioid overdoses, and self-harm. The sum of the individual mechanisms is higher than the total because some injury-related emergency department visits and hospitalizations had more than one mechanism of injury code.

†† Totals for each mechanism of injury might not sum to totals across sex and age group because of rounding the weighted estimates.

§§ P-value <0.05 when compared with reference group by t-test.

¶¶ ICD-10-CM codes were the following: injury diagnosis code in any position (ED) or primary position (hospital) M97, S00–S99, T07–T34, T36–T76 (T36–T50 with sixth character = 1–4, except T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 with a fifth character = 1–4), T79; and an unintentional fall code in any position: V00.11–V00.89 (with sixth character = 1), W00–W17 (W16 with a sixth character = 2, except W16.4 and W16.9 with a fifth character = 2), W18.1–W18.3, and W19.

*** ICD-10-CM codes were the following: injury diagnosis code in any position (ED) or primary position (hospital) M97, S00–S99, T07–T34, T36–T76 (T36–T50 with sixth character = 1–4, except T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 with a fifth character = 1–4), T79; and an unintentional motor vehicle crash code in any position: V02–V04 (.1 or .9), V09.2, V09.3, V12–V14 (.3–.9), V19.4–V19.6, V19.9, V20–V28 (.3–.9), V29.4–V29.9, V30–V79 (.4–.9), V80.3–V80.5, V81.1, V82.1, V83–V86 (.0–.3), V87.0–V87.8, V89.2 in any position.

††† ICD-10-CM codes were the following: T40.0X1, T40.1X1, T40.2X1, T40.3X1, T40.4X1, T40.601, and T40.691.

§§§ ICD-10-CM codes were the following: injury diagnosis code in any position (EDs) or primary position (hospital) M97, S00–S99, T07–T34, T36–T76 (T36–T50 with sixth character = 1–4, except T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 with a fifth character = 1–4), T79; and a self-harm code in any position: T36–T65 with sixth character = 2 (except for T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, T49.9, T51.9, T52.9, T53.9, T54.9, T56.9, T57.9, T58.0, T58.1, T58.9, T59.9, T60.9, T61.0, T61.1, T61.9, T62.9, T63.9, T64.0, T64.8, and T65.9 with fifth character = 2), T71 with sixth character = 2, T14.91, and X71–X83.

crashes was higher among men (91 per 100,000) than among women (74 per 100,000), whereas the rate of unintentional opioid overdose–related hospitalizations was higher among women (30 per 100,000) than among men (24 per 100,000). Unintentional opioid overdose–related hospitalizations decreased with age: among adults aged 65–74, 75–84, and ≥85 years, hospitalization rates per 100,000 were 31, 24, and 18, respectively. Hospitalization rates for unintentional opioid overdose (27 per 100,000) and self-harm (16 per 100,000) were higher than rates of ED visits during which patients were treated and released (16 and 11 per 100,000, respectively).

Discussion

In 2018, injuries from unintentional falls, unintentional motor vehicle crashes, unintentional opioid overdoses, and self-harm among adults aged ≥65 years were associated with an estimated 2.4 million ED visits and >700,000 hospitalizations. Unintentional falls accounted for >90% of these visits. Women had higher rates of fall-related injury ED visits and hospitalizations than did men. Although women are more likely to report fall injuries, fall-related mortality rates are higher in men than in women (*5*). The relationship between sex and fall-related injuries has not been fully explained. In this study, rates of ED visits and hospitalizations for fall-related injuries increased with age. Many risk factors for injuries increase with age, including poor balance, visual impairment, and increased medication use (*5*).

Motor vehicle crash injuries are related to visual impairment, use of certain medications, and frailty (*6*). This study found that ED visits for crash-related injuries decreased with age, perhaps because fewer older adults drive or ride in a car as they age (*7*). Older men constitute a higher percentage of drivers than do older women (*7*). This might partially explain the higher rates of crash-related hospitalizations among men in the present study.

Although injuries from opioid overdoses or self-harm were less common than were injuries from falls or motor vehicle crashes, these injury mechanisms share common risk factors. Depression has been associated with opioid use, self-harm, and falls among older adults (*3*,*5*,*8*). Opioid use is associated

Summary

What is already known about this topic?

Injuries are a leading cause of death among U.S. adults aged ≥65 years; nonfatal injuries among this age group are more common and result in long-term health consequences, including brain injuries or the loss of independence.

What is added by this report?

In 2018, an estimated 2.4 million emergency department visits and >700,000 hospitalizations occurred among older adults as a result of injuries from falls, motor vehicle crashes, opioid overdoses, and self-harm. Unintentional falls accounted for >90% of these visits.

What are the implications for public health practice?

Injuries are not an inevitable part of aging. Educational campaigns that use positive messages can encourage older adults to speak with their health care provider about preventing injuries. Health care providers can help prevent injuries by referring to physical therapy and deprescribing certain medications.

with an increased risk for falls and motor vehicle crashes (*4*). Poisoning, the most common mechanism of self-harm among older adults (*8*), often includes medications linked to falls, including opioids, benzodiazepines, and tricyclic antidepressants (*4*,*5*,*9*). Managing these shared risk factors can help prevent injuries.

The findings in this report are subject to at least seven limitations. First, this study examined a subset of common nonfatal injuries; therefore, not all nonfatal injuries among older adults are represented. Second, injury-related ED visits and hospitalizations could have multiple ICD-10-CM mechanism of injury codes, causing some injuries (<1%) to be attributed to multiple mechanisms. Third, ED visits for falls, crashes, and self-harm were included only if both an injury diagnosis ICD-10-CM code and a mechanism of injury ICD-10-CM code were present, leading to a possible underestimation of injury-related ED visits. Fourth, hospitalizations for falls, motor vehicle crashes, and self-harm were included only if the primary diagnosis was an injury. This could underestimate rates of injury-related hospitalizations. Fifth, injury visits should not be interpreted to represent individual patients because all encounter types were counted, which could include multiple visits for a single injury. Sixth, this analysis was specific to unintentional opioid overdoses, which account for approximately 53% of unintentional overdose deaths among older adults.[§§§] Finally, injuries of undetermined intent were not included in this analysis, which could lead to an underestimation of injury rates for which intent is difficult to determine, such as opioid overdose.

[§§§] https://wonder.cdc.gov/

Injuries are not an inevitable part of aging and can be prevented (*10*). CDC's Still Going Strong awareness campaign can guide older adults about simple steps to avoid injuries as they age. Important steps include exercises to improve strength and mobility, regular eye exams, and speaking with a health care provider about reducing medications that can increase the risk for injury, such as benzodiazepines, opioids, and antidepressants.[¶¶¶] CDC also offers tools to help health care providers and their older patients prevent injuries and deaths from falls,[****] motor vehicle crashes,[††††] opioid overdoses,[§§§§] and suicide.[¶¶¶¶] Resources such as these can help reduce common injuries among older populations and reduce the number of injuries that require medical treatment.

[¶¶¶] https://doi.org/10.1111/jgs.15767
[****] https://www.cdc.gov/steadi/index.html
[††††] https://www.cdc.gov/motorvehiclesafety/pdf/older_adult_drivers/CDC-AdultMobilityTool-9.27.pdf
[§§§§] https://www.cdc.gov/drugoverdose/pubs/featured-topics/evidence-based-strategies.html
[¶¶¶¶] https://www.cdc.gov/violenceprevention/pdf/suicideTechnicalPackage.pdf

Acknowledgments

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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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Surveillance to Track Progress Toward Polio Eradication — Worldwide, 2019–2020

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When the Global Polio Eradication Initiative (GPEI) was established in 1988, an estimated 350,000 poliomyelitis cases were reported worldwide. In 2020, 140 wild poliovirus (WPV) cases were confirmed, representing a 99.99% reduction since 1988. WPV type 1 transmission remains endemic in only two countries (Pakistan and Afghanistan), but outbreaks of circulating vaccine-derived poliovirus (cVDPV) occurred in 33 countries during 2019–2020 (*1*,*2*). Poliovirus transmission is detected primarily through syndromic surveillance for acute flaccid paralysis (AFP) among children aged <15 years, with confirmation by laboratory testing of stool specimens. Environmental surveillance supplements AFP surveillance and plays an increasingly important role in detecting poliovirus transmission. Within 2 weeks of COVID-19 being declared a global pandemic (*3*), GPEI recommended continuing surveillance activities with caution and paused all polio supplementary immunization activities (*4*). This report summarizes surveillance performance indicators for 2019 and 2020 in 42 priority countries at high risk for poliovirus transmission and updates previous reports (*5*). In 2020, 48% of priority countries* in the African Region, 90% in the Eastern Mediterranean Region, and 40% in other regions met AFP surveillance performance indicators nationally. The number of priority countries rose from 40 in 2019 to 42 in 2020.† Analysis of 2019–2020 AFP surveillance data from 42 countries at high risk for poliovirus transmission indicates that national and subnational nonpolio AFP rates and stool specimen adequacy declined in many priority countries, particularly in the African Region, suggesting a decline in surveillance sensitivity and quality. The findings in this report can be used to guide improvements to restore a sensitive surveillance system that can track poliovirus transmission and provide evidence of interruption of transmission.

Acute Flaccid Paralysis Surveillance

Two key performance indicators assess AFP surveillance quality: the nonpolio AFP (NPAFP) rate§ and the collection of adequate stool specimens from AFP patients. Based on the background incidence of other acute flaccid paralytic illnesses, an NPAFP rate ≥2 per 100,000 children aged <15 years indicates that a system is sufficiently sensitive to detect circulating poliovirus. Surveillance quality is assured by collection of adequate stool specimens from ≥80% of persons with AFP.¶

Surveillance performance in 42 priority countries that had recent WPV or cVDPV transmission or that were deemed at high risk for poliovirus transmission were reviewed. In the World Health Organization (WHO) African Region (AFR), the percentage of priority countries that met targets for both national NPAFP rate and stool adequacy indicators was 67% in 2019 and 48% in 2020 (Table 1). Both surveillance indicator targets were met in 61% of first subnational administrative level areas (e.g., state or province) in 2019 and 53% in 2020 (Figure). Either cVDPV2 cases or environmental isolates were detected in 14 AFR countries in 2019 and in 21 countries in 2020 (Table 1).

All 10 of the assessed priority WHO Eastern Mediterranean Region (EMR) countries met targets for both indicators in 2019, and all but one (Yemen, with stool adequacy of 78%) did so in 2020. Subnational surveillance performance remained high in most EMR countries, but gaps were apparent in Yemen and Libya, where 44% and 53% of the population, respectively, lived in areas that met both surveillance indicator targets in 2020 (Figure). From 2019 to 2020, the number of WPV1 cases declined in the region; cVDPV2 cases increased in Afghanistan (from none to 308), Pakistan (from 22 to 135), Somalia (from three to 14), and Sudan (from none to 58); and in Yemen, significantly more cVDPV1 cases were confirmed in 2020 (31) than in 2019 (one).

In the WHO European Region (EUR), surveillance performance was assessed in the two priority countries of Tajikistan

* 2020 priority countries: *African Region:* Angola, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Eritrea, Ethiopia, Ghana, Guinea, Kenya, Liberia, Madagascar, Mali, Mauritania, Mozambique, Niger, Nigeria, Senegal, Sierra Leone, South Sudan, Togo, and Zambia; *Eastern Mediterranean Region:* Afghanistan, Egypt, Iran, Iraq, Libya, Pakistan, Somalia, Sudan, Syria, and Yemen; *European Region:* Tajikistan and Uzbekistan; *South-East Asia Region:* Burma (Myanmar); *Western Pacific Region:* Malaysia and Philippines.

† Countries for this report (2019–2020) were selected according to whether they had endemic transmission, had ≥1 cVDPV isolate from AFP or environmental surveillance, or were deemed to be programmatically at high risk.

§ The number of NPAFP cases per 100,000 children aged <15 years.

¶ Two stool specimens collected ≥24 hours apart and within 14 days of paralysis onset, and arrival at a WHO-accredited laboratory by reverse cold chain (storing and transporting samples at recommended temperatures from the point of collection to the laboratory) and in good condition (i.e., without leakage or desiccation).

TABLE 1. National and subnational acute flaccid paralysis surveillance performance indicators and number of confirmed wild poliovirus and circulating vaccine-derived poliovirus cases, by country — 42 priority countries, World Health Organization African, Eastern Mediterranean, European, South-East Asia, and Western Pacific regions, 2019–2020*

Year/WHO region/ Country	No. of AFP cases (all ages)	Regional/ National NPAFP rate†	% Subnational areas with NPAFP rate ≥2§	% Regional or national AFP cases with adequate specimens¶	% Subnational areas with ≥80% adequate specimens	% Population living in areas meeting both indicators**	No. of confirmed WPV cases	No. of confirmed cVDPV cases††
2019								
African Region	**21,234**	**5.8**	**N/A**	**84.0**	**N/A**	**N/A**	—§§	**328**
Angola	578	2.8	66.7	74.4	38.9	14.7	—	138
Benin	310	6.0	100.0	90.6	83.3	84.9	—	8
Burkina Faso	374	4.1	69.2	82.4	84.6	65.6	—	1
Cameroon	613	5.7	80.0	79.8	50.0	35.9	—	—
Central African Republic	230	8.2	100.0	51.7	0.0	0.0	—	21
Chad	821	11.0	95.7	82.8	56.5	68.1	—	11
Congo	195	8.0	100.0	81.0	58.3	61.9	—	—
Côte d'Ivoire	420	3.8	95.0	78.3	50.0	48.0	—	—
Democratic Republic of the Congo	3,808	8.9	100.0	70.6	7.7	7.7	—	88
Eritrea	110	5.0	83.3	100.0	83.3	73.5	—	—
Ethiopia	1,222	2.7	100.0	85.3	90.9	99.6	—	14
Ghana	648	5.2	100.0	87.5	93.8	96.4	—	18
Guinea	233	4.1	100.0	87.6	62.5	59.6	—	—
Guinea-Bissau	44	5.1	100.0	86.4	77.8	70.5	—	—
Kenya	560	2.6	72.3	92.9	78.7	66.9	—	—
Liberia	70	3.3	86.7	91.4	80.0	81.7	—	—
Madagascar	613	5.6	100.0	93.0	86.4	91.9	—	—
Mali	301	3.2	90.9	82.1	63.6	77.8	—	—
Mauritania	55	3.0	86.7	85.5	73.3	59.7	—	—
Mozambique	513	3.6	100.0	72.3	27.3	31.5	—	—
Niger	906	7.7	100.0	67.7	0.0	0.0	—	1
Nigeria	7,509	8.5	100.0	94.1	100.0	100.0	—	18
Senegal	183	2.4	64.3	80.9	57.1	46.7	—	—
Sierra Leone	123	3.7	100.0	78.9	50.0	43.5	—	—
South Sudan	399	7.0	100.0	89.0	90.0	84.0	—	—
Togo	164	4.5	100.0	68.9	50.0	52.2	—	8
Zambia	232	2.8	70.0	81.9	70.0	36.8	—	2
Eastern Mediterranean Region	**24,788**	**12.3**	**N/A**	**89.2**	**N/A**	**N/A**	**176**	**26**
Afghanistan	3,768	23.9	100.0	93.8	100.0	100.0	29	—
Egypt	1,343	4.0	92.6	93.4	88.9	85.0	—	—
Iran	1,070	5.5	96.8	97.0	96.8	98.9	—	—
Iraq	1,157	7.1	100.0	94.3	100.0	100.0	—	—
Libya	107	5.9	85.7	98.1	100.0	91.9	—	—
Pakistan	15,218	21.3	100.0	86.6	100.0	100.0	147	22
Somalia	361	5.0	100.0	95.6	100.0	100.0	—	3
Sudan	608	3.6	100.0	96.4	100.0	100.0	—	—
Syria	377	5.8	85.7	85.4	71.4	65.1	—	—
Yemen	779	6.7	100.0	85.8	95.7	97.5	—	1
European Region	**226**	**1.7**	**N/A**	**98.2**	**N/A**	**N/A**	**—**	**—**
Tajikistan	92	2.7	100.0	95.7	100.0	100.0	—	—
Uzbekistan	134	1.4	14.3	100.0	100.0	9.5	—	—
South-East Asia Region	**420**	**3.0**	**N/A**	**90.2**	**N/A**	**N/A**	**—**	**6**
Burma (Myanmar)¶¶	420	3.0	83.3	90.2	83.3	77.0	—	6
Western Pacific Region	**1,075**	**2.5**	**N/A**	**51.6**	**N/A**	**N/A**	**—**	**17**
Malaysia	183	2.3	64.3	74.3	42.9	27.9	—	3
Philippines	892	2.5	25.0	47.0	0.0	0.0	—	14
2020								
African Region	**20,181**	**5.4**	**N/A**	**85.2**	**N/A**	**N/A**	**—**	**532**
Angola	383	2.4	77.8	82.0	61.1	37.3	—	3
Benin	277	5.4	100.0	88.1	91.7	94.5	—	3
Burkina Faso	1,178	11.9	100.0	86.1	92.3	95.2	—	61
Cameroon	605	5.4	100.0	77.9	50.0	40.3	—	7
Central African Republic	222	9.8	100.0	64.4	28.6	28.2	—	4

See table footnotes on the next page.

TABLE 1. (*Continued*) National and subnational acute flaccid paralysis surveillance performance indicators and number of confirmed wild poliovirus and circulating vaccine-derived poliovirus cases, by country — 42 priority countries, World Health Organization African, Eastern Mediterranean, European, South-East Asia, and Western Pacific regions, 2019–2020*

Year/WHO region/ Country	No. of AFP cases (all ages)	Regional/ National NPAFP rate†	% Subnational areas with NPAFP rate ≥2§	% Regional or national AFP cases with adequate specimens¶	% Subnational areas with ≥80% adequate specimens	% Population living in areas meeting both indicators**	No. of confirmed WPV cases	No. of confirmed cVDPV cases††
Chad	990	11.7	95.7	81.4	65.2	69.0	—	99
Congo	93	3.7	66.7	83.9	66.7	31.7	—	2
Côte d'Ivoire	742	6.0	100.0	74.5	39.4	32.6	—	60
Democratic Republic of the Congo	3,303	7.6	100.0	81.0	53.8	55.9	—	81
Eritrea	156	7.0	66.7	99.4	66.7	61.2	—	—
Ethiopia	1,341	2.9	81.8	86.4	81.8	91.5	—	26
Ghana	709	5.9	100.0	85.9	81.2	78.7	—	12
Guinea	321	4.6	100.0	70.1	25.0	16.4	—	44
Guinea-Bissau	21	2.6	45.5	52.4	9.1	13.8	—	—
Kenya	336	1.6	29.8	86.9	70.2	17.4	—	—
Liberia	48	2.3	73.3	95.8	100.0	64.8	—	—
Madagascar	635	5.7	100.0	90.4	95.5	96.4	—	—
Mali	375	3.4	90.9	76.0	45.5	59.9	—	45
Mauritania	17	0.9	26.7	64.7	13.3	0.0	—	—
Mozambique	374	2.6	72.7	73.5	36.4	14.6	—	—
Niger	585	4.8	100.0	72.0	25.0	24.1	—	9
Nigeria	6,330	7.0	97.3	94.5	97.3	97.8	—	8
Senegal	135	1.7	50.0	77.0	28.6	12.2	—	—
Sierra Leone	115	3.2	80.0	78.3	40.0	19.3	—	9
South Sudan	434	6.4	100.0	80.4	70.0	64.3	—	50
Togo	161	4.0	100.0	62.1	0.0	0.0	—	9
Zambia	295	3.6	80.0	69.8	10.0	8.5	—	—
Eastern Mediterranean Region	**20,418**	**9.7**	**N/A**	**87.7**	**N/A**	**N/A**	**140**	**546**
Afghanistan	3,972	22.9	100.0	91.9	97.1	98.4	56	308
Egypt	1,009	3.0	85.2	94.5	92.6	93.8	—	—
Iran	618	3.2	87.1	98.5	96.8	91.2	—	—
Iraq	476	2.9	84.2	93.3	94.7	89.0	—	—
Libya	95	5.1	71.4	98.9	100.0	52.9	—	—
Pakistan	11,969	16.4	100.0	85.1	100.0	100.0	84	135
Somalia	378	4.9	85.7	94.2	81.0	94.8	—	14
Sudan	733	3.9	100.0	92.8	94.4	93.6	—	58
Syria	343	5.3	92.9	84.5	78.6	63.6	—	—
Yemen	825	6.8	95.7	77.8	56.5	43.8	—	31
European Region	**138**	**1.0**	**N/A**	**95.7**	**N/A**	**N/A**	**—**	**1**
Tajikistan	83	2.4	50.0	92.8	100.0	30.6	—	1
Uzbekistan	55	0.5	0.0	100.0	92.9	0.0	—	—
South-East Asia Region	**186**	**1.3**	**N/A**	**85.5**	**N/A**	**N/A**	**—**	**—**
Burma (Myanmar)¶¶	186	1.3	22.2	85.5	72.2	9.0	—	—
Western Pacific Region	**980**	**2.3**	**N/A**	**65.3**	**N/A**	**N/A**	**—**	**2**
Malaysia	157	2.0	37.5	81.5	62.5	22.9	—	1
Philippines	823	2.4	5.9	62.2	5.9	2.0	—	1

Abbreviations: AFP = acute flaccid paralysis; cVDPV = circulating vaccine-derived poliovirus; N/A = not applicable; NPAFP = nonpolio AFP; WHO = World Health Organization; WPV = wild poliovirus.

* Data as of April 16, 2021.

† Per 100,000 persons aged <15 years per year.

§ For all subnational areas regardless of population size.

¶ Standard WHO target is adequate stool specimen collection from ≥80% of AFP cases, assessed by timeliness and condition. For this analysis, timeliness was defined as two specimens collected ≥24 hours apart (≥1 calendar day in this data set), both within 14 days of paralysis onset. Good condition was defined as arrival of specimens in a WHO-accredited laboratory with reverse cold chain maintained and without leakage or desiccation.

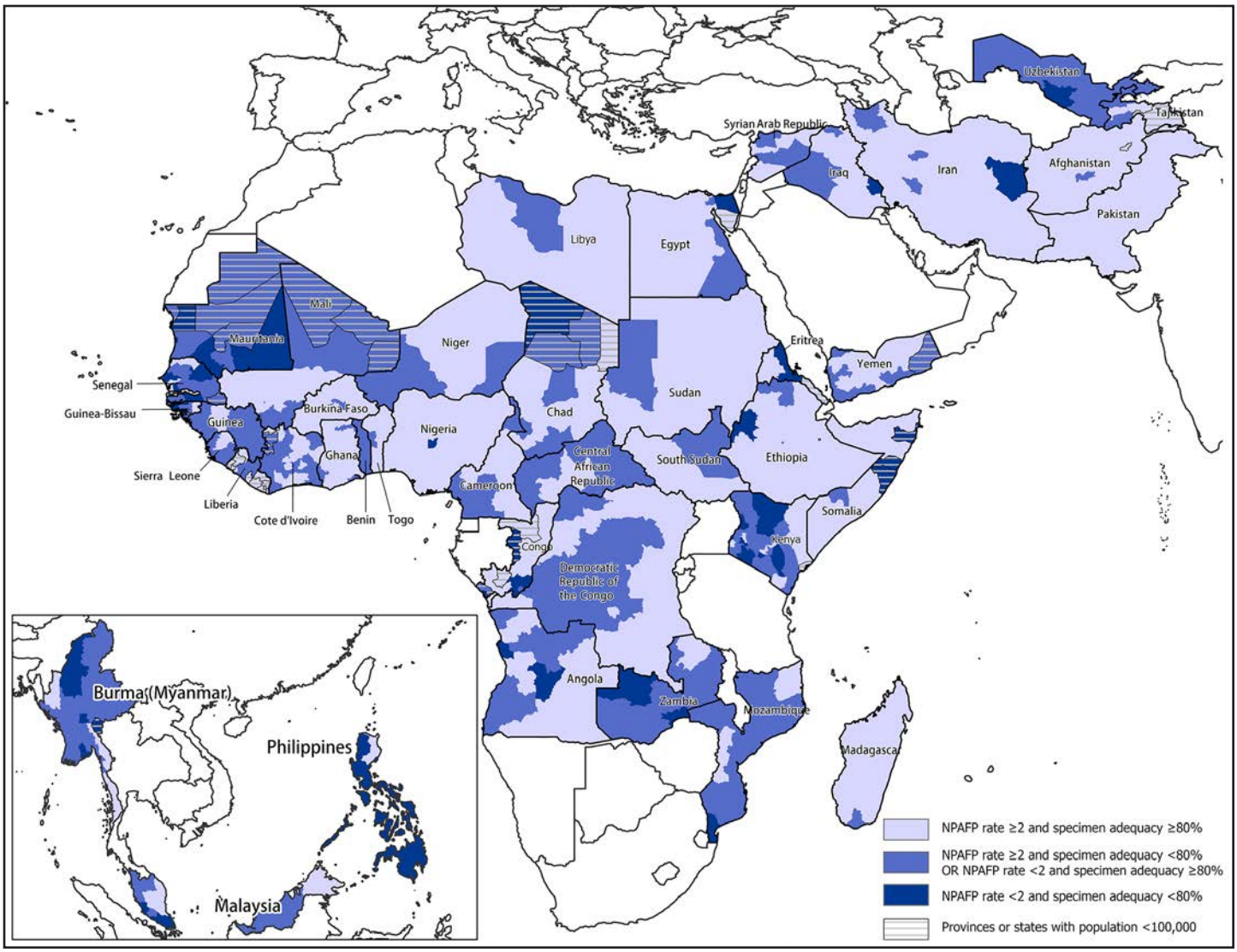
** Percentage of the country's population living in subnational areas that met both surveillance indicators (NPAFP rates ≥2 per 100,000 persons aged <15 years per year and ≥80% of AFP cases with adequate specimens).

†† cVDPV was associated with at least one case of AFP with evidence of community transmission and genetically linked. Guidelines for classification of cVDPV are available. https://polioeradication.org/wp-content/uploads/2016/09/Reporting-and-Classification-of-VDPVs_Aug2016_EN.pdf

§§ Dashes indicate that no confirmed cases were found.

¶¶ For this country, *MMWR* uses the U.S. State Department short-form name "Burma"; WHO uses "Myanmar."

FIGURE. Combined performance indicators for the quality of acute flaccid paralysis surveillance* in subnational areas of 42 priority countries† — World Health Organization African, Eastern Mediterranean, South-East Asia, and Western Pacific regions, 2020



Abbreviations: AFP = acute flaccid paralysis; NPAFP = nonpolio AFP; WHO = World Health Organization.

* Targets: two or more NPAFP cases per 100,000 children aged <15 years per year and ≥80% of persons with AFP having two stool specimens collected ≥24 hours apart within 14 days of paralysis onset and arrival of these specimens at a WHO-accredited laboratory by reverse cold chain and in good condition.

† For Burma (Myanmar), *MMWR* uses the U.S. State Department short-form name "Burma"; WHO uses "Myanmar."

and Uzbekistan. In 2019 and 2020, only Tajikistan met both surveillance indicator targets at the national level. In both years, Uzbekistan met only the stool adequacy indicator target. Subnational surveillance performance was poor in both countries in 2020 (Figure); in Uzbekistan, no subnational area met both surveillance indicator targets. One cVDPV2 case was detected in Tajikistan in 2020, and the subsequent outbreak resulting from this case continues in 2021.

Surveillance performance was assessed in Burma (Myanmar),** the single priority country in the WHO South-East Asia Region (SEAR), where, at the national level, both surveillance indicator targets were met in 2019 and only stool adequacy was met in 2020. Subnational surveillance performance declined from 2019 to 2020; in 2019, 77% of the population lived in areas that met both surveillance indicator targets whereas in 2020 only 9% lived in areas that met both surveillance targets.

In the WHO Western Pacific Region (WPR), surveillance performance was assessed in Malaysia and Philippines. Both countries met the NPAFP indicator target in 2019 and 2020, and neither met the stool adequacy indicator in 2019; however, Malaysia did meet the stool adequacy indicator in 2020.

** For this country, *MMWR* uses the U.S. State Department short-form name "Burma"; WHO uses "Myanmar."

During 2019–2020, approximately one quarter of Malaysia's population and <3% of Philippines' population lived in areas that met both indicator targets (Figure); cVDPV1 cases occurred in both countries in 2019, and one case occurred in Malaysia in 2020. Philippines reported cVDPV2 cases in both 2019 and 2020.

Genomic sequence analysis identified 41 cVDPV emergences from AFP cases (39 type 2 cVDPV emergences) in 18 countries in 2019 and 34 cVDPV emergences (32 type 2 cVDPV emergences) in 25 countries in 2020. More than one half (22 of 41) of cVDPV emergences detected in 2019 continued to be detected during 2020.

Environmental Surveillance

Environmental surveillance is the systematic testing of sewage samples to identify populations shedding polioviruses; environmental surveillance in some locations, might be more sensitive to detection of poliovirus transmission than AFP surveillance, given that paralysis occurs in <1% of poliovirus infections (*6*). During 2019–2020, poliovirus was isolated in a sewage sample before (or in the absence of) a confirmed AFP case in Afghanistan, Cameroon, Chad, Côte d'Ivoire, Egypt, Ghana, Iran, Kenya, Liberia, Senegal (all cVDPV2), Philippines (cVDPV1), and Malaysia (cVDPV1 and cVDPV2).

In Nigeria, the number of cVDPV2 isolations declined from 104 isolates collected from 22 environmental sites in 2019 to 11 isolates collected from three sites in 2020. In Afghanistan and Pakistan, the number of cVDPV2 detections increased from 56 isolates in 2019 (all in Pakistan) to 599 isolates (57% in Afghanistan) resulting from two 2019 cVDPV2 emergences and seven additional new cVDPV2 emergences in 2020.

In 2019, 10 WPV1 genetic clusters (isolates with ≥95% genetic relatedness) were detected in environmental sites from four provinces in Afghanistan and four provinces in Pakistan (*7*). During the reporting period, 30 cVDPV emergences (29 cVDPV2 and one cVDPV1) were detected in sewage samples collected in 26 countries (12 countries in 2019 and 24 countries in 2020).

Global Polio Laboratory Network

The WHO Global Polio Laboratory Network (GPLN) is an essential component of poliovirus surveillance. It comprises 145 quality-assured poliovirus laboratories in the six WHO regions. GPLN laboratories implement standardized protocols to 1) isolate polioviruses (all laboratories); 2) conduct intratypic differentiation to identify WPV, Sabin (oral polio vaccine) polioviruses, and VDPV (134 laboratories); and 3) conduct genomic sequencing (28 laboratories). Poliovirus transmission pathways are monitored through sequence analysis of the capsid protein (VP1) coding region from isolates. The accuracy and quality of testing at GPLN laboratories are monitored through an annual accreditation program of on-site reviews and proficiency testing (*8*). For laboratories conducting environmental surveillance, another accreditation checklist with separate timeliness indicators is used.

GPLN tested 219,049 stool specimens in 2019 and 147,582 in 2020 (Table 2), and cVDPVs were isolated from 437 AFP cases in 2019 and from 1,067 in 2020. From 2019 to 2020, the number of cVDPV isolates increased from 303 to 530 in AFR, from 50 to 533 in EMR, and from zero to two in EUR; the number decreased from 10 to zero in SEA and from 74 to two in WPR. In 2019 and 2020, all regions met the timeliness indicator for poliovirus isolation.

The South Asia genotype (the only WPV1 genotype detected globally since 2016) was detected in Afghanistan and Pakistan in 2019 (176 cases) and 2020 (140 cases). Orphan isolates (those with ≤98.5% genetic identity in VP1, compared with other isolates) indicate possible gaps in AFP surveillance; in 2019, orphan isolates accounted for five of 176 (3%) WPV1 isolates from AFP patients (two in Afghanistan and three in Pakistan) and in 2020 for 18 of 140 (13%) (11 in Afghanistan and seven in Pakistan).

Discussion

From 2019 to 2020, national NPAFP rates and stool adequacy declined overall in priority countries; subnational surveillance performance declined overall except for WPR countries. Although the total number of WPV1 cases decreased globally from 2019 to 2020, the increase in orphan WPV1 isolates between 2019 and 2020 in both countries suggests gaps in AFP surveillance. The COVID-19 pandemic substantially affected polio eradication activities in 2020 (*9*). In most AFR countries, polio surveillance field and laboratory staff were reemployed to support COVID-19 response efforts as recommended by GPEI (*4*). Surveillance staff and GPEI logistical assets supported COVID-19 surveillance, contact tracing, and data management. The virologic analyses of COVID-19 specimens increased the workload of GPLN staff, who often analyze specimens from multiple laboratory networks. During 2020, movement restrictions in many countries led to batching stool specimens and sewage samples before shipping to the national level (*9*). For countries with no internal WHO-accredited national polio laboratories, transport was further impeded by international travel restrictions.

The findings in this report are subject to at least three limitations. First, factors including security concerns and hard-to-reach subpopulations could affect national and subnational AFP surveillance indicators and limit their interpretation. Second, high NPAFP rates do not necessarily indicate highly sensitive surveillance because some reported AFP cases might

TABLE 2. Number of poliovirus isolates from stool specimens of persons with acute flaccid paralysis and timing of results, by World Health Organization region — worldwide, 2019 and 2020*

WHO region/Year	No. of specimens	No. of poliovirus isolates			% Poliovirus isolation results on time**	% ITD results within 7 days of receipt at laboratory††	% ITD results within 60 days of paralysis onset
		Wild†	Sabin§	cVDPV¶			
African Region							
2019	51,634	0	1,207	303	93	99	94
2020	47,914	0	3314	530	91	91	NA
American Region							
2019	1,957	0	15	0	80	78	88
2020	1,066	0	12	0	81	82	82
Eastern Mediterranean Region							
2019	58,924	312	1,927	50	92	99	92
2020	40,179	245	1,311	533	96	61	95
European Region							
2019	3,295	0	52	0	83	100	87
2020	2,016	0	24	2	89	73	82
South-East Asia Region							
2019	88,734	0	1,807	10	94	98	97
2020	44,799	0	1,315	0	94	95	90
Western Pacific Region							
2019	14,505	0	164	74	97	96	71
2020	11,608	0	124	2	96	100	84
Total§§							
2019	**219,049**	**312**	**5,172**	**437**	**95**	**99**	**96**
2020	**147,582**	**245**	**6,100**	**1,067**	**94**	**84**	**92**

Abbreviations: AFP = acute flaccid paralysis; cVDPV = circulating vaccine-derived poliovirus; ITD = intratypic differentiation; NA = not available; WHO = World Health Organization.

* 2019 data as of March 18, 2020; 2020 data as of March 25, 2021.

† Number of AFP cases with WPV isolates.

§ Either 1) concordant Sabin-like results in ITD test and VDPV screening, or 2) ≤1% VP1 nucleotide sequence difference compared with Sabin vaccine virus (≤0.6% for type 2).

¶ For poliovirus types 1 and 3, 10 or more VP1 nucleotide differences from the respective poliovirus; for poliovirus type 2, six or more VP1 nucleotide differences from Sabin type 2 poliovirus.

** Results reported within 14 days of receipt of specimen.

†† Results of ITD reported within 7 days of receipt of specimen.

§§ For the last three indicators, total represents weighted mean percentage of regional performance.

not meet the case definition, some actual AFP cases might go undetected, and apparent adequate national data can obscure wide heterogeneity in subnational AFP rates. Finally, the accuracy of stool specimen collection timeliness depends on whether the field investigator can elicit an accurate paralysis onset date.

Sensitive AFP surveillance is critical to detecting poliovirus transmission and relies on timely case detection, notification, investigation, specimen transport, and laboratory testing. With adherence to proper infection control precautions, activities to restore sensitive surveillance must be pursued. Given the successful repurposing of polio resources to support COVID-19 pandemic challenges, further investments in disease surveillance could enable the program to respond to new threats. Thoughtful and planned action is needed as country Expanded Programmes on Immunization move to integrate surveillance for vaccine-preventable and other diseases.

Summary

What is already known about this topic?

Global polio eradication relies on detecting poliovirus transmission, primarily through acute flaccid paralysis (AFP) surveillance supplemented by environmental surveillance of sewage samples.

What is added by this report?

Analysis of 2019–2020 AFP surveillance data from 42 countries at high risk for poliovirus transmission indicated that national and subnational nonpolio AFP rates and stool specimen adequacy declined in many priority countries.

What are the implications for public health practice?

The findings provided in this report can help guide improvement efforts to restore timely and sensitive field surveillance activities, which were adversely affected by the COVID-19 pandemic.

Acknowledgments

The Global Polio Eradication Initiative; The Global Polio Laboratory Network; Data and Information Management Network; Surveillance Task Team members; Ana Chevez; Eugene Saxentoff; Gloria Rey; Hieronyma Nelisiwe Gumede-Moeletsi; Humayun Asghar; Johnson Muluh Ticha; Lucky Sangal; Muhammad Obaid-ul Butt; Patrick Michael O'Connor; Shahin Huseynov; Sudhir Joshi; Tigran Avagyan; Varja Grabovac; Jane Iber; Elizabeth Henderson.

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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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Effectiveness of Pfizer-BioNTech and Moderna Vaccines Against COVID-19 Among Hospitalized Adults Aged ≥65 Years — United States, January–March 2021

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On April 28, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

Adults aged ≥65 years are at increased risk for severe outcomes from COVID-19 and were identified as a priority group to receive the first COVID-19 vaccines approved for use under an Emergency Use Authorization (EUA) in the United States (*1*–*3*). In an evaluation at 24 hospitals in 14 states,* the effectiveness of partial or full vaccination† with Pfizer-BioNTech or Moderna vaccines against COVID-19–associated hospitalization was assessed among adults aged ≥65 years. Among 417 hospitalized adults aged ≥65 years (including 187 case-patients and 230 controls), the median age was 73 years, 48% were female, 73% were non-Hispanic White, 17% were non-Hispanic Black, 6% were Hispanic, and 4% lived in a long-term care facility. Adjusted vaccine effectiveness (VE) against COVID-19–associated hospitalization among adults aged ≥65 years was estimated to be 94% (95% confidence interval [CI] = 49%–99%) for full vaccination and 64% (95% CI = 28%–82%) for partial vaccination. These findings are consistent with efficacy determined from clinical trials in the subgroup of adults aged ≥65 years (*4*,*5*). This multisite U.S. evaluation under real-world conditions suggests that vaccination provided protection against COVID-19–associated hospitalization among adults aged ≥65 years. Vaccination is a critical tool for reducing severe COVID-19 in groups at high risk.

Randomized clinical trials of vaccines that have received an EUA in the United States showed efficacy of 94%–95% in preventing COVID-19–associated illness (*4*,*5*).§ However, hospitalization is a rare outcome among patients with COVID-19–associated illness of any severity, so most cases detected in the trials did not lead to hospitalization; therefore, the studies had limited power to assess protection against severe COVID-19 among older adults. Postmarketing observational studies are important to assess VE against COVID-19–associated hospitalizations in adults aged ≥65 years under real-world conditions and to strengthen evidence from clinical trials of vaccine efficacy. A standard approach to postmarketing VE evaluation involves the test-negative design in which vaccine performance is assessed by comparing the odds of antecedent vaccination among case-patients with acute laboratory-confirmed COVID-19 and control-patients without acute COVID-19 (*6*).

During January 1, 2021–March 26, 2021, adults with COVID-19–like illness¶ admitted to 24 hospitals in 14 states within two networks (the Hospitalized Adult Influenza Vaccine Effectiveness Network [HAIVEN] and the Influenza and Other Viruses in the Acutely Ill [IVY] Network) were enrolled.

* Patients were enrolled from 24 medical centers in 14 states (University of California Los Angeles and Stanford University [California], UCHealth University of Colorado Hospital [Colorado], Johns Hopkins Hospital [Maryland], Beth Israel Deaconess Medical Center and Baystate Medical Center [Massachusetts], University of Michigan, Henry Ford, and St. Joseph [Michigan], Hennepin County Medical Center [Minnesota], Montefiore Healthcare Center [New York], Wake Forest University [North Carolina], Ohio State University [Ohio], Oregon Health & Science University [Oregon], University of Pittsburgh Medical Center, Shadyside, Mercy, Passavant, St. Margaret, and Presbyterian Hospitals [Pennsylvania], Vanderbilt University Medical Center [Tennessee], Baylor Scott & White Medical Center, Temple, Round Rock, Hillcrest/Waco [Texas], and Intermountain Health [Utah]).

† Partially vaccinated is defined as receipt of 1 dose of a 2-dose vaccine series (Pfizer-BioNTech or Moderna vaccines) ≥14 days before illness onset or 2 doses with the second dose received <14 days before illness onset. Fully vaccinated is defined as receipt of both doses of a 2-dose vaccine series, with the second dose received ≥14 days before illness onset.

§ Pfizer-BioNTech and Moderna COVID-19 vaccines are approved for use under an EUA in the United States. The Vaccine Adverse Event Reporting System (VAERS) is used to detect possible signals of adverse events associated with vaccines. Adverse events related to these COVID-19 vaccines can be reported at https://www.fda.gov/vaccines-blood-biologics/report-problem-center-biologics-evaluation-research/vaccine-adverse-events or https://vaers.hhs.gov/reportevent.html.

¶ IVY Network criteria for COVID-19–like illness included presence of fever, feverishness, cough, sore throat, myalgias, shortness of breath, chest pain, loss of taste, loss of smell, respiratory congestion, increased sputum production, new oxygen saturation <94% on room air, new requirement for invasive or noninvasive mechanical ventilation, or new pulmonary findings on chest imaging consistent with pneumonia. HAIVEN criteria included fever without a known non–COVID-19 cause, new or worsening cough, a change in sputum production, or new or worsening shortness of breath.

Summary

What is already known about this topic?

Clinical trials suggest high efficacy for COVID-19 vaccines, but evaluation of vaccine effectiveness against severe outcomes in real-world settings and in populations at high risk, including older adults, is needed.

What is added by this report?

In a multistate network of U.S. hospitals during January–March 2021, receipt of Pfizer-BioNTech or Moderna COVID-19 vaccines was 94% effective against COVID-19 hospitalization among fully vaccinated adults and 64% effective among partially vaccinated adults aged ≥65 years.

What are the implications for public health practice?

SARS-CoV-2 vaccines significantly reduce the risk for COVID-19–associated hospitalization in older adults and, in turn, might lead to commensurate reductions in post-COVID conditions and deaths.

Patients were eligible if they were aged ≥65 years on the date of hospital admission, received clinical testing for SARS-CoV-2 (the virus that causes COVID-19) by reverse transcription–polymerase chain reaction (RT-PCR) or antigen test within 10 days of illness onset, and had onset of symptoms 0–14 days before admission. Case-patients were those who received one or more positive test results for SARS-CoV-2. Patients meeting eligibility criteria who received negative SARS-CoV-2 RT-PCR test results served as controls. Baseline demographic and health information, details about the current illness, and SARS-CoV-2 testing history were obtained by patient or proxy interviews with trained study personnel and electronic medical record review. Patients or proxies were asked about SARS-CoV-2 vaccination history including number of doses, dates and location of vaccination, and availability of vaccination record cards documenting receipt. Secondary electronic medical records and state immunization registry searches for SARS-CoV-2 vaccination records were conducted during March 26, 2021–April 19, 2021, for all included patients without vaccination record cards to verify reported or unknown vaccination status.

Participants were considered to have received COVID-19 vaccine doses based on documentation by CDC vaccination record card, state immunization registry search, electronic medical record search, or by plausible self-report if they provided vaccination dates and location. Documented record of vaccination dates was used when any potential discordance was identified between self-reported and documented dates. Participants with unverified COVID-19 testing status or vaccination status, or vaccination with Janssen COVID-19 vaccine (Johnson & Johnson), which was in limited use during the evaluation period, were not included. SARS-CoV-2 vaccination status included four categories: 1) unvaccinated, defined as no receipt of any SARS CoV-2 vaccine before illness onset; 2) single-dose vaccinated <14 days before illness, defined as receipt of the first vaccine dose <14 days before COVID-19–like illness onset; 3) partially vaccinated, defined as receipt of 1 dose of a 2-dose vaccination series (Pfizer-BioNTech or Moderna vaccines) ≥14 days before illness onset or 2 doses, with the second dose received <14 days before illness onset** (*7*); and 4) fully vaccinated, defined as receipt of both doses of a 2-dose vaccine series, with the second dose received ≥14 days before illness onset. Estimates of VE were calculated by comparing the odds of SARS-CoV-2 vaccination in case-patients and controls using the equation VE = 100% × (1 – odds ratio), determined from logistic regression models (*8*). The 95% CIs were calculated as $1 - CI_{OR}$, where CI_{OR} is the confidence interval of the odds ratio estimates. Models were adjusted a priori for suspected confounders, including U.S. Census region, calendar month, age (as a continuous variable), sex, and race/ethnicity. Other factors were included in the model if they changed the adjusted odds ratio of vaccination by >5%. Primary VE estimates were stratified by partial versus full vaccination. VE for patients reporting illness onset <14 days after receipt of the first dose of a 2-dose vaccine was also assessed. Because protective immunity is unlikely to be achieved immediately after vaccination (*4*,*5*,*7*), absence of VE within 14 days of the first dose was used as a proxy indicator of absence of bias in the primary VE estimates (*6*). Statistical analyses were conducted using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and the other participating institutions and was conducted consistent with applicable federal law and CDC policy.††

During January 1–March 26, 2021, 489 patients were eligible for participation, 72 (15%) of whom were excluded for the following reasons: 30 had SARS-CoV-2 testing >10 days after illness onset, 19 were hospitalized >14 days after illness onset, eight had onset of COVID-19–like illness after admission, three received the Janssen COVID-19 vaccine, and 12 had incomplete vaccination verification. Among the 417 patients included in the final analysis (including 187 case-patients and 230 controls), median age was 73 years for case-patients and controls, 48% were female, 17% were non-Hispanic Black, 6% were Hispanic (any race), 48% had one or more earlier hospitalizations in the last year, and 4% lived in a long-term care facility before admission (Table). Among the 187 case-patients, 19 (10%) had received at least 1 dose of Pfizer-BioNTech or Moderna vaccine ≥14 days before illness onset (including 18 [10%] who were partially vaccinated and one [0.5%] who was fully vaccinated) compared with 62 (27%) of 230 test-negative controls (including 44 [19%] and 18 [8%] who were partially and fully vaccinated, respectively). Prevalence

** Based on postmarketing findings from Israel, where VE was observed at 14 days after vaccination after 1 dose.

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

TABLE. Characteristics of adults aged ≥65 years with COVID-19–like illness* tested for SARS-CoV-2 infection, by COVID-19 case status† — 24 medical centers in 14 states,§ January–March 2021

Characteristic	Total (N = 417)	Case status, no. (column %) Case-patients (n = 187)	Control participants (n = 230)	p-value
Month of admission				
January	**80 (19)**	52 (28)	28 (12)	<0.01
February	**153 (37)**	74 (40)	79 (34)	
March	**184 (44)**	61 (33)	123 (53)	
U.S. Census region¶				
Northeast	**174 (42)**	61 (33)	113 (49)	<0.01
South	**135 (32)**	77 (41)	58 (25)	
Midwest	**68 (16)**	23 (12)	45 (20)	
West	**40 (10)**	26 (14)	14 (6)	
Age group, yrs				
65–74	**244 (59)**	106 (57)	138 (60)	0.49
≥75	**173 (41)**	81 (43)	92 (40)	
Female sex	**200 (48)**	83 (44)	117 (51)	0.19
Race/Ethnicity				
White, non-Hispanic	**303 (73)**	129 (69)	174 (76)	0.32
Black, non-Hispanic	**70 (17)**	34 (18)	36 (16)	
Other, non-Hispanic	**14 (3)**	9 (5)	5 (2)	
Hispanic, any race	**26 (6)**	12 (6)	14 (6)	
Unknown	**4 (1)**	3 (2)	1 (0.4)	
Medical insurance (missing = 1)				
Yes	**408 (98)**	180 (96)	228 (99)	0.01
No	**8 (2)**	7 (4)	1 (0.4)	
Resident in long-term care facility (missing = 1)**	**16 (4)**	6 (3)	10 (4)	0.55
≥1 previous hospitalization in last year (missing = 12)**	**195 (48)**	63 (35)	132 (59)	<0.01
Received current season influenza vaccination (missing = 18)**	**312 (78)**	134 (76)	178 (80)	0.38
Current tobacco use (missing = 8)**				
Yes	**35 (9)**	8 (4)	27 (12)	<0.01
No	**374 (91)**	174 (96)	200 (88)	
SARS-CoV-2 vaccination status†				
Unvaccinated	**287 (69)**	146 (78)	141 (61)	<0.01
Single-dose vaccinated <14 days before illness onset	**49 (12)**	22 (12)	27 (12)	
Partially vaccinated	**62 (15)**	18 (10)	44 (19)	
Fully vaccinated	**19 (5)**	1 (0.5)	18 (8)	
Vaccine type, if vaccinated (missing = 11)				
Pfizer-BioNTech	**63 (53)**	15 (42)	48 (58)	0.10
Moderna	**56 (47)**	21 (58)	35 (42)	
Admission characteristic				
Days from illness onset to admission, median (IQR)	**3 (1–6)**	4 (1–7)	2 (0–4)	<0.01
Days from illness onset to SARS-CoV-2 testing, median (IQR)	**2 (0–4)**	3 (0–5)	1 (0–4)	<0.01

Abbreviations: HAIVEN = Hospitalized Adult Influenza Vaccine Effectiveness Network; IQR = interquartile range; IVY = Influenza and Other Viruses in the Acutely Ill.

* Clinical criteria for hospitalized COVID-19–like illness varied by hospital network. IVY Network criteria for COVID-19–like illness included presence of fever, feverishness, cough, sore throat, myalgias, shortness of breath, chest pain, loss of taste, loss of smell, respiratory congestion, increased sputum production, new oxygen saturation <94% on room air, new requirement for invasive or noninvasive mechanical ventilation, or new pulmonary findings on chest imaging consistent with pneumonia. HAIVEN criteria included fever without a known non–COVID-19 cause, new or worsening cough, a change in sputum production, or new or worsening shortness of breath.

† SARS-CoV-2 vaccination status included the following four categories: 1) unvaccinated, defined as no receipt of any SARS CoV-2 vaccine; 2) single-dose vaccinated <2 weeks before illness onset, defined as receipt of the first vaccine dose within 14 days before onset of COVID-like illness; 3) partially vaccinated, defined as receipt of 1 dose of a 2-dose vaccine series (Pfizer-BioNTech or Moderna) ≥14 days before illness onset or receipt of 2 doses, with the second dose received <14 days before illness onset; 4) fully vaccinated, defined as receipt of both doses of a 2-dose vaccine series, with the second dose received ≥14 days before illness onset.

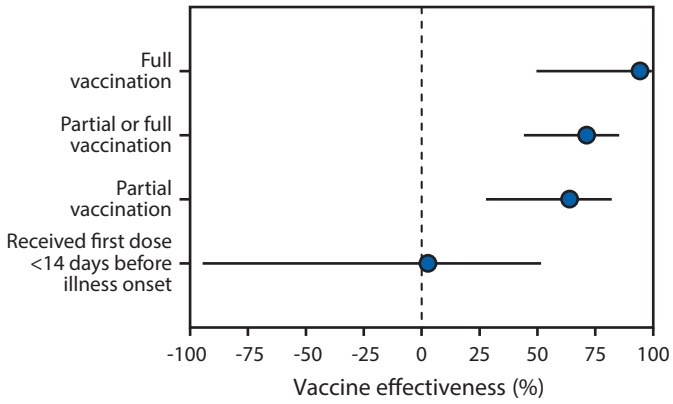
§ Patients were enrolled from 24 medical centers in 14 states (University of California Los Angeles and Stanford University [California], UCHealth University of Colorado Hospital [Colorado], Johns Hopkins Hospital [Maryland], Beth Israel Deaconess Medical Center and Baystate Medical Center [Massachusetts], University of Michigan, Henry Ford, and St. Joseph [Michigan], Hennepin County Medical Center [Minnesota], Montefiore Healthcare Center [New York], Wake Forest University [North Carolina], Ohio State University [Ohio], Oregon Health & Science University [Oregon], University of Pittsburgh Medical Center, Shadyside, Mercy, Passavant, St. Margaret, and Presbyterian Hospitals [Pennsylvania], Vanderbilt University Medical Center [Tennessee], Baylor Scott & White Medical Center, Temple, Round Rock, Hillcrest/Waco [Texas], and Intermountain Health [Utah]).

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

** Information was obtained by patient or proxy self-report.

of receipt of Pfizer-BioNTech and Moderna vaccines was similar (53% and 47%, respectively, among those vaccinated with ≥1 doses). Adjusted VE for full vaccination using Pfizer-BioNTech or Moderna vaccine was 94% (95% CI = 49%–99%), and adjusted VE for partial vaccination was 64% (95% CI = 28%–82%) (Figure). There was no significant effect for receiving the first dose of a 2-dose COVID-19 vaccine series within 14 days before illness onset (adjusted VE = 3%, 95% CI = –94%–51%).

FIGURE. Adjusted* vaccine effectiveness (with 95% confidence intervals) against COVID-19 among hospitalized† adults aged ≥65 years, by vaccination status§ — 24 medical centers in 14 states,¶ January–March 2021



Abbreviations: HAIVEN = Hospitalized Adult Influenza Vaccine Effectiveness Network; IVY = Influenza and Other Viruses in the Acutely Ill.

* Vaccine effectiveness estimates were adjusted for U.S. Census region, calendar month, continuous age in years, sex, race and ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic other or unknown, or Hispanic of any race), and one or more versus zero self-reported previous hospitalizations in the past year.

† Clinical criteria for hospitalized COVID-19–like illness varied by hospital network. IVY Network criteria for COVID-19–like illness included presence of fever, feverishness, cough, sore throat, myalgias, shortness of breath, chest pain, loss of taste, loss of smell, respiratory congestion, increased sputum production, new oxygen saturation <94% on room air, new invasive or noninvasive ventilation, or new pulmonary findings on chest imaging consistent with pneumonia in the IVY Network; criteria included fever without a known non–COVID-19 cause, new or worsening cough, a change in sputum production, or new or worsening shortness of breath in the HAIVEN network.

§ SARS-CoV-2 vaccination status included the following four categories: 1) unvaccinated, defined as no receipt of any SARS CoV-2 vaccine; 2) first vaccine dose <14 days before illness onset, defined as a single dose of vaccine within 14 days prior to onset of COVID-19–like illness; 3) partially vaccinated, defined as receipt of 1 dose of a 2-dose vaccine series (Pfizer-BioNTech or Moderna) ≥14 days before illness onset or 2 doses with the second dose received <14 days before illness onset); 4) fully vaccinated, defined as receipt of both doses of a 2-dose vaccine series ≥14 days before illness onset.

¶ Patients were enrolled from 24 medical centers in 14 states (University of California Los Angeles and Stanford University [California], UCHealth University of Colorado Hospital [Colorado], Johns Hopkins Hospital [Maryland], Beth Israel Deaconess Medical Center and Baystate Medical Center [Massachusetts], University of Michigan, Henry Ford, and St. Joseph [Michigan], Hennepin County Medical Center [Minnesota], Montefiore Healthcare Center [New York], Wake Forest University [North Carolina], Ohio State University [Ohio], Oregon Health & Science University [Oregon], University of Pittsburgh Medical Center, Shadyside, Mercy, Passavant, St. Margaret, and Presbyterian Hospitals [Pennsylvania], Vanderbilt University Medical Center [Tennessee], Baylor Scott & White Medical Center, Temple, Round Rock, Hillcrest/Waco [Texas], and Intermountain Health [Utah]).

Discussion

Monitoring the effectiveness of SARS-CoV-2 vaccination under routine public health use and specifically against severe outcomes in patients at higher risk, including older adults, is a high priority. In this multistate analysis of adults aged ≥65 years, receipt of an authorized COVID-19 vaccine was associated with significant protection against COVID-19 hospitalization. Effectiveness was 94% among adults who were fully vaccinated and 64% among adults who were partially vaccinated (i.e., onset of COVID-like illness ≥14 days after the first vaccine dose in a 2-dose series but <14 days after the second dose). These findings are consistent with efficacy determined from clinical trials in the subgroup of adults aged ≥65 years (*4*,*5*). Early reports from Israel have also documented the real-world effectiveness of SARS-CoV-2 vaccination, including among older adults (*7*,*9*). However, those postmarketing reports only represented the Pfizer-BioNTech vaccine. In the current report, Pfizer-BioNTech and Moderna vaccine products were equally represented, and approximately one half of the patients were aged ≥75 years, providing evidence of real-world effectiveness of both vaccines against an important measure of severe COVID-19 in older adults. Moreover, in assessing the impact of receiving only a single dose, no significant vaccine effectiveness <14 days after the first dose of a SARS-CoV-2 vaccine was detected. This suggests that bias is unlikely in the primary estimates of vaccine effectiveness from partial and full vaccination. This also highlights the continued risk for severe illness shortly after vaccination, before a protective immune response has been achieved and reinforces the need for vaccinated adults to continue physical distancing and prevention behaviors, such as use of face masks and recommended hand hygiene at least 14 days after the second dose of a 2-dose vaccine. The findings suggest that SARS-CoV-2 vaccines can reduce the risk for COVID-19–associated hospitalization and, as a consequence of preventing severe COVID-19, vaccination might have an impact on post-COVID conditions (e.g., "long COVID") and deaths (*2*,*10*).

The findings in this report are subject to at least six limitations. First, the CIs for VE estimates were wide because of the small sample size, and the number of participants was too small to assess VE by vaccine product, age group, or underlying conditions. Second, as an interim analysis that included self-reported data, vaccination status might have been misclassified, or participants might have had imperfect recollection of vaccination or illness onset dates. Third, selection bias and residual confounding cannot be excluded. Fourth, although the analysis included hospitalized adults from 14 states, the participants were not geographically representative of the U.S. population. Fifth, the case-control design infers protection based on associations between disease outcome and previous

vaccination but cannot establish causation. Finally, duration of VE and VE for nonhospitalized COVID-19 was not assessed.

During January–March 2021, in a multistate network of U.S. hospitals, vaccination was associated with a reduced risk for COVID-19–associated hospitalization among adults aged ≥65 years. These data suggest that continuing to rapidly vaccinate U.S. adults against COVID-19 will likely have a marked impact on COVID-19 hospitalization and might lead to commensurate reductions in post-COVID conditions and deaths (*2*,*10*).

Acknowledgments

Michael Smith, Tnelda Zunie, Deepika Konatham, Angela Kennedy, Deborah Hendricks, Jason Ettlinger, Natalie Settele, Elisa Priest, Jennifer Thomas, Madhava Beeram, Jay Fox, James Morrison, Baylor Scott & White Health.

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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. Christopher J. Lindsell reports grants from National Institutes of Health, U.S. Department of Defense, Marcus Foundation, Endpoint Health, Entegrion, bioMerieux, and Bioscape Digital, outside the submitted work. Jay S. Steingrub reports grants from National Institutes of Health, outside the submitted work. Akram Khan reports grants from United Therapeutics, Actelion Pharmaceuticals, Regeneron, and Reata Pharmaceuticals, outside the submitted work. Samuel M. Brown reports grants from National Institutes of Health, U.S. Department of Defense, Intermountain Research and Medical Foundation, and Janssen, and consulting fees paid to his employer from Faron and Sedana, all outside the submitted work. Ithan D. Peltan reports grants from National Institutes of Health and, outside the submitted work, grants from Asahi Kasei Pharma, Janssen Pharmaceuticals, and Regeneron. Adit A. Ginde reports grants from National Institutes of Health, U.S. Department of Defense and AbbVie, outside the submitted work. Carlos G. Grijalva reports consulting fees from Pfizer, Merck, and Sanofi-Pasteur, grants from Campbell Alliance/Syneos Health, National Institutes of Health, Food and Drug Administration, and Agency for Health Care Research and Quality, outside the submitted work. Michelle N. Gong reports grants from National Institutes of Health, Agency for Healthcare Research and Quality, and consulting fees from Regeneron, Philips Healthcare, all outside the submitted work. Steven Y. Chang reports consulting fees from PureTech Health and speaker fees from La Jolla Pharmaceuticals, both outside the submitted work. Jonathan D. Casey reports grants from National Institutes of Health, outside the submitted work. Todd W. Rice reports grants from National Institutes of Health and Endpoint Health, consulting work for Cumberland Pharmaceuticals, Inc, and Sanofi, Inc., outside the submitted work. Manjusha Gaglani reports grants from CDC-Abt Associates, outside the submitted work. Emily T. Martin reports personal fees from Pfizer and grants from Merck, outside the submitted work. Anurag Malani reports shareholder of Pfizer pharmaceuticals. Arnold S. Monto reports personal fees from Sanofi Pasteur and Seqirus, outside the submitted work. Fernanda P. Silveira reports grants from Shire, Qiagen, Ansun, and Novartis, outside the submitted work. Richard K. Zimmerman reports grants from Sanofi Pasteur, outside the submitted work. Donald B. Middleton reports grants and personal fees from Pfizer and personal fees from Seqirus, Sanofi Pasteur, and GlaxoSmithKline, outside the submitted work. No other potential conflicts of interest were disclosed.

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Safety Monitoring of the Janssen (Johnson & Johnson) COVID-19 Vaccine — United States, March–April 2021

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On April 30, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

On February 27, 2021, the Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) for Janssen (Ad.26.COV2.S) COVID-19 vaccine (Janssen Biotech, Inc., a Janssen Pharmaceutical company, Johnson & Johnson) (*1*). The Janssen COVID-19 vaccine, the third COVID-19 vaccine authorized for use in the United States, uses a replication-incompetent human adenoviral type 26 vector platform* (*2*) and is administered as a single intramuscular dose, whereas the first two authorized vaccines use an mRNA platform and require 2 doses. On February 28, 2021, the Advisory Committee on Immunization Practices (ACIP) issued interim recommendations for use of Janssen COVID-19 vaccine among persons aged ≥18 years (*3*). During April 13–23, CDC and FDA recommended a pause in use of Janssen vaccine after reports of six cases of cerebral venous sinus thrombosis (CVST) with thrombocytopenia (platelet count <150,000/μL of blood) among Janssen vaccine recipients (*4*). Similar thrombotic events, primarily among women aged <60 years, have been described in Europe after receipt of the AstraZeneca COVID-19 vaccine, which uses a replication-incompetent chimpanzee adenoviral vector (*5*–*7*). The U.S. CVST cases that prompted the pause in Janssen vaccination, as well as subsequently detected CVST cases, are described elsewhere (*8*). This report summarizes adverse events among Janssen vaccine recipients, including non-CVST cases of thrombosis with thrombocytopenia syndrome (TTS), reported to the Vaccine Adverse Events Reporting System (VAERS), a passive surveillance system, and through v-safe, an active monitoring system. As of April 21, 2021, 7.98 million doses of the Janssen COVID-19 vaccine had been administered. Among 13,725 VAERS reports reviewed, 97% were classified as nonserious and 3% as serious,† including three reports among women of cases of thrombosis in large arteries or veins accompanied by thrombocytopenia during the second week after vaccination. These three cases and the previously detected CVST cases are consistent with 17 cases of TTS,§ a newly defined condition. Approximately 338,700 Janssen COVID-19 vaccine recipients completed at least one v-safe survey during the week after vaccination; 76% reported a systemic reaction, 61% reported a local reaction, and 34% reported a health impact.¶ Fatigue and pain were commonly reported symptoms in both VAERS and v-safe. The overall safety profile is consistent with preauthorization clinical trials data. Prompt review of U.S. vaccine safety data detected three additional cases of non-CVST TTS, in addition to the previously recognized CVST cases that initiated the pause in use of the Janssen COVID-19 vaccine. Ongoing monitoring of adverse events after COVID-19 vaccination, including vaccination with the Janssen single-dose vaccine, is essential for evaluating the risks and benefits of each vaccine.

VAERS is a national passive surveillance program managed by CDC and FDA that monitors adverse events after all vaccinations (*9*). VAERS reports are accepted from health care providers, vaccine manufacturers, and the public. Under EUAs for each COVID-19 vaccine, health care providers are required to report several types of adverse events to VAERS, including all deaths.** Signs and symptoms in VAERS reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA).†† VAERS staff members attempt to obtain medical records and supporting information from health care providers for all reported serious events, as well as death certificates and autopsy reports for all deaths.

V-safe is a new, voluntary text-based surveillance system designed to collect additional information about COVID-19 vaccine adverse events, particularly for common side effects.§§ Vaccine recipients who enroll in v-safe receive regularly scheduled text message reminders to complete short online health surveys that include questions about local injection site and

* The Janssen COVID-19 vaccine contains double-stranded DNA encoding a variant of the SARS-CoV-2 spike glycoprotein inserted into a replication-incompetent human adenovirus type 26 virus.

† VAERS reports are classified as serious if any of the following are reported: death, life-threatening illness, hospitalization or prolongation of hospitalization, permanent disability, congenital anomaly, or birth defect.

§ Brighton Collaboration's draft interim case finding definition for TTS: any patient presenting with acute venous or arterial thrombosis and new onset thrombocytopenia, with no known exposure to heparin or any other underlying condition or explanation for the condition. https://brightoncollaboration.us/wp-content/uploads/2021/04/TTS-Case-Finding-and-Definition-Process.v1.0-1-1.pdf

¶ A health impact was defined as being unable to perform normal daily activities, being unable to work, or receiving medical care.

** https://vaers.hhs.gov/faq.html

†† Each VAERS report might be assigned more than one MedDRA preferred term. A MedDRA coded event does not indicate a medically confirmed diagnosis. https://www.meddra.org/how-to-use/basics/hierarchy

§§ https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/vsafe.html

systemic reactions and health impacts (i.e., whether the enrollee was unable to perform normal daily activities, missed work, or received care from a medical professional because of new symptoms or conditions).[¶¶] Enrollees who report seeking medical care are contacted by CDC's v-safe call center and encouraged to complete a VAERS report, if indicated.

In this report, VAERS and v-safe data are described by sex, age group, and race/ethnicity of vaccine recipients. VAERS data include reports received and processed during March 2–April 21. V-safe data from persons vaccinated during March 2–April 12 were analyzed to permit time for respondents to complete up to eight daily health surveys after vaccination. These activities were reviewed by CDC and are consistent with applicable federal law and CDC policy.[***]

As of April 21, 2021, 7.98 million doses of Janssen COVID-19 vaccine had been administered in the United States, 50% to women. The median age at vaccination was 50 years. Race/ethnicity was unknown for 39% of persons vaccinated; 38% were non-Hispanic White (White).

Review of VAERS Data

VAERS received and processed[†††] 13,725 adverse event reports for Janssen COVID-19 vaccine recipients; median age was 42 years, and 66% were women (Table 1). Among these VAERS reports, 13,294 (97%) were classified as nonserious, and 343 (3%) were classified as serious, including three reports of non-CVST TTS (no deaths). Two of the TTS cases occurred among women aged 30–39 years and one in a woman aged 50–59 years. Each of these women had evidence of large-vessel thrombosis and thrombocytopenia (Table 2). As of April 25, 14 CVST cases had been confirmed (*8*), for a total of 17 TTS cases.

CDC and FDA reviewed 88 reports of death after receipt of Janssen COVID-19 vaccine; death certificates were available for 12 (14%). Among the 88 reported decedents, 44 were female, 38 were male, and the sex of six was not reported (Table 1). The median decedent age was 69 years (range = 21–97 years); median interval from vaccination to death was 2 days (range = 0–23 days). All death reports received a medical review[§§§]; the most frequent preliminary impressions of CDC and FDA reviewers regarding cause of death were 1) decedent found dead, with no additional details available (34 reports); 2) cardiac arrest or cardiovascular disease (23 reports); 3) COVID-19 disease (eight reports); and 4) cerebrovascular disease (five reports). As of most recent follow-up (April 28, 2021), three patients with TTS had died. Among 79 reports of anaphylaxis after vaccination, four were confirmed as anaphylaxis cases after interview with a health care provider or review of medical records (<0.5 cases per 1 million doses administered); four reports remain under review. Headache (34%), fever (34%), chills (33%), injection site pain (26%), and fatigue (24%) were the symptoms most frequently reported to VAERS (Table 1).

Review of v-safe Data

During March 2–April 12, v-safe enrolled 338,765 Janssen COVID-19 vaccine recipients who completed at least one postvaccination survey. The median age of v-safe enrollees was 46 years (range = 15–109 years); 60% were women (Supplementary Table, https://stacks.cdc.gov/view/cdc/105473). Sixty-seven percent of enrollees identified as White. During days 0–7 after vaccination, 76% of enrollees reported at least one systemic reaction, and 61% reported at least one injection site reaction (Table 3). Fatigue, pain, and headache were the most commonly reported reactions. Symptoms were most frequently reported on the first day after vaccination; the proportion of enrollees reporting specific reactions decreased with number of days since vaccination. On postvaccination day 1, 28% of enrollees reported being unable to perform normal, daily activities, and 16% reported being unable to work. Only 1.4% of enrollees reported seeking any form of medical care in the 7 days after vaccination.

Discussion

A review of postauthorization safety data after administration of 7.98 million doses of Janssen COVID-19 vaccine during March–April 2021 found that the most commonly reported reactions were similar to those observed in the preauthorization trials (*2*). Among processed VAERS reports, 97% were classified as nonserious events. However, reports included 17 events consistent with TTS, a newly defined condition, including three reports of non-CVST thrombotic events with thrombocytopenia among women aged <60 years during the

[¶¶] CDC has encouraged jurisdictions receiving COVID-19 vaccines to offer v-safe promotional materials, supplied by CDC, at all vaccination sites. V-safe enrollees receive daily health check-ins via text messages that link to web-based surveys on days 0–7 after vaccination; then weekly through 6 weeks after vaccination; and then 3, 6, and 12 months after vaccination.

[***] 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.

[†††] Processed VAERS reports are reports that have been coded using MedDRA, have been deduplicated, and have undergone standard quality assurance and quality control review.

[§§§] Medical reviews were conducted by CDC and FDA staff physicians, who reviewed all available data, including medical records, death certificates, and autopsy reports, to form preliminary impressions about the cause of death for each decedent. These reviews might be ongoing for some decedents.

TABLE 1. Percentage of nonserious and serious adverse events after receipt of Janssen COVID-19 vaccine, by demographic characteristics of vaccine recipients and reported symptoms — Vaccine Adverse Event Reporting System, United States, March–April 2021

Characteristic	Total (N = 13,725)	Severity of adverse event, %*		
		Nonserious (n = 13,294)	Serious, excluding death (n = 343)	Death (n = 88)
Sex				
Female	**66.2**	66.6	57.1	50.0
Male	**31.2**	30.8	40.5	43.2
Unknown	**2.6**	2.6	2.3	6.8
Age group, yrs				
0–17	**1.5**	1.6	0.6	0.0
18–49	**57.0**	57.9	34.4	13.6
50–64	**26.8**	26.7	33.8	18.2
65–74	**6.8**	6.5	14.3	18.2
75–84	**1.8**	1.5	6.4	15.9
≥85	**0.6**	0.4	3.2	19.3
Unknown	**5.6**	5.5	7.3	14.8
Race/Ethnicity				
Hispanic or Latino	**7.3**	7.3	6.1	1.1
Non-Hispanic or Latino				
American Indian or Alaska Native	**0.2**	0.2	0.0	0.0
Asian	**2.3**	2.3	1.5	3.4
Black	**3.4**	3.3	5.5	8.0
Native Hawaiian or Pacific Islander	**0.1**	0.1	0.0	0.0
White	**58.4**	58.6	52.2	45.5
Multiracial	**1.3**	1.3	0.9	0.0
Other	**0.4**	0.4	0.3	1.1
Unknown race	**0.5**	0.5	1.5	2.3
Unknown ethnicity				
American Indian or Alaska Native	**0.1**	0.1	0.0	0.0
Asian	**0.3**	0.3	0.6	2.3
Black	**0.8**	0.7	2.6	1.1
Native Hawaiian or Pacific Islander	**<0.1**	<0.1	0.0	0.0
White	**5.8**	5.7	8.8	9.1
Multiracial	**0.2**	0.2	0.0	0.0
Other	**1.7**	1.7	0.9	0.0
Unknown race/ethnicity	**17.4**	17.3	19.2	26.1
Reported symptoms				
Headache	**34.4**	35.0	17.8	6.8
Fever	**33.7**	34.2	21.6	8.0
Chills	**32.7**	33.3	14.9	4.6
Pain	**25.5**	26.1	10.2	1.1
Fatigue	**23.9**	24.3	12.8	5.7

* Reports are classified as serious if any of the following are reported: death, life-threatening illness, hospitalization or prolongation of hospitalization, permanent disability, congenital anomaly, or birth defect.

pause in Janssen vaccine use. Among 88 deaths reported after vaccination, three occurred in patients with CVST (*8*); after preliminary reviews, no other deaths appear to have an association with vaccination.

Two other COVID-19 vaccines, both using an mRNA platform, were authorized for use as a 2-dose series before the Janssen vaccine received authorization. The Janssen adenoviral vector vaccine only requires a single dose for substantial protection from COVID-19 and can be stored at refrigerator temperatures (*2*). Because of these advantages, some health jurisdictions and providers have used the Janssen COVID-19 vaccine among persons for whom ensuring a second dose might be difficult or in settings such as college campuses or drive-through vaccination sites where simple storage requirements are important.¶¶¶ In an update of recommendations for use of the Janssen COVID-19 vaccine, ACIP considered the balance between these benefits and a rare but serious safety concern, the risk for thrombosis in large arteries or veins (*10*). On April 23, 2021, after a review of the benefits and risks, ACIP reaffirmed its interim recommendation for use of the Janssen COVID-19 vaccine in all persons aged ≥18 years under the FDA's EUA (*10*). The EUA now includes a warning for rare clotting events with low platelets, primarily occurring among women aged 18–49 years.

The findings in this report are subject to at least three limitations. First, VAERS data are based on a well-established but passive surveillance system (*9*). Reporting differences are likely, in part because of the EUA requirement that health care providers report all potentially life-threatening events after receipt of the Janssen COVID-19 vaccine. Second, a comprehensive medical review of reported serious adverse events after vaccination, particularly deaths, depends on the availability of medical records, death certificates, and autopsy reports. For many of the serious adverse events reported after vaccination to date, these reviews are in progress. Finally, although v-safe is an important new component of the U.S. COVID-19 vaccine safety monitoring system, participation is contingent on promotion by vaccine administrators and an opt-in enrollment system that uses text messages. Therefore, v-safe data might not be generalizable to the entire population of persons who have received the Janssen COVID-19 vaccine.

The safety profile thus far of the Janssen COVID-19 vaccine is similar to that observed in clinical trials. A rare but serious adverse event occurring primarily in women, blood clots in large vessels accompanied by a low platelet count, was rapidly detected by the U.S. vaccine safety monitoring system. Monitoring for common and rare adverse events after receipt of all COVID-19 vaccines, including the Janssen COVID-19 vaccine, is continuing. Safety data will be evaluated by ACIP as needed to guide benefit-risk assessments of COVID-19 vaccines in use under EUAs.

¶¶¶ https://doi.org/10.15585/mmwr.mm7018e3

TABLE 2. Characteristics of patients with evidence of thrombosis with thrombocytopenia syndrome* after receipt of Janssen COVID-19 vaccine — Vaccine Adverse Events Reporting System, United States, March–April, 2021

Patient	Age group, yrs	Days to symptom onset after vaccination	Initial signs and symptoms	Later signs and symptoms	Lowest platelet count†	Anti-PF4 antibody status§	Location of thrombus/occlusion
A	30–39	10	Headache, left-sided paresis	Headache, left-sided paresis	60,000/μL	Positive	Right carotid artery, left brachial vein, right femoral vein
B	50–59	11	Left leg swelling, bruising	Bilateral lower extremity swelling	15,000/μL	Not available	Left lower extremity deep vein, right femoral artery, left and right iliac arteries
C	30–39	6	Nausea, vomiting, shortness of breath, altered mental status	Nausea, vomiting, shortness of breath, altered mental status	20,000/μL	Not available	Portal vein, superior mesenteric and splenic arteries, pulmonary artery

Abbreviations: PF4 = platelet factor 4; TTS = thrombosis with thrombocytopenia syndrome.
* Patients with evidence of TTS not classified as cerebral venous sinus thrombosis. Brighton Collaboration's draft interim case finding definition for TTS: any patient presenting with acute venous or arterial thrombosis and new onset thrombocytopenia, with no known exposure to heparin or any other underlying condition or explanation for the condition. https://brightoncollaboration.us/wp-content/uploads/2021/04/TTS-Case-Finding-and-Definition-Process.v1.0-1-1.pdf
† Normal range = 150,000–450,000/μL.
§ The heparin:PF4 complex is the antigen in heparin-induced thrombocytopenia, an autoimmune reaction to administration of heparin, an anticoagulant. Anti-PF4 antibodies also have been found in patients with thrombosis who have no known exposure to heparin. Anti-PF4 antibodies have been detected in persons with thrombosis and thrombocytopenia after receipt of Janssen and AstraZeneca COVID-19 vaccines (Scully M, Singh D, Lown R, et al. Pathologic antibodies to platelet factor 4 after ChAdOx1 nCoV-19 vaccination. N Engl J Med 2021. Epub April 16, 2021).

TABLE 3. V-safe enrollees who completed at least one survey and reported a local or systemic reaction or health impact on days 0–7 after receiving Janssen COVID-19 vaccine — United States, March 2–April 12, 2021

	Percentage of enrollees reporting reaction or health impact								
Event	**Days 0–7***	**Day 0**	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**
Total enrollees, no. (%) of enrollees reporting†	**338,765 (100)**	**207,483 (61)**	**259,535 (77)**	**261,096 (77)**	**251,676 (74)**	**238,946 (71)**	**225,427 (67)**	**209,958 (62)**	**202,138 (60)**
Reaction reported									
Fatigue	59.1	17.9	56.3	26.2	16.7	12.8	11.0	9.8	9.0
Injection site pain	57.9	31.6	48.5	39.1	30.1	21.5	13.7	7.9	5.0
Headache	52.2	13.0	50.8	19.9	10.8	8.1	7.6	7.5	7.4
Myalgia	47.8	9.0	47.9	19.2	9.7	6.6	5.3	4.6	4.4
Fever	34.7	4.8	37.0	8.3	2.8	1.8	1.4	1.2	1.2
Chills	34.2	5.5	35.7	6.7	2.3	1.4	1.2	1.0	1.0
Joint pain	26.1	3.5	25.3	8.9	4.5	3.3	2.8	2.6	2.4
Nausea	18.7	3.8	15.7	5.4	3.5	2.6	2.1	1.9	1.7
Diarrhea	9.4	0.9	4.3	3.4	2.7	2.1	1.7	1.5	1.5
Swelling	9.3	1.8	4.6	4.6	4.4	3.9	2.9	2.1	1.5
Abdominal pain	7.4	0.9	5.0	2.2	1.6	1.3	1.2	1.1	1.1
Redness	7.4	1.2	2.5	4.0	4.1	3.4	2.4	1.6	1.0
Itching	7.1	1.2	1.8	2.6	3.2	3.0	2.5	1.8	1.4
Vomiting	2.1	0.2	1.6	0.4	0.2	0.2	0.2	0.2	0.2
Rash	1.9	0.2	0.5	0.6	0.6	0.6	0.6	0.6	0.6
Any injection site reaction§	60.7	33.1	50.3	41.8	33.1	24.1	15.9	9.7	6.6
Any systemic reaction¶	76.4	29.8	74.8	44.1	28.9	22.3	19.7	18.2	17.3
Any health impact**	33.9	4.8	33.2	9.7	5.1	3.8	3.3	3.1	3.1
Unable to perform normal daily activities	28.3	3.8	27.7	7.4	4.0	3.0	2.6	2.5	2.5
Unable to work	17.0	1.8	16.3	4.5	2.0	1.3	1.0	1.0	0.9
Needed medical care	1.4	0.1	0.4	0.2	0.3	0.3	0.3	0.4	0.4
Telehealth	0.53	0.02	0.16	0.09	0.11	0.12	0.11	0.12	0.12
Clinic	0.40	0.03	0.05	0.05	0.07	0.10	0.11	0.12	0.12
Emergency visit	0.31	0.04	0.08	0.05	0.06	0.06	0.07	0.07	0.06
Hospitalization	0.04	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01

* Proportion of enrollees who reported a reaction or health impact at least once during postvaccination days 0–7.
† Enrollees were able to respond on multiple days.
§ Injection site pain, swelling, redness, or itching.
¶ Fatigue, headache, myalgia, fever, chills, nausea, diarrhea, abdominal pain, vomiting, or rash at injection site.
** A health impact was defined as being unable to perform normal daily activities, being unable to work, or receiving medical care.

Summary

What is already known about this topic?

An Emergency Use Authorization of the Janssen COVID-19 vaccine was granted February 27, 2021. Use was paused during April 12–23, 2021, after detection of six cases of cerebral venous sinus thrombosis (CVST).

What is added by this report?

By April 21, nearly 8 million doses of the Janssen COVID-19 vaccine had been administered. Review of safety monitoring data found that 97% of reported reactions after vaccine receipt were nonserious, consistent with preauthorization clinical trials data. Seventeen thrombotic events with thrombocytopenia have been reported, including three non-CVST events.

What are the implications for public health practice?

Ongoing monitoring for rare and common adverse events after vaccination is important for evaluating the balance between risks and benefits for each authorized COVID-19 vaccine, including the Janssen COVID-19 vaccine.

Acknowledgment

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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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Anxiety-Related Adverse Event Clusters After Janssen COVID-19 Vaccination — Five U.S. Mass Vaccination Sites, April 2021

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On April 30, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

On April 7, 2021, after 5 weeks' use of the Janssen COVID-19 vaccine under the Food and Drug Administration (FDA) Emergency Use Authorization (EUA), CDC received reports of clusters of anxiety-related events after administration of Janssen COVID-19 vaccine from five mass vaccination sites, all in different states. To further investigate these cases, CDC interviewed vaccination site staff members to gather additional information about the reported events and vaccination site practices. Four of the five sites temporarily closed while an investigation took place. Overall, 64 anxiety-related events, including 17 reports of syncope (fainting), an anxiety-related event, among 8,624 Janssen COVID-19 vaccine recipients, were reported from these sites for vaccines administered during April 7–9. As a follow-up to these interviews, CDC analyzed reports of syncope shortly after receipt of Janssen COVID-19 vaccine to the Vaccine Adverse Event Reporting System (VAERS), the vaccine safety monitoring program managed by CDC and FDA. To compare the occurrence of these events with those reported after receipt of other vaccines, reports of syncopal events after influenza vaccine administered in the 2019–20 influenza season were also reviewed. Syncope after Janssen COVID-19 vaccination was reported to VAERS (8.2 episodes per 100,000 doses). By comparison, after influenza vaccination, the reporting rate of syncope was 0.05 episodes per 100,000 doses. Anxiety-related events can occur after any vaccination. It is important that vaccination providers are aware that anxiety-related adverse events might be reported more frequently after receipt of the Janssen COVID-19 vaccine than after influenza vaccination and observe all COVID-19 vaccine recipients for any adverse reactions for at least 15 minutes after vaccine administration.

CDC interviewed staff members from the five mass COVID-19 vaccination sites that reported anxiety-related adverse event clusters after receipt of Janssen COVID-19 vaccine, focusing on site capacity and layout, vaccination processes, timeline of reported events, and clinical follow-up. Each of the five sites reported all anxiety-related events to VAERS; reports for each event were reviewed by CDC. VAERS is a national passive surveillance system that monitors adverse events after all vaccinations (*1*). VAERS reports are accepted from health care providers, vaccine manufacturers, and the public. Signs and symptoms in VAERS reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA) preferred terms.* VAERS reports are classified as serious if any of the following are reported: hospitalization, prolongation of hospitalization, life-threatening illness, permanent disability, congenital anomaly or birth defect, or death. An anxiety-related event was defined as any of the following occurring in a person during the 15-minute postvaccination observation period at any of the five sites reporting these clusters: tachycardia (rapid heart rate), hyperventilation (rapid breathing), dyspnea (difficulty breathing), chest pain, paresthesia (numbness or tingling), light-headedness, hypotension (low blood pressure), headache, pallor, or syncope (*2*). Six persons who received diphenhydramine or epinephrine at the vaccination visit were excluded because these events might have represented allergic reactions; none was classified as anaphylaxis.

As a follow-up to these interviews, CDC reviewed VAERS reports received during March 2–April 22, 2021, for adverse events associated with receipt of Janssen COVID-19 vaccine doses administered during March 2–April 12. Syncope, a common anxiety-related event reported by the five mass vaccination sites, has specific MedDRA preferred terms ("syncope" and "syncope vasovagal") and was the focus of this follow-up investigation. Syncopal events that occurred off-site or ≥1 hour after vaccine administration and those in 16 persons who received diphenhydramine or epinephrine were not included. VAERS reports of syncopal events occurring after receipt of any influenza vaccine administered to persons aged ≥18 years during the 2019–20 influenza season (i.e., July 1, 2019–June 30, 2020) served as a comparison, because influenza vaccine is similarly administered as a single dose and is available to all U.S. adults. Reporting rates were calculated using the approximate number of doses of each vaccine administered during the respective analysis periods.† Descriptive analyses of VAERS data were stratified by vaccine type, sex, and age group. These activities were reviewed by CDC and were conducted consistent with applicable federal law and CDC policy.§

* Each VAERS report might be assigned more than one MedDRA preferred term. A MedDRA coded event does not indicate a medically confirmed diagnosis. https://www.meddra.org/how-to-use/basics/hierarchy

† Influenza vaccine doses administered during the 2019–20 season were estimated based on coverage estimates. https://www.cdc.gov/flu/fluvaxview/coverage-1920estimates.htm

§ 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.

Anxiety-Related Adverse Event Clusters

The five mass vaccination sites reported 64 cases of anxiety-related events (Table 1), occurring during April 7–9, 2021; no event met the VAERS classification of serious. The most commonly reported signs and symptoms were light-headedness or dizziness (56%), pallor or diaphoresis (excessive sweating) (31%), syncope (27%), nausea or vomiting (25%), and hypotension (16%). Thirteen (20%) patients informed staff members of a history of fainting associated with receiving injections or needle aversion. Site A reported events during each of 3 days (April 7–9) and did not suspend vaccination; other sites reported multiple events on a single day, after which vaccination at those sites was temporarily suspended. Prevalence of anxiety-related adverse events ranged from 5.2 to 13.5 per 1,000 persons vaccinated. Among the 64 total cases, 39 (61%) occurred in women. Median patient age was 36 years (range = 18–77 years). Most events resolved within 15 minutes with supportive care.¶ Thirteen (20%) patients were transported to an emergency department for further medical evaluation; among these, all five for whom follow-up information was available were released from medical care on the same day.

¶ Supportive care included placing the person supine and offering hydration and food.

Four of the five sites (all except site C) offered drive-through vaccination; sites providing drive-through vaccination had previously administered 1,000–4,000 mRNA COVID-19 vaccines per day without reported similar clusters of events. Four of the five sites (all except site E) administered Janssen vaccine for the first time on the day these clusters were reported.

Reports of Syncope to VAERS

In addition to the anxiety-related events reported by the five mass vaccination sites, review of all VAERS reports containing the MedDRA term "syncope" or "syncope vasovagal" after vaccination with Janssen COVID-19 vaccine during March 2–April 11 identified 653 eligible reports (reports missing information regarding time of vaccine receipt and event were not included) (Table 2). During March and April 2021, among 7.98 million doses of Janssen COVID-19 vaccine administered in the United States, the VAERS reporting rate of syncope after Janssen COVID-19 vaccination was 8.2 per 100,000 doses. Seventeen (3%) of the 653 reports were classified as serious. One hundred twenty-three (19%) reports indicated that the recipient had a history of syncope associated with receiving injections or needle aversion. Among the 653 VAERS reports of syncope, 327 (50%) occurred in women. The median age of persons with syncope after Janssen

TABLE 1. Characteristics of anxiety-related adverse events after receipt of Janssen COVID-19 vaccine (N = 64) — five U.S. mass vaccination sites, April 7–9, 2021

Characteristic	Vaccination site, no. (%)				
	A	B	C*	D	E
Event date	Apr 7–9	Apr 8	Apr 7	Apr 7	Apr 7
First Janssen vaccination event	Y	Y	Y	Y	N
Drive-through site	Y	Y	N	Y	Y
No. vaccinated, total (per day)	3,901 (881; 1,673; 1,347)	2,323	37	593	1,770
No. of cases,† total (per day)	29 (10; 12; 7)	12	4	8	11
Cases per 1,000 vaccinated, total (per day)	7.4 (11.4; 7.2; 5.2)	5.2	10.8	13.5	6.2
Vaccination temporarily suspended	N	Y	Y	Y	Y
Case characteristic, no. (%)					
Women	18 (62)	6 (50)	4 (100)	4 (50)	7 (64)
Age range, yrs (median)	23–77 (42)	21–63 (40)	19–33 (20)	25–62 (34)	18–59 (35)
Transported to emergency department§	6 (21)	3 (25)	1 (25)	1 (13)	2 (18)
Reported history of anxiety related to needles or medical visits	7 (24)	4 (33)	1 (25)	0 (0)	1 (9)
Common signs and symptoms					
Chest pain	3 (10)	0 (0)	1 (25)	0 (0)	0 (0)
Hypotension	3 (10)	3 (25)	0 (0)	2 (25)	2 (18)
Light-headedness or dizziness	19 (66)	4 (33)	3 (75)	3 (38)	7 (64)
Nausea/Vomiting	10 (34)	2 (17)	0 (0)	1 (13)	3 (27)
Pallor or diaphoresis	7 (24)	2 (17)	1 (25)	6 (75)	4 (36)
Seizure-like activity	0 (0)	0 (0)	1 (25)	3 (38)	1 (9)
Syncope	5 (17)	4 (33)	2 (50)	3 (38)	3 (27)
Tachycardia	2 (7)	1 (8)	1 (25)	0 (0)	0 (0)

Abbreviations: N = no; Y = yes.

* Site C was located on a college campus that was vaccinating students.

† An anxiety-related adverse event was defined as any of the following occurring in a person during the 15-minute postvaccination observation period at one of the five sites reporting these events: tachycardia, hyperventilation, dyspnea, chest pain, paresthesia, light-headedness, hypotension, headache, pallor, or syncope. Persons with allergic-like symptoms and those who received diphenhydramine or epinephrine were excluded.

§ Thirteen patients were transported to an emergency department for further medical evaluation; all five patients with available follow-up information were released later that day.

TABLE 2. Reported syncopal events* per 100,000 persons vaccinated and patient demographic characteristics after receipt of Janssen COVID-19 vaccine and influenza vaccine — Vaccine Adverse Events Reporting System, United States, July 1, 2019–April 12, 2021

Characteristic	Vaccine, no. (%)	
	Janssen COVID-19	Influenza
Reporting date	Mar–Apr 2021	Jul 2019–Jun 2020
No. of syncope cases*	653	60
Doses administered	7,980,000	124,000,000
Rate†	8.2	0.05
Sex		
Female	327 (50)	28 (47)
Male	325 (50)	32 (53)
Missing	1 (0)	0 (—)
Age group, yrs		
Median (range)	30 (18–82)	26 (18–88)
18–29	311 (48)	36 (60)
30–39	164 (25)	12 (20)
40–49	77 (12)	4 (7)
49–59	68 (10)	3 (5)
≥60	26 (4)	5 (8)
Missing	7 (1)	0 (0)

* CDC reviewed reports to the Vaccine Adverse Events Reporting System that contained the Medical Dictionary for Regulatory Activities preferred terms "syncope" or "syncope vasovagal" for all Janssen COVID-19 vaccines administered during March 2–April 12, 2021, and any influenza vaccine administered to an adult aged ≥18 years during July 1, 2019–June 30, 2020. Events that occurred off-site or ≥1 hour after vaccine administration and those in persons who received diphenhydramine or epinephrine at the vaccination visit were not included.
† Cases per 100,000 persons vaccinated.

COVID-19 vaccination was 30 years (range = 18–82 years). The largest proportion of reported syncopal events after Janssen COVID-19 vaccination occurred among persons aged 18–29 years and decreased in increasing age groups.

By comparison, 60 reports of syncope after receipt of influenza vaccination were identified during July 1, 2019–June 30, 2020 (0.05 episodes of syncope per 100,000 doses of influenza vaccine administered). Syncopal events after influenza vaccination were reported most frequently among persons aged 18–29 years; the median patient age was 26 years (range = 18–88 years). Among the 60 reports of syncope after influenza vaccine, 15 (25%) indicated that the patient had a history of syncope or needle aversion. Sixteen (27%) reports indicated that the patient had received more than one vaccine immediately before the syncopal episode.

Discussion

Anxiety-related events, including syncope, can occur immediately after vaccination with any vaccine and might be caused by anxiety about receiving an injection (*3*). Although four of the five mass vaccination sites that reported anxiety-related events temporarily suspended COVID-19 vaccination, none of the reports to VAERS was considered serious. Reports of syncope were approximately 164 times more common after Janssen COVID-19 vaccination (8.2 per 100,000) than after influenza vaccination (0.05 per 100,000).

Approximately one quarter of the syncopal and other anxiety-related events after receipt of Janssen COVID-19 vaccine described in this report occurred in persons who reported a history of similar events after vaccination. Because the Janssen COVID-19 vaccine is administered as a single dose, this vaccine might be a more attractive option for persons who have needle aversion. Therefore, it is possible that some persons seeking Janssen COVID-19 vaccination could be more highly predisposed to anxiety-related events after being vaccinated. The stress of an ongoing pandemic might also increase anxiety surrounding COVID-19 vaccination. In addition, in mass vaccination situations, an anxiety-related event witnessed by others on-site or reported through media coverage might provoke additional anxiety-induced episodes (*4*).

Approximately one half of reports to VAERS of syncope after Janssen COVID-19 vaccination were for persons in the youngest age group (18–29 years) recommended for vaccination. Adolescents have higher rates of syncope after vaccination. For example, a rate of 7.8 syncopal events per 100,000 doses administered was reported after receipt of quadrivalent human papillomavirus vaccine (*5*). Most VAERS reports of syncope are for children aged 11–18 years (62%), followed by adults aged 19–49 years (25%) (*6*). As use of COVID-19 vaccines expands into younger age groups, providers should be aware that younger persons might be more highly predisposed to anxiety-related events after vaccination than are older persons.

The findings in this report are subject to at least three limitations. First, VAERS is a passive surveillance reporting system and subject to underreporting (*1*). VAERS reports are limited by the information provided by the reporter and might be incomplete, although those missing information regarding the time of vaccination or the time of the event were not included. Likewise, some mass vaccination sites had more information available than did others. Second, because the Janssen vaccine is under EUA and health care providers are required to report potentially life-threatening events, a reporting bias might exist. Finally, the Janssen COVID-19 vaccine was not directly compared with other currently available COVID-19 vaccines and instead was compared with influenza vaccine administered during the 2019–20 season. This was because the population that received Janssen vaccine during its introduction differed from that of the mRNA COVID-19 vaccines because of the prioritization (e.g., by age group, occupation, or underlying health condition) of COVID-19 vaccines.** The population receiving Janssen COVID-19 likely differs from the population

** CDC provided recommendations on who should be vaccinated first because COVID-19 vaccine supply was initially limited. https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations.html

Summary

What is already known about this topic?

Syncope and other anxiety-related events can occur after vaccination and have been reported to the Vaccine Adverse Events Reporting System (VAERS) for other vaccines.

What is added by this report?

Five mass vaccination sites reported 64 anxiety-related events, including 17 events of syncope (fainting) after receipt of Janssen COVID-19 vaccine. The reporting rates of syncope to VAERS after Janssen COVID-19 and influenza vaccines (2019–20) were 8.2 and 0.05 per 100,000 doses, respectively.

What are the implications for public health practice?

Vaccine providers should be aware of anxiety-related events after vaccination and observe all COVID-19 vaccine recipients for any adverse reactions for at least 15 minutes after vaccine administration.

who received influenza vaccine in during the 2019–20 season; however, the latter is representative of a typical adult population seeking routine vaccination with a single-dose vaccine.

The anxiety-related events described here were reported before reports of thrombosis with thrombocytopenia syndrome (*7*). The Advisory Committee on Immunization Practices reaffirmed its recommendation for the use of Janssen COVID-19 vaccine on April 23, 2021; a warning for rare clotting events, primarily in women aged 18–49 years is now included by FDA in the EUA and provider and patient information sheets (*8*). Anxiety-related events, including syncope, occurring soon after COVID-19 vaccination could raise concern among other vaccine recipients and staff members, particularly in a mass vaccination setting. All COVID-19 vaccine recipients should be observed for at least 15 minutes after vaccination for anxiety-related and other events (e.g., anaphylaxis or immediate allergic reaction) occurring shortly after vaccination.†† Increased awareness of anxiety-related events after vaccination will enable vaccination providers to make an informed decision about continuing vaccination.

†† Recommendations for observation after COVID-19 vaccine administration are available at https://www.cdc.gov/vaccines/covid-19/info-by-product/clinical-considerations.html.

Acknowledgments

State and local health departments that participated in this investigation.

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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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Notes from the Field

An Outbreak of *Escherichia coli* O157:H7 Infections Linked to Romaine Lettuce Exposure — United States, 2019

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On September 16, 2019, PulseNet, the national molecular subtyping network for foodborne disease surveillance, reported a multistate cluster of seven *Escherichia coli* O157:H7 infections from California (five), Oregon (one), and Pennsylvania (one). Isolates from cases of human illness were sequenced and then analyzed using core-genome multilocus sequence typing (cgMLST); the isolates were closely related within three allele differences (*1*). Federal, state, and local officials initiated a multistate outbreak investigation to identify the source and prevent additional illnesses.

State and local investigators interviewed patients to assess common food, restaurant, and grocery store exposures. Once investigators identified leafy greens as a suspected source of infection, a focused questionnaire was developed to collect detailed information about patients' restaurant and leafy greens exposures. By September 30, 2019, the California Department of Public Health (CDPH) identified five of six patients who reported eating at one of four locations of a national restaurant chain, including two unrelated patients who reported eating at the same restaurant chain location. All patients reported consuming salads containing romaine lettuce.

A case was defined as isolation of *E. coli* O157:H7 with the cgMLST profile matching the outbreak strain from an *E. coli* O157:H7 infection during July–October 2019. In total, PulseNet identified 23 cases in 12 states: California (eight), Arizona (three), Illinois (two), Pennsylvania (two), and one each in Florida, Georgia, Maryland, Nevada, New York, North Carolina, Oregon, and South Carolina. Illness onset dates ranged from July 12 to September 8, 2019. Patient ages ranged from 3 to 81 years (median = 43 years); 82% were female. Sixty percent of patients were hospitalized, and no deaths were reported. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Among patients with available information, 16 of 17 reported eating leafy greens, and 11 (85%) of 13 reported eating romaine lettuce in the week before becoming ill. This percentage was higher than the 47% ($p<0.02$) of persons who, in the 2006–2007 survey of healthy persons, reported eating romaine lettuce during the week before they were interviewed (*2*). Among the 11 patients who reported consuming romaine lettuce, six (five from California and one from Illinois) reported eating romaine lettuce in salads at one of five locations of the national restaurant chain; the remaining five patients reported eating it at other restaurants or purchasing it from grocery stores.

CDPH and the Food and Drug Administration (FDA) conducted a traceback investigation to determine the source of romaine lettuce supplied to the reported restaurant chain locations in California. The traceback identified two farms in California as common sources of romaine lettuce for these locations. FDA, CDPH, California Department of Food and Agriculture, and CDC initiated farm-level investigations on October 10, 2019. Investigators conducted an environmental assessment and collected soil, animal droppings, and water samples for laboratory testing; *E. coli* O157:H7 was not detected. A public warning was not issued because all romaine lettuce harvested from the two farms was past its shelf life, no longer available for purchase, and unlikely to be in persons' homes, indicating that there was no ongoing risk to the public.

Recent Shiga toxin-producing *E. coli* outbreaks associated with romaine lettuce highlight the continued food safety challenges associated with consumption of fresh leafy greens (*3*,*4*). Once epidemiologic and traceback data indicated that romaine lettuce from a specific location was the likely source of this outbreak, a field investigation was rapidly initiated, including an environmental assessment to identify possible sources and routes of contamination. Although the outbreak strain was not identified during the field investigations, on-farm investigations are an important component in understanding how a food could have become contaminated and in defining potential approaches to prevent similar contamination events in the future. Preventing contamination at the farm level is important because romaine lettuce is often consumed raw, and washing can remove some but not all harmful bacteria.

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

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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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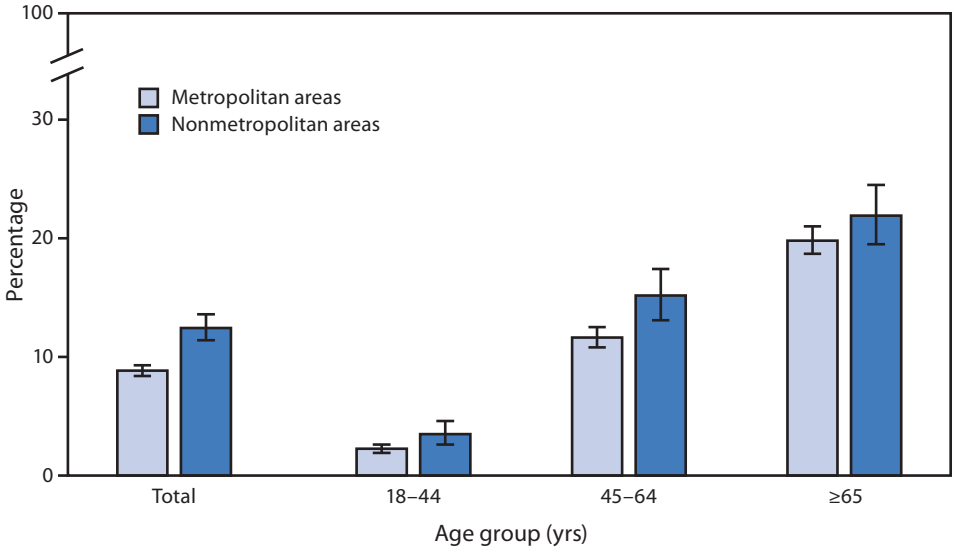
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥18 Years with Diagnosed Diabetes,† by Urbanization Level§ and Age Group — National Health Interview Survey, United States, 2019¶



Abbreviation: MSA = metropolitan statistical area.
* With 95% confidence intervals indicated with error bars.
† Based on a positive response to the survey question, "Has a doctor or other health professional ever told you that that you had diabetes?" Respondents were asked not to include prediabetes or gestational diabetes.
§ Urbanization level is based on the Office of Management and Budget's February 2013 delineation of MSAs, in which each MSA must have at least one urbanized area of ≥50,000 inhabitants. Areas with <50,000 inhabitants are grouped into the nonmetropolitan category.
¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

In 2019, the percentage of adults aged ≥18 years with diagnosed diabetes was higher among those living in nonmetropolitan areas (12.4%) than among those living in metropolitan areas (8.9%). Percentages of adults with diagnosed diabetes were higher in nonmetropolitan than metropolitan areas for those aged 18–44 years (3.5% versus 2.3%) and 45–64 years (15.2% versus 11.6%). Among adults aged ≥65 years, the difference by urbanization level (21.9% in nonmetropolitan areas versus 19.8% in metropolitan areas) did not reach statistical significance. The prevalence of diagnosed diabetes increased with age in both nonmetropolitan and metropolitan areas.

Source: National Center for Health Statistics, National Health Interview Survey, 2019. https://www.cdc.gov/nchs/nhis.htm

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The *Morbidity and Mortality Weekly Report (MMWR)* Series is prepared by the Centers for Disease Control and Prevention (CDC) and is available free of charge in electronic format. To receive an electronic copy each week, visit *MMWR* at *https://www.cdc.gov/mmwr/index.html*.

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ISSN: 0149-2195 (Print)