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Surveillance To Track Progress Toward Poliomyelitis Eradication — Worldwide, 2021–2022

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Since the Global Polio Eradication Initiative (GPEI) was established in 1988, the number of wild poliovirus (WPV) cases has declined by >99.9%, and WPV serotypes 2 and 3 have been declared eradicated (*1*). By the end of 2022, WPV type 1 (WPV1) transmission remained endemic only in Afghanistan and Pakistan (*2*,*3*). However, during 2021–2022, Malawi and Mozambique reported nine WPV1 cases that were genetically linked to Pakistan (*4*,*5*), and circulating vaccine-derived poliovirus (cVDPV) outbreaks were detected in 42 countries (*6*). cVDPVs are oral poliovirus vaccine-derived viruses that can emerge after prolonged circulation in populations with low immunity allowing reversion to neurovirulence and can cause paralysis. Polioviruses are detected primarily through surveillance for acute flaccid paralysis (AFP), and poliovirus is confirmed through stool specimen testing. Environmental surveillance, the systematic sampling of sewage and testing for the presence of poliovirus, supplements AFP surveillance. Both surveillance systems were affected by the COVID-19 pandemic's effects on public health activities during 2020 (*7*,*8*) but improved in 2021 (*9*). This report updates previous reports (*7*,*9*) to describe surveillance performance during 2021–2022 in 34 priority countries.* In 2022, a total of 26 (76.5%) priority countries met the two key AFP surveillance performance indicator targets nationally compared with 24 (70.6%) countries in 2021; however, substantial gaps remain in subnational areas. Environmental surveillance expanded to 725 sites in priority countries, a 31.1% increase from the 553 sites reported in 2021. High-quality surveillance is critical to rapidly detect poliovirus transmission and enable prompt poliovirus outbreak response to stop circulation. Frequent monitoring of surveillance guides improvements to achieve progress toward polio eradication.

Acute Flaccid Paralysis Surveillance

Performance Indicators. AFP surveillance quality is assessed using two performance indicators: 1) the nonpolio AFP

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* Priority countries were selected for this 2021–2022 report because of ongoing gaps in surveillance and vulnerability to poliovirus circulation, as determined in the World Health Organization Global Polio Surveillance Action Plan, 2022–2024. The plan was updated in July 2022 to reflect WPV1 detections in the African Region and increased risk for lower administration levels. Priority countries by region in 2022 included the following: *African Region* (24): Angola, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Ethiopia, Guinea, Guinea-Bissau, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, South Sudan, Tanzania, Togo, Zambia, and Zimbabwe; *Eastern Mediterranean Region* (7): Afghanistan, Iraq, Pakistan, Somalia, Sudan, Syria, and Yemen; *South-East Asia Region* (1): Burma (Myanmar); and *Western Pacific Region* (2): Papua New Guinea and the Philippines.

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(NPAFP) rate, by which an NPAFP rate of at least two per 100,000 persons aged <15 years is deemed sufficiently sensitive to detect circulating poliovirus, and 2) stool adequacy,[†] with the target of ≥80% adequate stool specimens collected from AFP patients indicating effective identification of poliovirus. Surveillance indicators were assessed in 34 priority countries during 2021–2022 and summarized by region (Table 1).

African Region. Among 24 priority countries in the World Health Organization (WHO) African Region (AFR), 19 (79.2%) met both national AFP surveillance indicator targets in 2022 compared with 17 (70.8%) in 2021 (Table 1). In 2022, all 24 countries met the NPAFP rate target nationally, and 19 (79.2%) met the stool adequacy target. Indicators at the first subnational administrative level (i.e., province or state) were similar both years, with 73.2% and 72.4% of subnational areas meeting both targets in 2021 and 2022, respectively (Figure). In 2022, ≥80% of subnational areas in 21 (87.5%) countries met the NPAFP rate target compared with 20 (83.3%) countries in 2021. The stool adequacy target was met by more than 80% of subnational areas in 10 (41.7%) countries in 2022 compared with 11 (45.8%) countries in 2021. Subnational area stool adequacy performance varied; nine countries (37.5%) reported more subnational areas meeting the target in 2022, and six (25.0%) reported fewer. In 2022, eight WPV1 cases were detected, and one WPV1 case had onset in 2021. The number of VDPV cases increased from 512 (13 cVDPV type 1 [cVDPV1] cases and 499 cVDPV type 2 [cVDPV2] cases) in 2021 to 653 (173 cVDPV1 and 480 cVDPV2) in 2022.

Eastern Mediterranean Region. All seven priority countries in the WHO Eastern Mediterranean Region (EMR) met both national surveillance indicator targets in 2021 and 2022. In 2022, 88.2% of subnational areas met both indicator targets compared with 89.0% in 2021. EMR reported 22 WPV1 and 168 cVDPV2 cases in 2022 compared with five WPV1, three cVDPV1, and 118 cVDPV2 in 2021.

South-East Asia Region. In the WHO South-East Asia Region (SEAR) priority country of Burma (Myanmar)[§], the NPAFP rate improved from 0.2 to 1.1 cases per 100,000 but remained below the target. In 2021 and 2022, Burma met stool adequacy targets (84.8% and 88.0%, respectively). Three (16.7%) of 18 subnational areas met both NPAFP rates and stool adequacy targets in 2022 compared with none in 2021. No poliovirus cases were detected in Burma during 2021–2022.

Western Pacific Region. Of the two priority countries in the WHO Western Pacific Region (WPR), neither Papua New Guinea nor the Philippines met both national surveillance

[†] Two stool specimens that are collected from AFP patients ≤14 days after paralysis onset and ≥24 hours apart and are received in good condition (i.e., without leakage or desiccation) by a WHO-accredited laboratory via reverse cold chain (a transportation and storage method designed to keep samples at recommended temperatures from collection through arrival at the laboratory).

[§] *MMWR* uses the U.S. Department of State's short-form name "Burma"; WHO uses "Myanmar."

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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 — 34 priority countries, World Health Organization African, Eastern Mediterranean, South-East Asia, and Western Pacific Regions, 2021–2022*

Year/WHO region/Country	No. of AFP cases	Regional or national NPAFP rate†	Percentage				No. of confirmed cases	
			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**	WPV	cVDPV (type 1, type 2)††
2021								
African	**23,345**	**5.9**	**NA**	**88.9**	**NA**	**NA**	**1**	**512 (13, 499)**
Angola	471	2.9	88.9	83.0	66.7	46.7	—§§	—
Benin	259	4.9	100.0	88.4	91.7	97.0	—	3 (0, 3)
Burkina Faso	1,400	14.5	100.0	90.2	100.0	100.0	—	2 (0, 2)
Cameroon	755	6.7	100.0	82.9	50.0	43.7	—	3 (0, 3)
Central African Republic	202	8.9	100.0	77.2	28.6	35.1	—	—
Chad	1,055	13.6	100.0	84.6	69.6	70.3	—	—
Côte d'Ivoire	738	6.6	100.0	84.8	75.8	81.9	—	—
Democratic Republic of the Congo	3,444	7.9	100.0	85.3	84.6	91.0	—	28 (0, 28)
Equatorial Guinea	19	3.6	42.9	89.5	57.1	24.0	—	—
Ethiopia	1,694	3.7	90.9	91.5	100.0	94.6	—	10 (0, 10)
Guinea	370	6.2	100.0	79.5	50.0	49.6	—	6 (0, 6)
Guinea-Bissau	20	1.9	36.4	65.0	27.3	28.3	—	3 (0, 3)
Kenya	660	3.0	80.9	85.9	68.1	55.9	—	—
Madagascar	602	5.1	100.0	94.7	100.0	100.0	—	13 (13, 0)
Malawi	177	1.9	50.0	75.1	50.0	54.8	1	—
Mali	448	4.6	100.0	84.6	81.8	80.7	—	—
Mozambique	468	3.1	100.0	73.7	27.3	19.2	—	2 (0, 2)
Niger	628	4.9	100.0	83.4	75.0	75.0	—	18 (0, 18)
Nigeria	7,801	8.0	100.0	93.9	100.0	100.0	—	415 (0, 415)
South Sudan	565	9.1	100.0	89.2	100.0	100.0	—	9 (0, 9)
Tanzania	885	3.1	90.3	97.9	96.8	90.9	—	—
Togo	298	8.6	100.0	92.6	100.0	100.0	—	—
Zambia	244	2.8	100.0	65.6	10.0	15.1	—	—
Zimbabwe	142	1.5	50.0	84.5	80.0	52.1	—	—
Eastern Mediterranean	**20,261**	**13.5**	**NA**	**87.1**	**NA**	**NA**	**5**	**121 (3, 118)**
Afghanistan	4,095	25.5	100.0	93.4	100.0	100.0	4	43 (0, 43)
Iraq	709	4.2	94.7	91.1	94.7	85.5	—	—
Pakistan	13,119	18.1	85.7	84.8	100.0	100.0	1	8 (0, 8)
Somalia	349	4.6	90.5	96.0	90.5	83.0	—	1 (0, 1)
Sudan	637	3.6	100.0	94.0	100.0	100.0	—	—
Syria	431	6.7	92.9	85.4	78.6	61.9	—	—
Yemen	921	7.1	100.0	81.7	78.3	67.0	—	69 (3, 66)
South-East Asia	**33**	**0.2**	**NA**	**84.8**	**NA**	**NA**	—	—
Burma (Myanmar)¶¶	33	0.2	0	84.8	33.3	0	—	—
Western Pacific	**946**	**2.5**	**NA**	**76.8**	**NA**	**NA**	**—**	**—**
Papua New Guinea	52	1.3	13.6	50.0	13.6	0	—	—
Philippines	894	2.6	82.4	78.4	52.9	43.9	—	—
2022								
African	**29,024**	**7.2**	**NA**	**90.2**	**NA**	**NA**	**8**	**653 (173, 480)**
Angola	384	2.4	66.7	89.3	77.8	74.2	—	—
Benin	337	6.1	100.0	82.5	75.0	69.2	—	11 (0, 11)
Burkina Faso	1,250	12.7	100.0	93.0	100.0	100.0	—	—
Cameroon	852	7.4	100.0	81.9	60.0	64.7	—	3 (0, 3)
Central African Republic	215	9.6	100.0	86.0	57.1	64.9	—	5 (0, 5)
Chad	1,254	15.2	95.7	82.1	52.2	53.7	—	44 (0, 44)
Côte d'Ivoire	788	6.8	100.0	81.1	66.7	62.6	—	—
Democratic Republic of the Congo	4,561	9.2	100.0	85.9	61.5	61.2	—	478 (133, 345)
Equatorial Guinea	20	3.5	57.1	75.0	57.1	26.3	—	—
Ethiopia	1,606	3.5	90.9	93.0	90.9	92.7	—	1 (0, 1)
Guinea	389	6.5	100.0	86.6	87.5	85.2	—	—
Guinea-Bissau	38	3.7	72.7	52.6	36.4	15.7	—	—
Kenya	634	2.9	83.0	86.3	74.5	71.0	—	—
Madagascar	647	5.4	100.0	95.1	100.0	100.0	—	14 (14, 0)
Malawi	470	4.8	100.0	71.3	25.0	0.1	—	4 (4, 0)

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 — 34 priority countries, World Health Organization African, Eastern Mediterranean, South-East Asia, and Western Pacific Regions, 2021–2022*

Year/WHO region/Country	No. of AFP cases	Regional or national NPAFP rate†	Percentage				No. of confirmed cases	
			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**	WPV	cVDPV (type 1, type 2)††
Mali	562	5.6	100.0	87.4	90.9	99.5	—	2 (0, 2)
Mozambique	928	5.7	90.9	74.6	27.3	15.7	8	26 (22, 4)
Niger	990	7.5	100.0	87.8	75.0	75.0	—	15 (0, 15)
Nigeria	10,247	10.9	100.0	96.7	100.0	100.0	—	48 (0, 48)
South Sudan	557	9.5	100.0	94.3	100.0	100.0	—	—
Tanzania	1,286	4.4	93.5	98.1	100.0	98.6	—	—
Togo	277	7.8	100.0	89.5	100.0	100.0	—	2 (0, 2)
Zambia	382	4.2	100.0	66.8	10.0	18.7	—	—
Zimbabwe	350	4.6	100.0	88.3	90.0	90.6	—	—
Eastern Mediterranean	**27,993**	**18.5**	**NA**	**87.3**	**NA**	**NA**	**22**	**168 (0, 168)**
Afghanistan	5,370	33.7	100.0	94.4	100.0	100.0	2	—
Iraq	835	4.8	100.0	91.7	94.7	87.6	—	—
Pakistan	19,023	26.0	85.7	84.9	100.0	100.0	20	—
Somalia	356	4.4	90.5	97.2	95.2	96.7	—	5 (0, 5)
Sudan	650	3.7	100.0	97.1	94.4	98.1	—	1 (0, 1)
Syria	382	5.8	92.9	91.4	92.9	85.2	—	—
Yemen	1,377	10.1	100.0	81.0	60.9	59.7	—	162 (0, 162)
South-East Asia	**150**	**1.1**	**NA**	**88.0**	**NA**	**NA**	**—**	**—**
Burma (Myanmar)¶¶	150	1.1	16.7	88.0	61.1	11.7	—	—
Western Pacific	**816**	**2.1**	**NA**	**77.6**	**NA**	**NA**	**—**	**—**
Papua New Guinea	64	1.4	9.1	57.8	27.3	4.0	—	—
Philippines	752	2.2	29.4	79.3	35.3	11.0	—	—

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

* Data as of April 25, 2023.

† 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 patients, 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 ≤14 days of paralysis onset. Good condition was defined as arrival of specimens in a WHO-accredited laboratory via reverse cold chain (a transportation and storage method designed to keep samples at recommended temperatures from collection through arrival at the laboratory) and without leakage or desiccation.

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

†† https://polioeradication.org/wp-content/uploads/2016/09/Reporting-and-Classification-of-VDPVs_Aug2016_EN.pdf

§§ Dashes indicate that no confirmed cases were found.

¶¶ *MMWR* uses the U.S. Department of State's short-form name "Burma"; WHO uses "Myanmar."

indicator targets during the assessment period. In Papua New Guinea, the NPAFP rate (1.3 in 2021 and 1.4 in 2022) was below target; stool adequacy increased from 50% in 2021 to 57.8% in 2022 but remained below target. In 2021 and 2022, the Philippines met NPAFP rate targets (2.6 and 2.2, respectively) but missed stool adequacy targets (78.4% and 79.3%, respectively). Across both countries, the number of subnational areas meeting both indicators declined from 20.5% in 2021 to 10.3% in 2022. No poliovirus was detected in the two WPR priority countries in 2021 or 2022.

Environmental Surveillance

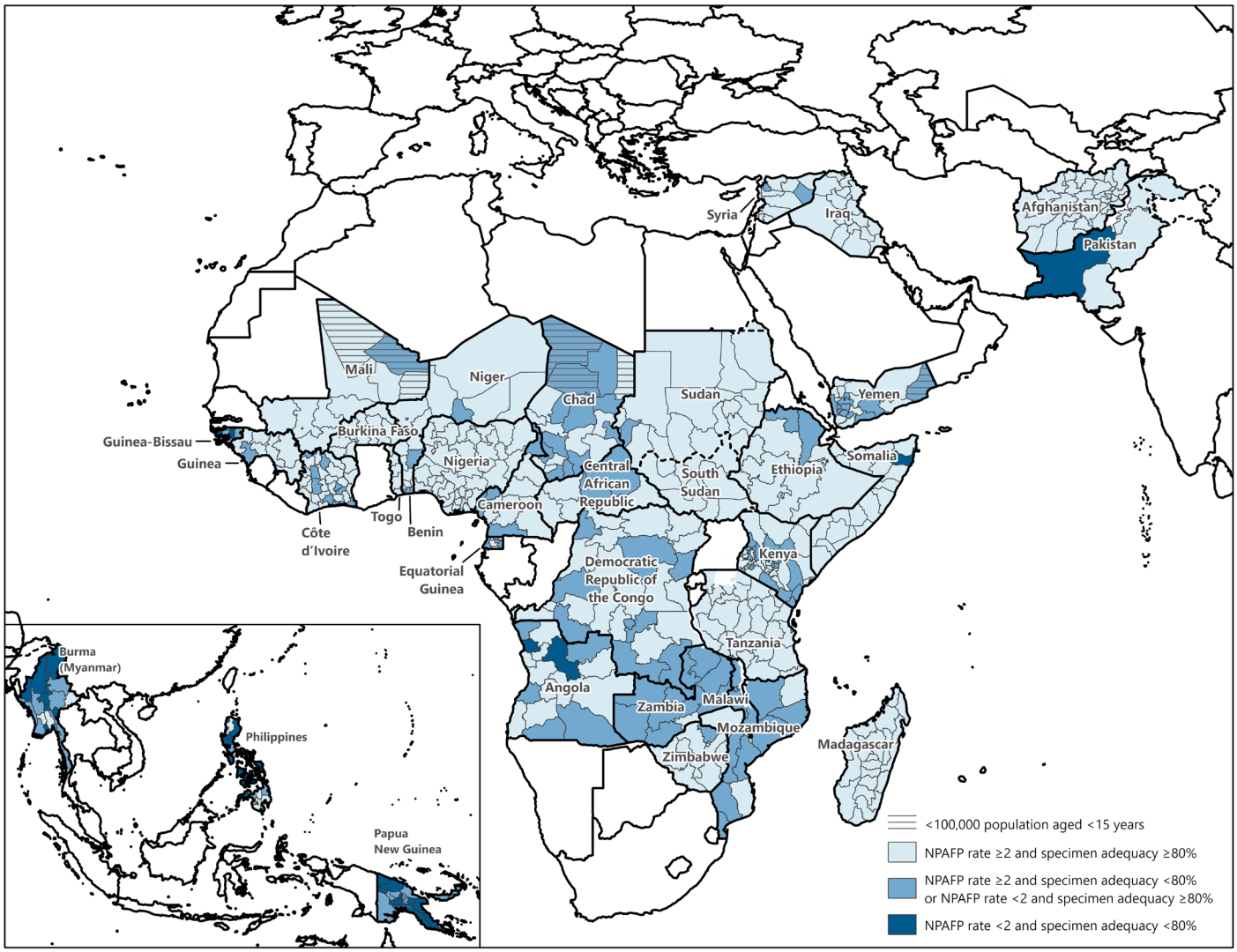
Environmental surveillance for poliovirus, the systematic collection and testing of sewage samples for poliovirus, supplements the sensitivity of AFP surveillance by detecting poliovirus circulation in the absence of confirmed paralytic polio cases. In 2022, 32 (94.1%) of the priority countries¶ reported 725 environmental surveillance sites compared with 553 sites in 2021, a 31.1% increase. Performance (sensitivity to detect poliovirus) is assessed by the annual enterovirus isolation rate, the proportion of environmental samples that have positive test results for any polio or nonpolio enterovirus, with a target of ≥50%.**

In AFR, the number of sites increased 11.9%, from 371 in 2021 to 415 in 2022, and the overall proportion of sites meeting the target increased from 27.8% to 40.5%. Eleven

¶ No environmental surveillance sites were reported from Papua New Guinea or Zimbabwe during 2021–2022.

** https://polioeradication.org/wp-content/uploads/2022/02/Global-Polio-Surveillance-Action-Plan-2022-2024.pdf

FIGURE. Combined performance indicators for the quality of acute flaccid paralysis surveillance* in subnational areas of 34 priority countries†,§ — World Health Organization African, Eastern Mediterranean, South-East Asia, and Western Pacific regions, 2022



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

* Targets: Two or more NPAFP cases per 100,000 persons aged <15 years per year and ≥80% of persons with AFP having two stool specimens collected ≤14 days of paralysis onset and ≥24 hours apart and received in good condition (i.e., without leakage or desiccation) by a WHO-accredited laboratory via reverse cold chain (storing and transporting samples at recommended temperatures from the point of collection to the laboratory).

† Priority countries by region in 2022 included the following: *African Region* (24): Angola, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Ethiopia, Guinea, Guinea-Bissau, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, South Sudan, Tanzania, Togo, Zambia, and Zimbabwe; *Eastern Mediterranean Region* (7): Afghanistan, Iraq, Pakistan, Somalia, Sudan, Syria, and Yemen; *South-East Asia Region* (1): Burma (Myanmar); and *Western Pacific Region* (2): Papua New Guinea and the Philippines.

§ NPAFP rate is difficult to interpret when the population aged <15 years is <100,000.

(47.8%) countries reported an increase in the proportion of sites meeting the indicator in 2022, and seven (30.4%) countries reported a decrease.

The number of sites in EMR increased from 162 in 2021 to 294 in 2022, including 120 added in Pakistan. More than 85% of sites met the indicator in each year.

In SEAR and WPR, Burma's single reporting site met the environmental surveillance indicator. The Philippines had 17 environmental sites in 2021, five (29.4%) of which met the indicator. In 2022, 15 sites reported, and four (26.7%) met the indicator.

Global Polio Laboratory Network

The Global Polio Laboratory Network (GPLN) consists of 144 WHO-accredited laboratories in the six WHO regions, monitored through a standardized quality assurance program of annual on-site audits and proficiency tests (*10*). All 144 GPLN laboratories are responsible for isolating polioviruses;

134 conduct intratypic differentiation to identify WPV, VDPV, and Sabin (oral poliovirus vaccine)[††] polioviruses; and 28 conduct genomic sequencing. These 28 laboratories participated in global proficiency testing, analyzed the region of the poliovirus genome that codes for the capsid viral protein 1 (VP1), and demonstrated their ability to accurately characterize poliovirus in stool specimens (*10*).

In 2022, GPLN tested 193,945 stool specimens collected from patients with AFP (Table 2). Three of six regions (the Americas [AMR], EMR, and European [EUR]) did not meet the timeliness indicator for poliovirus isolation (results reported for ≥80% of specimens ≤14 days after receipt); however, all regions met the timeliness indicator for intratypic differentiation (results reported for more than 80% of specimens, both ≤7 days of receipt of isolate and ≤60 days of paralysis onset).

During 2021–2022, the South Asia (SOAS) genotype was the only circulating WPV1 isolated from 36 AFP patients, 27 from the two endemic countries (Afghanistan and Pakistan), and nine from two nonendemic countries (Malawi and Mozambique). In Pakistan, 21 WPV1 cases were related to the YB3C genetic cluster (i.e., groups of polioviruses sharing ≥95% sequence identity in the region coding VP1), two of which were orphan viruses.[§§] The YB3C cluster was also found in the nine cases from Malawi and Mozambique and two cases detected in Afghanistan. Cluster YB3A was detected in three cases in Afghanistan and in environmental samples in Pakistan. Two additional distinct clusters (YB3B and XC2B) were detected in environmental samples collected in Pakistan during 2021.

[††] Sabin polioviruses are often detected during and for several weeks after vaccination campaigns that use the oral poliovirus vaccine. Detection of Sabin poliovirus does not indicate virus circulation.

[§§] Orphan viruses, with ≥1.5% nucleotide divergence of the VP1-coding region from known isolates, indicate surveillance did not detect prolonged virus circulation.

TABLE 2. Number of poliovirus isolates from stool specimens of persons with acute flaccid paralysis and timing of results, by World Health Organization region, 2021* and 2022[†]

		No. of poliovirus isolates			% of results		
WHO region/Year	No. of specimens	WPV[§]	Sabin[¶]	cVDPV**	Poliovirus isolation results ≤14 days of receipt of specimen[††,§§]	ITD results ≤7 days of receipt of isolate at laboratory[††,§§]	ITD results ≤60 days of paralysis onset[††,§§]
African							
2021	58,004	1	3,396	521	89	79	85
2022	53,961	8	3,065	453	86	85	83
Americas							
2021	1,152	0	6	0	83	100	100
2022	1,858	0	7	2	74	100	67
Eastern Mediterranean							
2021	43,370	5	1,050	70	97	97	94
2022	57,364	22	1,331	277	75	88	82
European							
2021	2,350	0	53	68	79	96	95
2022	2,980	0	22	2	79	91	91
South-East Asia							
2021	53,649	0	1,030	0	93	89	90
2022	67,118	0	1,067	2	96	98	93
Western Pacific							
2021	12,356	0	58	0	97	100	99
2022	10,664	0	32	0	98	100	100
Total[§§]							
2021	**170,881**	**6**	**5,593**	**659**	**93**	**84**	**88**
2022	**193,945**	**30**	**5,524**	**736**	**87**	**88**	**85**

Abbreviations: cVDPV = circulating vaccine-derived poliovirus; cVDPV1 = circulating vaccine-derived poliovirus type 1; cVDPV2 = circulating vaccine-derived poliovirus type 2; cVDPV3 = circulating vaccine-derived poliovirus type 3; ITD = intratypic differentiation; VDPV = vaccine-derived poliovirus; VP1 = viral protein 1; WHO = World Health Organization; WPV = wild poliovirus.

* Data as of March 10, 2022.

† Data as of January 31, 2023.

§ Number of acute flaccid paralysis 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).

** Includes cVDPV1, cVDPV2, and cVDPV3. For cVDPV1 and cVDPV3, 10 or more VP1 nucleotide differences from the respective poliovirus; for cVDPV2, six or more VP1 nucleotide differences from Sabin type 2 poliovirus.

†† Timeliness indicator targets: ≥80% of specimen results are reported within the respective time frame (poliovirus isolation ≤14 days of receipt, ITD results ≤7 days of receipt, and ITD results ≤60 days of paralysis onset).

§§ Total represents weighted mean percentage of regional performance.

In priority countries during 2021–2022, 38 cVDPV emergence groups (eight cVDPV1 and 30 cVDPV2) were isolated from 1,454 AFP patients and 750 environmental samples. The number of cVDPV1 emergence groups increased from four isolated from 16 AFP patients and 33 environmental samples in 2021 to seven from 173 patients and 99 samples in 2022. The number of cVDPV2 emergence groups decreased from 24 isolated from 617 AFP patients and 449 environmental samples in 2021 to 17 emergence groups isolated from 648 patients and 169 samples in 2022.

Discussion

After the COVID-19 pandemic weakened poliovirus surveillance performance (*7*,*8*), NPAFP rates during 2022 improved in most priority countries in AFR and EMR; improvements in stool adequacy, however, were only marginal. All high-priority countries in AFR and EMR met national NPAFP rate targets, and 26 of 31 countries met stool adequacy targets. Subnational surveillance gaps exist, particularly for stool adequacy, with 14 of 24 AFR countries and one of seven EMR countries reporting <80% of subnational areas meeting the target. SEAR and WPR priority countries and subnational areas showed improvement in 2022 but not enough to meet targets.

The detection of WPV1 in Malawi and Mozambique (*4*,*5*) highlights the risk for importation and the importance of monitoring surveillance performance to detect transmission. Substantial surveillance gaps persist in both countries, with <25% of the population living in areas that met both AFP surveillance indicators in 2022. The 653 VDPV cases detected in 42 countries during 2022 also emphasize the importance of sensitive and timely surveillance to help response activities interrupt poliovirus transmission. While polioviruses continue to circulate, all countries remain at risk for importation and must strengthen and maintain surveillance.

The findings in this report are subject to at least four limitations. First, the NPAFP rate depends on the accurate identification of AFP cases; however, the data presented in this study might include cases not meeting the AFP case definition and exclude actual AFP cases that were not reported. Environmental surveillance improves sensitivity without relying on AFP case detection. Second, AFP surveillance measures of timeliness depend on the accurate identification of paralysis onset date during the field investigation. Third, performance measures reported at regional and national levels can obscure variation at lower administrative levels. Finally, populations living in hard-to-access areas might not be adequately identified by the surveillance system and could affect subnational surveillance indicators and limit their interpretation.

High-quality surveillance is critical for the timely detection of circulating poliovirus and the rapid activation of outbreak response vaccination activities to stop transmission. Countries should maintain high-quality surveillance by monitoring surveillance indicators to identify gaps, enhance the sensitivity and timeliness of surveillance activities, and guide program decision-making toward polio eradication.

Summary

What is already known about this topic?

The primary means for detecting poliovirus is through acute flaccid paralysis (AFP) surveillance, which is supplemented by environmental surveillance of sewage samples.

What is added by this report?

During 2021–2022, among 34 priority countries experiencing or at high risk for poliovirus transmission, 26 (76.5%) met national AFP surveillance indicator targets, and the number of environmental surveillance sites increased by 31%. However, substantial national and subnational AFP surveillance gaps persist.

What are the implications for public health practice?

Maintaining high-quality surveillance is critical to achieving the goal of global polio eradication. Monitoring surveillance indicators is important to identify gaps and guide surveillance-strengthening activities, particularly in countries at high risk for poliovirus circulation.

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References

1. Rachlin A, Patel JC, Burns CC, et al. Progress toward polio eradication—worldwide, January 2020–April 2022. MMWR Morb Mortal Wkly Rep 2022;71:650–5. PMID:35552352 https://doi.org/10.15585/mmwr.mm7119a2
2. Mohamed A, Akbar IE, Chaudhury S, et al. Progress toward poliomyelitis eradication—Afghanistan, January 2021–September 2022. MMWR Morb Mortal Wkly Rep 2022;71:1541–6. PMID:36480464 https://doi.org/10.15585/mmwr.mm7149a1

3. Mbaeyi C, Baig S, Safdar MR, et al. Progress toward poliomyelitis eradication—Pakistan, January 2021–July 2022. MMWR Morb Mortal Wkly Rep 2022;71:1313–8. PMID:36264783 https://doi.org/10.15585/mmwr.mm7142a1
4. Global Polio Eradication Initiative. Malawi. Geneva, Switzerland: Global Polio Eradication Initiative; 2022. https://polioeradication.org/where-we-work/malawi
5. Global Polio Eradication Initiative. Mozambique. Geneva, Switzerland: Global Polio Eradication Initiative; 2022. https://polioeradication.org/where-we-work/Mozambique
6. Bigouette JP, Henderson E, Traoré MA, et al. Update on vaccine-derived poliovirus outbreaks—worldwide, January 2021–December 2022. MMWR Morb Mortal Wkly Rep 2023;72:366–71. PMID:37022974 https://doi.org/10.15585/mmwr.mm7214a3
7. Tuma JN, Wilkinson AL, Diop OM, et al. Surveillance to track progress toward polio eradication—worldwide, 2019–2020. MMWR Morb Mortal Wkly Rep 2021;70:667–73. PMID:33956779 https://doi.org/10.15585/mmwr.mm7018a2
8. Zomahoun DJ, Burman AL, Snider CJ, et al. Impact of COVID-19 pandemic on global poliovirus surveillance. MMWR Morb Mortal Wkly Rep 2021;69:1648–52. PMID:33382673 https://doi.org/10.15585/mmwr.mm695152a4
9. Wilkinson AL, Diop OM, Jorba J, Gardner T, Snider CJ, Ahmed J. Surveillance to track progress toward polio eradication—worldwide, 2020–2021. MMWR Morb Mortal Wkly Rep 2022;71:538–44. PMID:35421079 https://doi.org/10.15585/mmwr.mm7115a2
10. Diop OM, Kew OM, de Gourville EM, Pallansch MA. The Global Polio Laboratory Network as a platform for the viral vaccine-preventable and emerging diseases laboratory networks. J Infect Dis 2017;216(Suppl 1):S299–307. PMID:28838192 https://doi.org/10.1093/infdis/jix092

Safety Monitoring of mRNA COVID-19 Vaccine Third Doses Among Children Aged 6 Months–5 Years — United States, June 17, 2022–May 7, 2023

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As of May 7, 2023, CDC's Advisory Committee on Immunization Practices (ACIP) recommends that all children aged 6 months–5 years receive at least 1 age-appropriate bivalent mRNA COVID-19 vaccine dose. Depending on their COVID-19 vaccination history and history of immunocompromise, these children might also need additional doses* (*1*–*3*). Initial vaccine safety findings after primary series vaccination among children aged 6 months–5 years showed that transient local and systemic reactions were common whereas serious adverse events were rare (*4*). To characterize the safety of a third mRNA COVID-19 vaccine dose among children aged 6 months–5 years, CDC reviewed adverse events and health surveys reported to v-safe, a voluntary smartphone-based U.S. safety surveillance system established by CDC to monitor health after COVID-19 vaccination (https://vsafe.cdc.gov/en/) and the Vaccine Adverse Event Reporting System (VAERS), a U.S. passive vaccine safety surveillance system co-managed by CDC and the Food and Drug Administration (FDA) (https://vaers.hhs.gov/) (*5*). During June 17, 2022–May 7, 2023, approximately 495,576 children aged 6 months–4 years received a third dose (monovalent or bivalent) of Pfizer-BioNTech vaccine and 63,919 children aged 6 months–5 years received a third dose of Moderna vaccine.† A third mRNA COVID-19 vaccination was recorded for 2,969 children in v-safe; approximately 37.7% had no reported reactions, and among those for whom reactions were reported, most reactions were mild and transient. VAERS received 536 reports after a third dose of mRNA COVID-19 vaccine for children in these age groups; 98.5% of reports were nonserious and most (78.4%) were classified as a vaccination error.§ No new safety concerns were identified. Preliminary safety findings after a third dose of COVID-19 vaccine for children aged 6 months–5 years are similar to those after other doses. Health care providers can counsel parents and guardians of young children that most reactions reported after vaccination with Pfizer-BioNTech or Moderna vaccine were mild and transient and that serious adverse events are rare.

Starting June 19, 2022, parents could enroll children aged 6 months–4 years in v-safe after mRNA COVID-19 vaccination.¶ A parent with a v-safe account could register a child or adolescent aged <16 years, receive text message reminders, and complete health surveys on behalf of the child.** Health surveys sent daily during the week after vaccination inquire about local injection site and systemic reactions and health impacts; respondents can provide additional information via free-text responses. CDC's v-safe call center contacts registrants who report receiving medical care to request more information; registrants are encouraged to complete a VAERS report, if indicated.

VAERS accepts reports of postvaccination adverse events from health care providers, vaccine manufacturers, and members of the public.†† Signs, symptoms, and diagnoses reported to VAERS are assigned Medical Dictionary for Regulatory Activities (MedDRA) preferred terms (PTs) by VAERS staff members.§§

This report includes data for children aged 6 months–5 years who received a third mRNA COVID-19 dose during

* On June 17, 2022, the Food and Drug Administration (FDA) amended the Emergency Use Authorizations (EUAs) for COVID-19 mRNA vaccines to include monovalent (mRNA encoding the spike protein from the SARS-CoV-2 ancestral strain) formulations of Pfizer-BioNTech (administered as 3 doses for children aged 6 months–4 years) and Moderna vaccines (administered as 2 doses for children aged 6 months–5 years) for younger children. On December 8, 2022, FDA amended EUAs for both manufacturers to include bivalent (mRNA encoding the spike protein from the SARS-CoV-2 ancestral strain and BA.4/BA.5 Omicron variants) formulations for both age groups. EUAs for both manufacturers have since been amended regarding bivalent doses; ACIP guidance has changed to reflect these updates.

† https://covid.cdc.gov/covid-data-tracker/#vaccination-demographic (Accessed April 26, 2023).

§ Vaccination errors are categorized into the following groups: administration errors, contraindication to vaccination, equipment, general, inappropriate schedule of drug administration, incorrect dose, prescribing and dispensing, product quality, product labeling/packaging, and wrong product. Section 4.5 vaccination error groups and MedDRA PTs for COVID-19 vaccination errors are available online. https://www.cdc.gov/vaccinesafety/pdf/VAERS-COVID19-SOP-02-02-2022-508.pdf

¶ On May 19, 2023, CDC closed enrollment in v-safe for COVID-19 vaccines. Health check-ins (and follow-up calls, if needed) for any doses added before May 19 will continue until June 30, 2023.

** Health check-ins are sent 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. Specific questions were included for children aged 6 months–2 years who might not be able to describe reactions or who might experience reactions that differ from those experienced by children aged ≥3 years. Parents use the following definitions to describe the severity of a child's symptoms: mild (noticeable, but not problematic), moderate (limit normal daily activities), or severe (make daily activities difficult or impossible). V-safe also sends text-message reminders when a person is eligible for their next vaccine dose; an additional reminder was sent on March 21, 2023, to parents of children who were eligible for a booster dose but had not reported one.

†† Under EUA regulations, health care providers are required to report certain adverse events after COVID-19 vaccination to VAERS, including vaccination errors and death (https://vaers.hhs.gov/faq.html). VAERS forms ask for patient, vaccine, administration, and adverse event information. https://vaers.hhs.gov/docs/VAERS%202.0_Checklist.pdf

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

June 17, 2022–May 7, 2023.[¶¶] Local and systemic reactions and health impacts reported during the week after vaccination were described for v-safe registrants aged 6 months–5 years. VAERS reports were described by serious and nonserious classification, demographic characteristics, and MedDRA PTs. Serious reports[***] and reports not specifying vaccination error were reviewed by CDC physicians to form a consensus clinical impression based on available data. All analyses were conducted using SAS software (version 9.4; SAS Institute). These activities were reviewed by CDC and conducted consistent with applicable federal law and CDC policy.[†††]

Review of v-safe Data

During June 17, 2022–May 7, 2023, a total of 2,969 v-safe registrants aged 6 months–5 years received a third COVID-19 vaccine dose and had at least one health survey completed; l,082 aged 6 months–2 years and 823 aged 3–4 years received Pfizer-BioNTech vaccine and 580 aged 6 months–2 years and 484 aged 3–5 years received Moderna vaccine. Concomitant receipt of another vaccine was reported for 437 (22.9%) children who received Pfizer-BioNTech and 66 (6.2%) who received Moderna; most (423; 84.1%) children received co-administered influenza vaccine.

Local and systemic reactions reported after receipt of either Pfizer-BioNTech or Moderna vaccines were most commonly reported (930; 53.2%) on the day after vaccination; 1,119 (37.7%) children had no reported reactions (Table 1). Local reactions were reported for 215 (19.9%) children aged 6 months–2 years and 304 (36.9%) aged 3–4 years after Pfizer-BioNTech vaccination and for 179 (30.9%) aged 6 months–2 years and 252 (52.1%) aged 3–5 years after Moderna vaccination. Systemic reactions were reported for 617 (57.0%) children aged 6 months–2 years and for 361 (43.9%) children aged 3–4 years after Pfizer-BioNTech vaccination, and for 309 (53.3%) children aged 6 months–2 years and for 229 (47.3%) children aged 3–5 years after Moderna vaccination. The most commonly reported reactions after receipt of either vaccine among children aged 6 months–2 years were irritability or crying, injection site pain, sleepiness, and fever (Table 2). Among children aged 3–5 years, the most frequently reported reactions were injection site pain, fatigue, and fever. Most reactions were described as mild in severity (noticeable, but not problematic).

Parents of 211 (7.1%) children aged 6 months–5 years reported at least once during the week after vaccination that their child was unable to perform normal daily activities, including 126 Pfizer BioNTech recipients and 85 Moderna recipients (Table 1); 90 (3.0%) parents reported seeking medical care for their child. Among these, 61 (67.8%) reported that care was received in an outpatient clinic; one child was hospitalized for pneumonia; 43 (48.0%) had additional information available from the v-safe call center. Parents of 30 children indicated that medical care was unrelated to vaccination, 11 parents completed a VAERS report, and two parents indicated that the report was made in error. Symptoms or signs of infection (e.g., cough, conjunctivitis, or hand-foot-and-mouth disease rash) were reported via free text or VAERS report for 34 of the 90 reports of medical care.

Review of VAERS Data

During June 17, 2022–May 7, 2023, VAERS received and processed 407 reports of adverse events among children aged 6 months–4 years after receipt of Pfizer-BioNTech vaccine and 129 reports for children aged 6 months–5 years after Moderna vaccine (Table 3).[§§§] Most reports were for children who received COVID-19 vaccine without concomitantly administered vaccines (487; 90.9%).

The most common events reported (420; 78.4%) were vaccination errors (e.g., incorrect product formulation administered, inappropriate schedule of product administration, expired product administered, or incorrect dose administered). Among 330 reports of vaccination errors after administration of Pfizer-BioNTech and 90 after Moderna vaccines, 27 (5.0%) reports indicated that an adverse health event had occurred.

After the exclusion of reports specifying vaccination error, 108 nonserious reports remained, including 71 after Pfizer-BioNTech and 37 after Moderna vaccination. After review, the most commonly reported nonserious events included infection[¶¶¶] (57; 52.8%), no adverse event (13; 12.0%), and rash (nine; 8.3%).

[¶¶] Data for v-safe were included for children aged 6 months–4 years who received a third Pfizer-BioNTech dose during June 17, 2022–May 7, 2023, and for children aged 6 months–5 years who received a third Moderna dose during June 17, 2022–February 26, 2023. Reports to VAERS were included for children aged 6 months–4 years who received a third monovalent Pfizer-BioNTech dose during June 17, 2022–May 7, 2023, or bivalent Pfizer-BioNTech dose during December 8, 2022–May 7, 2023, and for children aged 6 months–5 years who received a third monovalent Moderna dose during June 17, 2022–May 7, 2023, or bivalent Moderna dose during December 8, 2022–May 7, 2023.

[***] VAERS reports are classified as serious (based on FDA C.F.R. Title 21) if any of the following are reported: hospitalization, prolongation of hospitalization, life-threatening illness, permanent disability, congenital anomaly or birth defect, or death. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr

[†††] 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 those that have been coded using MedDRA, deduplicated, and undergone standard quality assurance and quality control review.

[¶¶¶] Clinical review identified 57 reports of infection: cough or wheezing (three), COVID-19 (12), croup (three), ear infection (15), influenza (one), norovirus (one), pneumonia (one), respiratory tract infection (15), hand, foot, and mouth (one), strep throat (four), and viral rash (one).

TABLE 1. Reactions and health impacts reported to v-safe during days 0–7 postvaccination among children aged 6 months–5 years* who received a third dose of Pfizer-BioNTech or Moderna COVID-19 vaccine — United States, June 17, 2022–May 7, 2023

	No. (%) reporting reaction or health impact after vaccination,† by vaccine and age group				
	Pfizer-BioNTech n = 1,905		Moderna n = 1,064		
Event	6 mos–2 yrs n = 1,082	3–4 yrs n = 823	6 mos–2 yrs n = 580	3–5 yrs n = 484	Total N = 2,969
Any injection site reaction	**215 (19.9)**	**304 (36.9)**	**179 (30.9)**	**252 (52.1)**	**950 (32.0)**
Itching	NA	28 (3.4)	NA	13 (2.7)	**41 (1.4)**
Pain	159 (14.7)	276 (33.5)	130 (22.4)	231 (47.7)	**796 (26.8)**
Redness	66 (6.1)	51 (6.2)	66 (11.4)	56 (11.6)	**239 (8.1)**
Swelling or hardness	33 (3.1)	21 (2.6)	51 (8.8)	33 (6.8)	**138 (4.7)**
Groin or underarm swelling/tenderness	2 (0.2)	NA	2 (0.3)	NA	**4 (0.1)**
Any systemic reaction	**617 (57.0)**	**361 (43.9)**	**309 (53.3)**	**229 (47.3)**	**1,516 (51.1)**
Abdominal pain	NA	28 (3.4)	NA	29 (6.0)	**57 (1.9)**
Myalgia	NA	47 (5.7)	NA	41 (8.5)	**88 (3.0)**
Chills	NA	40 (4.9)	NA	32 (6.6)	**72 (2.4)**
Fatigue	NA	228 (27.7)	NA	139 (28.7)	**367 (12.4)**
Fever	196 (18.1)	143 (17.4)	113 (19.5)	121 (25.0)	**573 (19.3)**
Headache	NA	50 (6.1)	NA	38 (7.9)	**88 (3.0)**
Joint pain	NA	10 (1.2)	NA	4 (0.8)	**14 (0.5)**
Nausea	NA	27 (3.3)	NA	26 (5.4)	**53 (1.8)**
Diarrhea	68 (6.3)	49 (6.0)	30 (5.2)	20 (4.1)	**167 (5.6)**
Rash	44 (4.1)	16 (1.9)	20 (3.5)	9 (1.9)	**89 (3.0)**
Vomiting	46 (4.3)	33 (4.0)	37 (6.4)	29 (6.0)	**145 (4.9)**
Irritability/Crying	438 (40.5)	NA	214 (36.9)	NA	**652 (22.0)**
Loss of appetite	151 (14.0)	NA	77 (13.3)	NA	**228 (7.7)**
Sleepiness	245 (22.6)	NA	110 (19.0)	NA	**355 (12.0)**
Other	192 (17.7)	144 (17.5)	67 (11.6)	74 (15.3)	**477 (16.1)**
No reported reaction§	**414 (38.3)**	**333 (40.5)**	**219 (37.8)**	**153 (31.6)**	**1,119 (37.7)**
Any health impact	**145 (13.4)**	**122 (14.8)**	**72 (12.4)**	**76 (15.7)**	**415 (14.0)**
Unable to perform normal daily activities	65 (6.0)	61 (7.4)	39 (6.7)	46 (9.5)	**211 (7.1)**
Unable to attend child care facility or school	95 (8.8)	85 (10.3)	36 (6.2)	44 (9.1)	**260 (8.8)**
Needed medical care	31 (2.9)	26 (3.2)	20 (3.5)	13 (2.7)	**90 (3.0)**
Telehealth	8 (0.7)	4 (0.5)	5 (0.9)	3 (0.6)	**20 (0.7)**
Clinic	23 (2.1)	19 (2.3)	11 (1.9)	8 (1.7)	**61 (2.1)**
Emergency department visit	1 (0.1)	4 (0.5)	2 (0.3)	0 (—)	**7 (0.2)**
Hospitalization	0 (—)	1 (0.1)	0 (—)	0 (—)	**1 (0.03)**
Other	3 (0.3)	4 (0.5)	4 (0.7)	4 (0.8)	**15 (0.5)**

Abbreviation: NA = not applicable.

* Data were included for children aged 6 months–4 years who received a third Pfizer-BioNTech dose during June 17, 2022–May 7, 2023, and for children aged 6 months–5 years who received a third Moderna dose during June 17, 2022–May 7, 2023.

† Children whose parents reported a reaction or health impact at least once during days 0–7 postvaccination. Specific questions were included for children aged 6 months–2 years who might not be able to describe reactions or who might experience different reactions from those experienced by children aged ≥3 years.

§ Children whose parents or guardians reported neither injection site nor systemic reactions.

Eight (1.5%) serious reports were made to VAERS: six for children who received Pfizer-BioNTech and two for children who received Moderna. Clinical impressions of the serious reports included acute hemorrhagic edema of infancy (infection with non–SARS-CoV-2 coronavirus), diabetic ketoacidosis (following new onset of diabetes mellitus type 1), Henoch-Schönlein purpura, Kawasaki disease, new-onset afebrile seizure (two), pneumonia, and viral exacerbation of asthma. After review of all available information, no evidence suggested that these reported events were related to vaccination.

Discussion

This report provides findings from v-safe and VAERS for children aged 6 months–5 years who received a third dose of mRNA COVID-19 vaccine during June 17, 2022–May 7, 2023; during this period, approximately 559,495 third doses were administered to children in this age group. The findings in this report are consistent with those from postauthorization safety surveillance of the first 2 doses of mRNA COVID-19 vaccines. Systemic reactions after receipt of the first or second doses were more commonly reported for children aged 6 months–2 years than for those aged 3–5 years; 44.7% of VAERS reports included at least one vaccination error (*4*).

Reports to v-safe of injection site and systemic reactions after a third dose of mRNA COVID-19 vaccine were similar in frequency to those reported after a first (19.0%–32.4% reports of injection reaction and 32.2%–55.8% reports of systemic reaction) or second dose (18.3%–47.1% reports of injection

TABLE 2. Reactions most commonly reported to v-safe during days 0–7 postvaccination for children ages 6 months–5 years (N = 2,969)* who received a third dose of Pfizer-BioNTech or Moderna COVID-19 vaccine, by severity — United States, June 17, 2022–May 7, 2023

	No. (%) reporting reaction or health impact after vaccination†			
	6 mos–2 yrs n = 1,662		3–5 yrs n = 1,307	
Reaction or health impact (age group)	Pfizer-BioNTech n = 1,082	Moderna n = 580	Pfizer-BioNTech n = 823	Moderna n = 484
Irritability/Crying (6 mos–2 yrs)/Injection site pain (3–5 yrs)	**438 (40.5)**	**214 (36.9)**	**276 (33.5)**	**231 (47.7)**
Mild	265 (24.5)	134 (23.1)	239 (29.0)	193 (39.9)
Moderate	159 (14.7)	79 (13.6)	37 (4.5)	33 (6.8)
Severe	14 (1.3)	1 (0.2)	0 (—)	5 (1.0)
Sleepiness (6 mos–2 yrs)/Fatigue (3–5 yrs)	**245 (22.6)**	**110 (19.0)**	**228 (27.7)**	**139 (28.7)**
Mild	192 (17.7)	89 (15.3)	132 (16.0)	77 (15.9)
Moderate	42 (4.4)	20 (3.5)	86 (10.5)	55 (11.4)
Severe	5 (0.5)	1 (0.2)	10 (1.2)	7 (1.5)
Fever§ (6 mos–5 yrs)	**196 (18.1)**	**113 (19.5)**	**143 (17.4)**	**121 (25.0)**
Temperature not taken	63 (5.8)	27 (4.7)	33 (4.0)	29 (6.0)
Temperature taken	133 (12.3)	86 (14.8)	110 (13.4)	92 (19.0)
Normal	48 (4.4)	42 (7.2)	39 (4.7)	32 (6.6)
Fever	85 (7.9)	44 (7.6)	71 (8.6)	60 (12.4)
Mild	38 (3.6)	18 (3.1)	23 (2.8)	26 (5.4)
Moderate	29 (2.7)	9 (1.6)	33 (4.0)	16 (3.3)
Severe	15 (1.4)	13 (2.2)	12 (1.5)	16 (3.3)
Very severe	3 (0.3)	4 (0.7)	3 (0.4)	2 (0.4)
Injection site pain (6 mos–2 yrs)/Injection site redness (3–5 yrs)	**159 (14.7)**	**130 (22.4)**	**51 (6.2)**	**56 (11.6)**
Mild	132 (12.2)	108 (18.6)	43 (5.2)	49 (10.1)
Moderate	26 (2.4)	22 (3.8)	7 (0.9)	4 (0.8)
Severe	1 (0.1)	0 (—)	1 (0.1)	3 (0.6)
Loss of appetite (6 mos–2 yrs)/Myalgia (3–5 yrs)	**151 (14.0)**	**77 (13.3)**	**47 (5.7)**	**41 (8.5)**
Mild	96 (8.9)	46 (7.9)	21 (2.6)	21 (4.33)
Moderate	44 (4.1)	27 (4.7)	25 (3.0)	15 (3.1)
Severe	11 (1.0)	4 (0.7)	1 (0.1)	5 (1.0)

* Data were included for children aged 6 months–4 years who received a third Pfizer-BioNTech dose during June 17, 2022–May 7, 2023, and for children aged 6 months–5 years who received a third Moderna dose during June 17, 2022–May 7, 2023.

† Children whose parents or guardians reported a reaction or health impact at least once during days 0–7 after vaccination. Includes the most severe event reported during the 0–7 window. Parents and guardians who participate in v-safe use the following definitions to describe the severity of a child's symptoms: mild (noticeable, but not problematic), moderate (limit normal daily activities), or severe (make daily activities difficult or impossible).

§ Fever is self-reported and registrants are not required to record a temperature. Among children who had a reported temperature and met the definition for fever (temperature ≥100.4°F [≥38.0°C]) during days 0–3, fever was classified as mild (100.4–101.1°F [38.0–38.4°C]), moderate (101.2–102.0°F [38.4–38.9°C]), severe (102.1–104.0°F [38.9–40.0°C]), or very severe (>104.0°F [>40.0°C]).

reaction and 29.2%–58.2% reports of systemic reaction) among children aged 6 months–5 years (*4*). They were less frequent than those reported for children aged 5–11 years after a monovalent or bivalent booster dose (*6*,*7*). Approximately 38% of parents reported to v-safe that their child experienced no reactions in the week after a third mRNA vaccine dose. Most parents of children who received medical care reported that care was unrelated to vaccination. Many children who received medical care had signs and symptoms of an acute infection.

After administration of approximately 550,000 third doses of mRNA COVID-19 vaccine to children aged 6 months–5 years, eight serious reports were received by VAERS. More than 98.0% of reports were nonserious; most represented vaccination errors (78.4%). Vaccination errors have constituted a large proportion of VAERS reports among children. For example, 85.0% of VAERS reports for children aged 5–11 years after bivalent booster vaccination were related to vaccination error (*7*). Among reports not specifying vaccination error, one half were of an unrelated infection. Recent ACIP recommendations simplifying guidance for bivalent vaccination might reduce reports of vaccination error (*3*).

The findings in this report are subject to at least four limitations. First, v-safe is a voluntary program; as a result, data might not be representative of the vaccinated population. Second, VAERS is a passive reporting system and is subject to reporting biases and underreporting, especially of nonserious events (*5*). Third, this report combined data for monovalent and bivalent mRNA COVID-19 vaccine formulations. However, findings among older children did not differ by formulation (*7*). Finally, interpretation of these data is limited by the short surveillance period and small denominator of vaccinated children aged 6 months–5 years.

All children aged 6 months–5 years are recommended to receive at least 1 bivalent dose and might need multiple COVID-19 vaccine doses depending on their age and COVID-19 vaccination history**** (*3*). No new safety findings were identified among

**** As of May 7, 2023, monovalent COVID-19 vaccines are no longer authorized for use in the United States.

TABLE 3. Reports of nonserious and serious events to the Vaccine Adverse Event Reporting System for children aged 6 months–5 years* after receipt of dose 3 Pfizer-BioNTech or Moderna COVID-19 vaccine† — United States, June 17, 2022–May 7, 2023

Adverse events	No. (%) reporting by vaccine		
	Pfizer-BioNTech n = 407	Moderna n = 129	Total N = 536
Nonserious reports, total	**401 (98.5)**	**127 (98.5)**	**528 (98.5)**
Reports of vaccination error§	**330 (81.1)**	**90 (70.9)**	**420 (78.4)**
Error without adverse health event	305 (92.4)	88 (97.8)	**393 (93.6)**
Error with adverse health event¶	25 (7.6)	2 (2.2)	**27 (6.4)**
Reports not specifying vaccination error**	**71 (17.4)**	**37 (29.1)**	**108 (20.4)**
Diarrhea/Vomiting	6 (8.5)	1 (2.7)	**7 (6.5)**
Febrile seizure	2 (2.8)	0 (—)	**2 (1.9)**
Fever	2 (2.8)	3 (8.1)	**5 (4.6)**
Hives	2 (2.8)	6 (16.2)	**8 (7.4)**
Infection, COVID-19	5 (7.0)	7 (18.9)	**12 (11.1)**
Infection, other	31 (43.7)	14 (37.8)	**45 (41.7)**
Injection site reaction	1 (1.4)	0 (—)	**1 (0.9)**
No adverse event	11 (15.5)	2 (5.4)	**13 (12.0)**
Rash	6 (8.5)	3 (8.1)	**9 (8.3)**
Other	5 (7.0)	1 (2.7)	**6 (5.6)**
Serious reports, total††, §§	**6 (1.5)**	**2 (1.6)**	**8 (1.5)**

Abbreviations: MedDRA PT = Medical Dictionary for Regulatory Activities preferred term; VAERS = Vaccine Adverse Event Reporting System.

* Signs and symptoms in VAERS reports are assigned MedDRA PTs by VAERS staff members. Each VAERS report might be assigned more than one MedDRA PT, which can include normal diagnostic findings. A MedDRA PT does not indicate a medically confirmed diagnosis.

† Reports to VAERS were included for children aged 6 months–4 years who received a third monovalent Pfizer-BioNTech dose during June 17, 2022–May 7, 2023, or a bivalent Pfizer-BioNTech dose during December 8, 2022–May 7, 2023, and for children aged 6 months–5 years who received a third monovalent Moderna dose during June 17, 2022–May 7, 2023, or a bivalent Moderna dose during December 8, 2022–May 7, 2023.

§ The most common vaccination error MedDRA PTs among reports of vaccination error included incorrect product formulation administered (112; 26.7%), inappropriate schedule of product administration (86; 20.5%), expired product administered (47; 11.2%), and incorrect dose administered (43; 10.2%).

¶ The most common adverse health event MedDRA PTs for reports with nonserious vaccination errors included fever (seven; 25.9%), pain in extremity (four; 14.8%), and chills (three; 11.1%).

** Nonserious reports not specifying vaccination error were reviewed by CDC physicians to form a clinical impression and are listed in the table.

†† 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. https://www.meddra.org/how-to-use/basics/hierarchy

§§ Serious reports to VAERS were reviewed by CDC physicians to form a clinical impression. Clinical impressions included acute hemorrhagic edema of infancy (with human coronavirus OC43 infection), diabetic ketoacidosis (following new onset diabetes mellitus type 1), Henoch-Schönlein purpura, Kawasaki disease, new onset afebrile seizure (two), pneumonia, and viral exacerbation of asthma. After review of all available information, no evidence suggested that these reported events were related to vaccination.

Summary

What is already known about this topic?

All children aged 6 months–5 years are recommended to receive ≥1 bivalent mRNA COVID-19 vaccine dose; approximately 550,000 children in these age groups have received a third monovalent or bivalent mRNA vaccine dose.

What is added by this report?

In v-safe, 38% of children had no reported reactions after a third dose; most reported reactions were mild and transient. Vaccination errors accounted for 78% of events reported to the Vaccine Adverse Event Reporting System.

What are the implications for public health practice?

Findings after receipt of a third mRNA vaccine dose among young children were similar to those described after receipt of 1 and 2 doses; no new safety concerns were identified.

children aged 6 months–5 years after receipt of a third dose. Most reported reactions after vaccination were mild and transient. Although SARS-CoV-2 infection among young children typically results in mild infection, it can result in serious illness, including multisystem inflammatory syndrome in children, long-term sequalae, and death (*8*). mRNA COVID-19 vaccination provides protection against symptomatic SARS-CoV-2 infection for at least 4 months after vaccination among children aged 3–5 years (*9*). CDC and FDA will continue to monitor vaccine safety and will provide updates to help guide COVID-19 vaccination recommendations.

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References

1. Food and Drug Administration. Pfizer-BioNTech COVID-19 vaccine letter of authorization (reissued). Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2023. https://www.fda.gov/media/150386/download
2. Food and Drug Administration. Moderna COVID-19 vaccine letter of authorization (reissued). Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2023. https://www.fda.gov/media/144636/download

3. CDC. Vaccines & immunizations: use of COVID-19 vaccines in the United States. Atlanta, GA: US Department of Health and Human Services, CDC; 2023. Accessed April 26, 2023. https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html
4. Hause AM, Marquez P, Zhang B, et al. COVID-19 mRNA vaccine safety among children aged 6 months–5 years—United States, June 18, 2022–August 21, 2022. MMWR Morb Mortal Wkly Rep 2022;71:1115–20. PMID:36048728 https://doi.org/10.15585/mmwr.mm7135a3
5. Shimabukuro TT, Nguyen M, Martin D, DeStefano F. Safety monitoring in the Vaccine Adverse Event Reporting System (VAERS). Vaccine 2015;33:4398–405. PMID:26209838 https://doi.org/10.1016/j.vaccine.2015.07.035
6. Hause AM, Baggs J, Marquez P, et al. Safety monitoring of Pfizer-BioNTech COVID-19 vaccine booster doses among children aged 5–11 years—United States, May 17–July 31, 2022. MMWR Morb Mortal Wkly Rep 2022;71:1047–51. PMID:35980875 https://doi.org/10.15585/mmwr.mm7133a3
7. Hause AM, Marquez P, Zhang B, et al. Safety monitoring of bivalent COVID-19 mRNA vaccine booster doses among children aged 5–11 years—United States, October 12–January 1, 2023. MMWR Morb Mortal Wkly Rep 2023;72:39–43. PMID:36634021 https://doi.org/10.15585/mmwr.mm7202a5
8. Fleming-Dutra KE. COVID-19 epidemiology in children ages 6 months–4 years. Presented at the Advisory Committee on Immunization Practices meeting; June 17, 2022; Atlanta, GA. https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2022-06-17-18/02-covid-fleming-dutra-508.pdf
9. Fleming-Dutra KE, Ciesla AA, Roper LE, et al. Preliminary estimates of effectiveness of monovalent mRNA vaccines in preventing symptomatic SARS-CoV-2 infection among children aged 3–5 years—Increasing Community Access to Testing program, United States, July 2022–February 2023. MMWR Morb Mortal Wkly Rep 2023;72:177–82. PMID:36795625 https://doi.org/10.15585/mmwr.mm7207a3

Progress Toward Equitable Mpox Vaccination Coverage: A Shortfall Analysis — United States, May 2022–April 2023

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More than 30,000 monkeypox (mpox) cases were reported in the United States during the 2022 multinational outbreak; cases disproportionately affected gay, bisexual, and other men who have sex with men (MSM). Substantial racial and ethnic disparities in incidence were also reported (*1*). The national mpox vaccination strategy* emphasizes that efforts to administer the JYNNEOS mpox vaccine should be focused among the populations at elevated risk for exposure to mpox (*2*). During May 2022–April 2023, a total of 748,329 first JYNNEOS vaccine doses (of the two recommended) were administered in the United States.† During the initial months of the outbreak, lower vaccination coverage rates among racial and ethnic minority groups were reported (*1*,*3*); however, after implementation of initiatives developed to expand access to mpox vaccination,§ coverage among racial and ethnic minority groups increased (*1*,*4*). A shortfall analysis was conducted to examine whether the increase in mpox vaccination coverage was equitable across all racial and ethnic groups (*5*). Shortfall was defined as the percentage of the vaccine-eligible population that did not receive the vaccine (i.e., 100% minus the percentage of the eligible population that did receive a first dose). Monthly mpox vaccination shortfalls were calculated and were stratified by race and ethnicity; monthly percent reductions in shortfall were also calculated compared with the preceding month's shortfall (*6*). The mpox vaccination shortfall decreased among all racial and ethnic groups during May 2022–April 2023; however, based on analysis of vaccine administration data with race and ethnicity reported, 66.0% of vaccine-eligible persons remained unvaccinated at the end of this period. The shortfall was largest among non-Hispanic Black or African American (Black) (77.9%) and non-Hispanic American Indian or Alaska Native (AI/AN) (74.5%) persons, followed by non-Hispanic White (White) (66.6%) and Hispanic or Latino (Hispanic) (63.0%) persons, and was lowest among non-Hispanic Asian (Asian) (38.5%) and non-Hispanic Native Hawaiian and other Pacific Islander (NH/OPI) (43.7%) persons. The largest percentage decreases in the shortfall were achieved during August (17.7%) and September (8.5%). However, during these months, smaller percentage decreases were achieved among Black persons (12.2% and 4.9%, respectively), highlighting the need for a focus on equity for the entirety of a public health response. Achieving equitable progress in JYNNEOS vaccination coverage will require substantial decreases in shortfalls among Black and AI/AN persons.

Shortfall analysis, an approach that focuses on the percentage of persons who have not achieved a certain health outcome (*5*), was used to quantify progress in mpox vaccination overall and by racial and ethnic groups. Unlike many conventional disparity measures that compare the rate of a particular health outcome in racial and ethnic minority groups with the rate of another group, such as the group with most favorable rate or the overall population (*7*), shortfall analysis does not require a comparison group. Thus, the shortfall analysis can quantify progress in mpox vaccination coverage for any given racial or ethnic group without regard to changes in vaccination coverage in a comparison group. Further, comparisons of shortfalls across racial and ethnic groups can help to determine if progress in mpox vaccination coverage is equitable. Shortfall in mpox vaccination was calculated as 100% minus the percentage of the eligible population that received a first dose of mpox vaccine; thus, the shortfall measure reflects the deficit in the percentage of vaccinated persons in the eligible population from 100% coverage. Shortfalls, and decreases in shortfalls (measured as a percentage), were calculated at monthly intervals during May 2022–April 2023 for each racial and ethnic group (*6*). A reduction in shortfall indicates progress specific to an individual racial and ethnic group without the need for a reference group, because the reference point is 100% coverage (*6*). Shortfall analyses have been used for measuring progress for a range of health outcomes, such as increases in life expectancies (*6*).

Data on the number of persons aged ≥13 years among seven racial and ethnic groups¶ who received a first dose of mpox vaccine were obtained from case surveillance reports submitted to CDC by 49 states, the District of Columbia, and Puerto Rico, during May 2022–April 2023.** The size of

* https://www.cdc.gov/poxvirus/mpox/interim-considerations/overview.html (Accessed May 11, 2023).
† https://www.cdc.gov/poxvirus/mpox/response/2022/vaccines_data.html (Accessed May 14, 2023).
§ https://www.cdc.gov/poxvirus/mpox/health-departments/vaccine-equity-pilot.html

¶ Persons who indicated Hispanic ethnicity, regardless of race, were categorized as Hispanic. AI/AN, Asian, Black, NH/OPI, White, or Multiple race (more than one race category selected) or other persons were categorized as non-Hispanic. Persons with missing data on ethnicity or race were categorized as missing or unknown and not included in this analysis.
** Data from Vermont were not included in the analysis because vaccination data stratified by race and ethnicity were not reported.

the eligible population was calculated as 125% of the sum of the estimated number of MSM with HIV and the estimated number of MSM with HIV preexposure prophylaxis (PrEP) indications. The 25% increase was to account for additional persons who are more likely to be exposed: MSM who are at increased risk for mpox but do not have indications for HIV PrEP; cisgender female, transgender, and gender nonbinary persons who are partners of MSM; close contacts of persons with known or suspected mpox; and persons at risk for occupational exposure to orthopoxviruses (*8*). Estimates of the number of MSM with HIV by race and ethnicity and the estimates of MSM with HIV PrEP indications were obtained using data from CDC Atlas Plus.[††] To estimate the number of MSM with HIV PrEP indications by race and ethnicity,[§§] the racial and ethnic distribution of MSM with HIV PrEP indications was assumed to be the same as the racial and ethnic distribution of the male population in the United States.[¶¶] (*9*). Analyses were conducted using R statistical software (version 4.2.1; R Foundation). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[***]

Based on review of vaccination data with race and ethnicity reported, an estimated 34.0% of the eligible population had received a first dose of JYNNEOS vaccine by the end of April 2023, corresponding to a calculated shortfall of 66.0% (Table 1). The first dose coverage shortfall was larger among Black (77.9%) and AI/AN (74.5%) persons than among White (66.6%), Hispanic (63.0%), Asian (38.5%), and NH/OPI (43.7%) persons (Figure).

From June to July, the overall reduction in shortfall was modest (5.5%), with the smallest reductions observed among Black and AI/AN persons (2.8% each) (Table 2). The largest overall mpox vaccination shortfall reductions were achieved from July to August (17.7%) and August to September (8.5%). However, during these periods, larger shortfall reductions were observed in White (17.1% and 8.3%, respectively), Hispanic (19.2% and 9.3%, respectively), Asian (34.0% and 20.0%, respectively), and NH/OPI (30.8% and 17.5%, respectively) persons, and smaller reductions occurred among Black (12.2% and 4.9%, respectively) and AI/AN (10.5% and 7.5%, respectively) persons. Overall shortfall reductions were smaller from October to November (1.6%), November to December (0.8%), December to January (0.5%), and March to April (0.2%).

Discussion

During May 2022–April 2023, the shortfalls in receipt of a first dose of mpox vaccine by the eligible population were reduced among all racial and ethnic groups; however, the shortfall was larger among Black and AI/AN persons. The finding of a larger shortfall among Black persons is consistent with the findings of a previous report, which found that the higher vaccination rate among Black males relative to White males (rate ratio = 1.2) was not commensurate with the higher mpox incidence in Black males (rate ratio = 5.8) (*1*). Compared with White persons, Black persons are approximately 20% more likely to be vaccinated (*1*), but they are also approximately 83% more likely than White persons to be members of the vaccine-eligible population. Thus, despite the slightly higher vaccination rate among Black persons,[†††] the vaccine shortfall is larger among Black persons. The decrease in shortfall was modest from June to July and was most notable in August and September, which could be related to an increase in vaccine supply resulting from the recommendation for dose-sparing intradermal administration of JYNNEOS vaccine on August 9, 2022,[§§§] and expanded vaccination initiatives, including a focus on addressing disparities in vaccination coverage (*4*). Further, the shortfall among Hispanic persons was less than the overall shortfall, which could also be a consequence of the focus on health equity in the expanded vaccination initiatives (*1*). However, the shortfall reductions were not consistent across all racial and ethnic groups, with smaller reductions among Black and AI/AN populations.

[††] The estimated number of MSM with HIV by race and ethnicity was obtained from jurisdiction-specific estimates of 2020 HIV prevalence by race and ethnicity from Atlas Plus (an interactive tool that allows for the creation of customized tables, maps and charts using CDC's HIV, hepatitis, sexually transmitted infections, and tuberculosis surveillance data) describing men with HIV whose HIV transmission category was male-to-male sexual contact or male-to-male sexual contact and injection drug use. https://www.cdc.gov/nchhstp/atlas/index.htm

[§§] The number of MSM with indications for HIV PrEP was estimated as the ratio of the jurisdiction-specific number of MSM receiving HIV PrEP and the jurisdiction-specific HIV PrEP coverage from CDC's Atlas Plus. The number of MSM with indications for HIV PrEP by race and ethnicity was estimated by multiplying the number of MSM with HIV PrEP indications by the race and ethnicity weights derived from the racial and ethnic distribution of the male population in the United States. https://wonder.cdc.gov/single-race-v2021.html

[¶¶] This approach was employed based on the evidence indicating that the proportion of MSM reporting HIV PrEP indications was similar across racial and ethnic groups. A supplemental analysis was conducted in which the racial and ethnic distribution of MSM with HIV PrEP indications was assumed to be the same as the racial and ethnic distribution of new HIV diagnoses in MSM using data from CDC's Atlas Plus.

[***] 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.

[†††] The probability that a Black person would be in the vaccine-eligible population was calculated as the number of Black persons in the vaccine-eligible population divided by the number of Black persons aged ≥13 years in the United States (382,876 / 34,715,303 = 0.011), using 2021 population estimates from CDC wonder (https://wonder.cdc.gov/single-race-single-year-v2021.html). Using the same approach, the probability that a White person would be in the vaccine-eligible population was calculated as 1,036,538 / 171,591,284 = 0.006. The relative likelihood of a Black person being in the vaccine-eligible population compared with a White person was 1.83 (0.011 / 0.006).

[§§§] https://www.fda.gov/media/160774/download#:~:text=The%20FDA%20has%20granted%20an,high%20risk%20for%20monkeypox%20infection

TABLE 1. Numbers of persons eligible for JYNNEOS vaccine, cumulative numbers and percentages of persons who received a first dose, and vaccination shortfalls, by race and ethnicity — United States, May 2022–April 2023*

	Race and ethnicity†							
Characteristic/Month	Asian	AI/AN	Black or African American	NH/OPI	White	Hispanic or Latino	Multiple races/ Other	Total
Vaccine-eligible population (total)§	**82,103**	**11,171**	**382,876**	**3,116**	**1,036,538**	**419,689**	**60,908**	**1,996,401**
May–June								
No. vaccinated	195	8	161	6	1,987	484	132	**2,973**
% vaccinated¶	0.2	0.1	0.0	0.2	0.2	0.1	0.2	**0.1**
Shortfall,** %	99.8	99.9	100.0	99.8	99.8	99.9	99.8	**99.9**
July								
No. vaccinated	8,879	322	10,762	275	63,016	24,777	4,990	**113,021**
% vaccinated¶	10.8	2.9	2.8	8.8	6.1	5.9	8.2	**5.7**
Shortfall,** %	89.2	97.1	97.2	91.2	93.9	94.1	91.8	**94.3**
August								
No. vaccinated	33,740	1,466	56,310	1,151	229,852	100,689	23,252	**446,460**
% vaccinated¶	41.1	13.1	14.7	36.9	22.2	24.0	38.2	**22.4**
Shortfall,** %	58.9	86.9	85.3	63.1	77.8	76.0	61.8	**77.6**
September								
No. vaccinated	43,390	2,196	72,328	1,494	296,611	130,308	31,454	**577,781**
% vaccinated¶	52.8	19.7	18.9	47.9	28.6	31.0	51.6	**28.9**
Shortfall,** %	47.2	80.3	81.1	52.1	71.4	69.0	48.4	**71.1**
October								
No. vaccinated	47,004	2,511	78,076	1,640	322,104	141,693	34,445	**627,473**
% vaccinated¶	57.3	22.5	20.4	52.6	31.1	33.8	56.6	**31.4**
Shortfall,** %	42.7	77.5	79.6	47.4	68.9	66.2	43.4	**68.6**
November								
No. vaccinated	48,481	2,654	80,759	1,686	332,859	146,972	35,957	**649,368**
% vaccinated¶	59.0	23.8	21.1	54.1	32.1	35.0	59.0	**32.5**
Shortfall,** %	41.0	76.2	78.9	45.9	67.9	65.0	41.0	**67.5**
December								
No. vaccinated	49,226	2,724	82,136	1,714	338,297	149,965	36,689	**660,751**
% vaccinated¶	60.0	24.4	21.5	55.0	32.6	35.7	60.2	**33.1**
Shortfall,** %	40.0	75.6	78.5	45.0	67.4	64.3	39.8	**66.9**
January								
No. vaccinated	49,712	2,760	83,086	1,731	341,663	151,872	37,084	**667,908**
% vaccinated¶	60.5	24.7	21.7	55.6	33.0	36.2	60.9	**33.5**
Shortfall,** %	39.5	75.3	78.3	44.4	67.0	63.8	39.1	**66.5**
February								
No. vaccinated	50,039	2,785	83,855	1,738	343,751	153,298	37,376	**672,842**
% vaccinated¶	60.9	24.9	21.9	55.8	33.2	36.5	61.4	**33.7**
Shortfall,** %	39.1	75.1	78.1	44.2	66.8	63.5	38.6	**66.3**
March								
No. vaccinated	50,323	2,822	84,410	1,746	345,438	154,446	37,613	**676,798**
% vaccinated¶	61.3	25.3	22.0	56.0	33.3	36.8	61.8	**33.9**
Shortfall,** %	38.7	74.7	78.0	44.0	66.7	63.2	38.2	**66.1**
April								
No. vaccinated	50,517	2,850	84,757	1,755	346,599	155,212	37,769	**679,459**
% vaccinated¶	61.5	25.5	22.1	56.3	33.4	37.0	62.0	**34.0**
Shortfall,** %	38.5	74.5	77.9	43.7	66.6	63.0	38.0	**66.0**

Abbreviations: AI/AN = American Indian or Alaska Native; mpox = monkeypox; MSM = men who have sex with men; NH/OPI = Native Hawaiian or other Pacific Islander; PrEP = preexposure prophylaxis.

* Data from Vermont were not included in the analysis because vaccination data stratified by race and ethnicity were not reported.

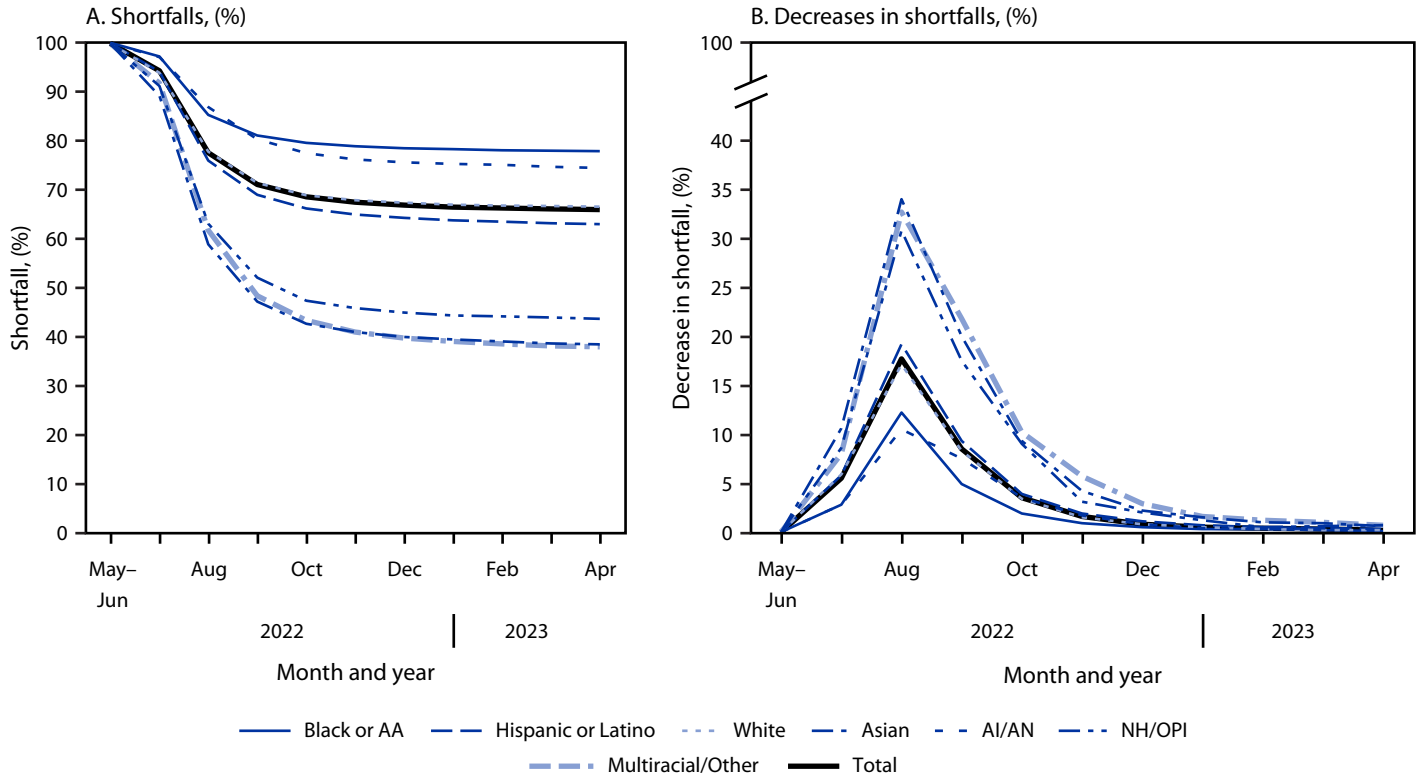
† Persons who indicated Hispanic or Latino (Hispanic) ethnicity, regardless of race, were categorized as Hispanic. AI/AN, Asian, Black or African American, NH/OPI, White, or Multiple race (more than one race category selected) or other persons were categorized as non-Hispanic. Persons with missing data on ethnicity or race were categorized as missing or unknown and not included in this analysis.

§ The size of the eligible population was calculated as 125% of the sum of the estimated number of MSM with HIV and the estimated number of MSM with HIV PrEP indications. The increase of 25% was to account for all other persons who are more likely to be exposed: MSM who are at increased risk for mpox but do not have indications for HIV PrEP; cisgender female, transgender, and gender nonbinary persons who are partners of MSM; close contacts of persons with known or suspected mpox; and persons at risk for occupational exposure to orthopoxviruses.

¶ Cumulative percent vaccinated and shortfalls are rounded to the nearest 10th of a percent.

** Shortfall was calculated by subtracting the cumulative percentage of eligible population that received ≥1 dose of vaccine from 100%.

FIGURE. Shortfalls* and percent decreases in shortfalls† in first dose JYNNEOS vaccination, by race and ethnicity§ — United States, May 2022–April 2023¶



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

* Calculated as the difference between 100% vaccination coverage and the reported vaccination coverage.

† Monthly reductions in shortfall were calculated as percent decrease in shortfall compared with the preceding month. Because no vaccines were administered before May, the percent decreases in shortfall for May–June were set to zero.

§ Persons who indicated Hispanic or Latino (Hispanic) ethnicity, regardless of race, were categorized as Hispanic. AI/AN, Asian, Black or African American, NH/OPI, White, and Multiple races (more than one race category selected) or other persons were categorized as non-Hispanic. Persons with missing data on ethnicity or race were categorized as missing or unknown and were not included in this analysis.

¶ Data from Vermont were not included in the analysis because vaccination data stratified by race and ethnicity were not reported.

The monthly shortfall reduction is likely a more meaningful measure of progress toward equity in vaccination coverage than is the increase in vaccination coverage, because the former quantifies progress toward 100% mpox vaccination, and the latter can be biased against racial and ethnic groups with lower coverage (i.e., the same percentage point increase in coverage will result in a larger relative percent increase among groups with lower coverage than in groups with higher coverage) (*5*). Accordingly, the decline in shortfall is consistent with the principle of proportional justice, in which equitable progress toward 100% vaccination requires that racial and ethnic minority groups with larger vaccination shortfalls achieve larger percentage point increases in vaccination coverage than do groups with smaller shortfalls (*5*,*6*). Focusing on the racial and ethnic groups with larger mpox vaccination shortfalls and prioritizing resources and improving access to vaccination for these groups can reduce the overall shortfall in mpox vaccination while simultaneously promoting health equity.

The findings in this report are subject to at least three limitations. First, data on race and ethnicity were missing for 9% of vaccine recipients; if vaccinated persons with missing race and ethnicity data were included in the analysis, the overall shortfall would be 62.5% rather than 66.0% (*8*). Second, the estimated sizes of racial and ethnic groups constituting the vaccine-eligible population are uncertain (*8*). For example, the racial and ethnic distribution of MSM with HIV PrEP indications is unknown; for this analysis, this distribution was assumed to be the same as the that of the U.S. male population, based on the evidence of similar levels of HIV PrEP indications across racial and ethnic groups (*9*). However, the actual racial and ethnic disparities in mpox vaccination shortfall could be notably higher than estimated if there are racial and ethnic disparities in the distribution of MSM with HIV PrEP indications¶¶¶ (*10*). Finally, estimates

¶¶¶ In the supplemental analysis in which the racial and ethnic distribution of MSM with HIV PrEP indications was assumed to be the same as the racial and ethnic distribution of new HIV diagnoses in MSM, the shortfalls in vaccination as of April 2023 for the three largest racial and ethnic groups were Black, 87.8% (versus 77.9% in the main analysis); Hispanic, 72.0% (versus 63.0%); and White, 44.4% (versus 66.6%). However, the overall shortfall was the same in both analyses (66.0%).

TABLE 2. Percent reductions in shortfall in administration of first JYNNEOS vaccine doses among vaccine-eligible persons, by race and ethnicity — United States, July 2022–April 2023*

	Reduction in shortfall,† %,§ by racial and ethnic group¶							
Month	Total	Asian	AI/AN	Black or African American	NH/OPI	White	Hispanic or Latino	Multiple races/ Other
July	**5.5**	10.6	2.8	2.8	8.6	5.9	5.8	8.0
August	**17.7**	34.0	10.5	12.2	30.8	17.1	19.2	32.7
September	**8.5**	20.0	7.5	4.9	17.5	8.3	9.3	21.8
October	**3.5**	9.3	3.5	1.9	9.0	3.4	3.9	10.2
November	**1.6**	4.2	1.7	0.9	3.1	1.5	1.9	5.7
December	**0.8**	2.2	0.8	0.5	2.0	0.8	1.1	2.9
January	**0.5**	1.5	0.4	0.3	1.2	0.5	0.7	1.6
February	**0.4**	1.0	0.3	0.3	0.5	0.3	0.5	1.2
March	**0.3**	0.9	0.4	0.2	0.6	0.2	0.4	1.0
April	**0.2**	0.6	0.3	0.1	0.7	0.2	0.3	0.7

Abbreviations: AI/AN = American Indian or Alaska Native; NH/OPI = Native Hawaiian or other Pacific Islander.
* Data from Vermont were not included in the analysis because vaccination data stratified by race and ethnicity were not reported.
† Monthly reductions in shortfall were calculated as percent decrease in shortfall compared with the preceding month.
§ Reductions in shortfall are rounded to the nearest 10th of a percent.
¶ Persons who indicated Hispanic or Latino (Hispanic) ethnicity, regardless of race, were categorized as Hispanic. AI/AN, Asian, Black or African American, NH/OPI, White, and Multiple races (more than one race category selected) or other persons were categorized as non-Hispanic. Persons with missing data on ethnicity or race were categorized as missing or unknown and were not included in this analysis.

of the size of the vaccine-eligible population were increased by 25% to include additional groups (other than MSM with HIV or MSM with HIV PrEP indications) who might benefit from vaccination. However, the need to expand the size of the vaccine-eligible population might be more pronounced for racial and ethnic minority groups because of social determinants of health and sexual partnership selection patterns based on race and ethnicity (e.g., persons tending to choose sexual partners of same race and ethnicity, age, and other characteristics). Accordingly, the vaccination shortfalls might be underestimated, particularly for some racial and ethnic minority groups.

This mpox vaccination shortfall analysis provides a better understanding of progress in mpox vaccination in eligible populations by racial and ethnic groups than assessing increases in percentage of persons vaccinated. The shortfall reductions among Black and AI/AN persons were smaller than the overall shortfall reductions at all monthly intervals considered, leading to larger and persistently higher shortfalls in these groups compared with overall shortfall. A focus on achieving equal reductions in shortfalls is needed to achieve equitable progress in mpox vaccination coverage. Effective strategies could include engaging trusted messengers, community-based organizations, and providers in the design and delivery of vaccination messages using relatable cultural and language nuances to reach populations at increased risk for mpox.**** To minimize the risk for future mpox outbreaks, vaccination coverage among all eligible persons needs to increase substantially, particularly among racial and ethnic minority groups with the largest shortfalls.

**** https://www.cdc.gov/poxvirus/mpox/resources/toolkits/equity.html

Summary

What is already known about this topic?

Vaccination efforts during the 2022 U.S. monkeypox (mpox) outbreak focused on populations at elevated risk for acquiring mpox.

What is added by this report?

As of April 2023, two thirds (approximately 66.0%) of mpox vaccine–eligible persons remained unvaccinated. The shortfall (difference between 100% coverage and reported first-dose coverage) was largest among Black or African American (Black) persons (77.9%). The largest monthly decreases in overall shortfall were in August (17.7%) and September (8.5%). However, during these months, smaller shortfall reductions were achieved among Black persons (12.2% and 4.9%, respectively).

What are the implications for public health practice?

Vaccination coverage among racial and ethnic minority groups with the largest shortfalls needs to increase substantially to reduce disparities in vaccination coverage and increase health equity.

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References

1. Kota KK, Hong J, Zelaya C, et al. Racial and ethnic disparities in mpox cases and vaccination among adult males—United States, May–December 2022. MMWR Morb Mortal Wkly Rep 2023;72:398–403. PMID:37053122 https://doi.org/10.15585/mmwr.mm7215a4
2. Kava CM, Rohraff DM, Wallace B, et al. Epidemiologic features of the monkeypox outbreak and the public health response—United States, May 17–October 6, 2022. MMWR Morb Mortal Wkly Rep 2022;71:1449–56. PMID:36355615 https://doi.org/10.15585/mmwr.mm7145a4
3. Kates J, Artiga S, Dawson L. National data show continuing disparities in monkeypox (MPX) cases and vaccinations among Black and Hispanic people. San Francisco, CA: KFF; 2022. https://www.kff.org/racial-equity-and-health-policy/issue-brief/national-data-show-continuing-disparities-in-mpx-monkeypox-cases-and-vaccinations-among-black-and-hispanic-people/
4. Kriss JL, Boersma PM, Martin E, et al. Receipt of first and second doses of JYNNEOS vaccine for prevention of monkeypox—United States, May 22–October 10, 2022. MMWR Morb Mortal Wkly Rep 2022;71:1374–8. PMID:36301741 https://doi.org/10.15585/mmwr.mm7143e2
5. Sen A. Public action and the quality of life in developing countries. Oxf Bull Econ Stat 1981;43:287–319. PMID:12339005 https://doi.org/10.1111/j.1468-0084.1981.mp43004001.x
6. Ruger JP. Ethics and governance of global health inequalities. J Epidemiol Community Health 2006;60:998–1003. PMID:17053290 https://doi.org/10.1136/jech.2005.041947
7. Harper S, King NB, Meersman SC, Reichman ME, Breen N, Lynch J. Implicit value judgments in the measurement of health inequalities. Milbank Q 2010;88:4–29. PMID:20377756 https://doi.org/10.1111/j.1468-0009.2010.00587.x
8. Owens LE, Currie DW, Kramarow EA, et al. JYNNEOS vaccination coverage among persons at risk for mpox—United States, May 22, 2022–January 31, 2023. MMWR Morb Mortal Wkly Rep 2023;72:342–7. PMID:36995962 https://doi.org/10.15585/mmwr.mm7213a4
9. Kimball AA, Zhu W, Tanner MR, et al.; THRIVE Project Team. The effect of navigation on linkage to a PrEP provider among PrEP-eligible men who have sex with men in a U.S. demonstration project. AIDS Behav 2023;27:1981–8. PMID:36417093 https://doi.org/10.1007/s10461-022-03931-y
10. Smith DK, Van Handel M, Grey J. Estimates of adults with indications for HIV pre-exposure prophylaxis by jurisdiction, transmission risk group, and race/ethnicity, United States, 2015. Ann Epidemiol 2018;28:850–857.e9. PMID:29941379 https://doi.org/10.1016/j.annepidem.2018.05.003

Notes from the Field

Exposures to Mpox Among Cases in Children Aged ≤12 Years — United States, September 25–December 31, 2022

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During May 17–December 31, 2022, 125 probable or confirmed U.S. monkeypox (mpox)[†] cases were reported among patients aged <18 years, including 45 (36%) in children aged ≤12 years. Eighty-three cases in persons aged <18 years diagnosed during May 17–September 24, 2022 were previously described (*1*); 28 (34%) of these were in children aged ≤12 years, 29% of whom did not have reported information on exposure. Among 20 (71%) of 28 patients with documented information on exposure, most were exposed by a household contact. This report updates the previous report using data collected during September 25–December 31, 2022, proposes possible mpox exposure routes in children aged ≤12 years, and describes three U.S. mpox cases in neonates. Household members or caregivers with mpox, including pregnant women and their health care providers, should be informed of the risk of transmission to persons aged <18 years, and strategies to protect persons aged <18 years at risk for exposure, including isolating household contacts with mpox, should be implemented immediately.

During September 25–December 31, 2022, 17 children aged ≤12 years with probable or confirmed mpox were identified through national surveillance. CDC provided a questionnaire to state and local health departments for collection of the child's history of exposure to any person with mpox[§] during the previous 3 weeks, exposure settings, types of contact (e.g., skin-to-skin, being held or cuddled, diaper change, or toilet use), and precautions taken by the person with mpox (e.g., practiced isolation or covered lesions). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[¶]

Three of the 17 pediatric patients were aged ≤7 days and had likely perinatal exposures; all three neonates were non-Hispanic Black or African American (Black). Two of these three mpox cases in neonates were previously reported (*2*). Ten of the remaining children were aged 0–4 years, and four children were aged 5–12 years. Nine patients were boys, and five were girls; nine were Black, two were Hispanic or Latino, and three were non-Hispanic White. Seven of the children aged 0–4 years, and two of those aged 5–12 years had known exposure to a person with mpox (Table); in five cases, the exposure source was unknown. Six of the seven children aged 0–4 years and both children aged 5–12 years known to be exposed to mpox were exposed by a caregiver or a household contact. Five of nine children with known exposure to a person with mpox were reported to have had close physical contact; notably, four of five children aged 0–4 years had skin-to-skin contact. Five of the nine children were exposed to a person with mpox who reported taking at least one precaution, including four persons who reported isolating. Two of these household contacts reported sharing a bed, bedroom, or bathroom with the child. Evidence suggests persons with mpox might transmit the virus up to 4 days before symptom onset (*3*); review of children's case histories suggest that in at least three cases, the person with mpox (i.e., the exposure source) did not begin isolating until after had they received a diagnosis.

This report includes the first three U.S. mpox cases reported in newborns in the 2022 outbreak; these cases were not included in the earlier report of cases of diagnosed persons aged <18 years during May 17–September 24, 2022, (*1*) but two of the cases were included in a subsequent report (*2*). Among children aged ≤12 years with mpox who had a known exposure to a person with mpox, the majority were exposed by household contacts or caregivers with mpox, consistent with previous findings (*1*). This report describes precautions taken by persons with mpox to whom pediatric patients were exposed. Not all persons with mpox reported taking precautions, and children might have been exposed to mpox before initiation of precautions. As described in a recent case report of

* These authors contributed equally to this report.
† https://www.cdc.gov/poxvirus/mpox/clinicians/case-definition.html
§ Exposure to a person with mpox was defined as exposure to a person with confirmed or suspected mpox during the 3 weeks before symptom onset (e.g., any interaction with someone with mpox, a mpox-like illness, or an unexplained rash).
¶ 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. Demographic characteristics and mpox exposure sources of children aged ≤12 years with mpox — United States, September 25–December 31, 2022*

Characteristic	Age group, yrs, no./No. (%)		
	All ≤12 (N = 14)	0–4* (n = 10)	5–12 (n = 4)
Race and ethnicity†			
Black or African American, non-Hispanic	**9/14 (64)**	7/10 (70)	2/4 (50)
White, Hispanic	**2/14 (14)**	1/10 (10)	1/4 (25)
White, non-Hispanic	**3/14 (21)**	2/10 (20)	1/4 (25)
Exposure source§			
Caregiver or household contact¶	**8/14 (57)**	6/10 (60)	2/4 (50)
Nonhousehold contact**	**1/14 (7)**	1/10 (10)	0/4 (—)
Unknown contact	**5/14 (36)**	3/10 (30)	2/4 (50)
Types of contact with known exposure source††			
Blood or other body fluid	**0/4 (—)**	0/3 (—)	0/1 (—)
Diaper change or toilet use	**1/5 (20)**	1/3 (33)	0/2 (—)
Face-to-face	**6/7 (86)**	4/5 (80)	2/2 (100)
Feeding	**1/5 (20)**	1/3 (33)	0/2 (—)
Holding or cuddling	**3/4 (75)**	2/3 (67)	1/1 (100)
Medical care	**0/5 (—)**	0/3 (—)	0/2 (—)
Pet	**0/6 (—)**	0/4 (—)	0/2 (—)
Shared clothes, towels, bedding, or bed linens	**1/4 (25)**	1/3 (33)	0/1 (—)
Shared food or dishes	**3/4 (75)**	1/2 (50)	2/2 (100)
Shared living space	**3/6 (50)**	2/4 (50)	1/2 (50)
Shared toiletries	**1/3 (33)**	1/2 (50)	0/1 (—)
Shared toys	**0/4 (—)**	0/3 (—)	0/1 (—)
Skin-to-skin	**5/6 (83)**	4/5 (80)	1/1 (100)
Precaution taken by known exposure source§§			
Covered lesions	**3/7 (43)**	2/5 (40)	1/2 (50)
Isolated	**4/8 (50)**	3/7 (43)	1/1 (100)
Refrained from sharing	**1/8 (12)**	0/6 (—)	1/2 (50)
Wore gloves or other protective gear	**1/6 (17)**	0/4 (—)	1/2 (50)
Wore mask	**1/7 (14)**	1/5 (20)	0/2 (—)
Other	**0/7 (—)**	0/6 (—)	0/1 (—)

Abbreviation: mpox = monkeypox

* Information for children aged ≤12 years in this table excludes the three cases among neonates.

† Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic. Other race responses included Asian, American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, Other, and Unknown; these groups were not included because they were not identified in this group or in any cases.

§ Exposure to a person with confirmed or suspected mpox in the 3 weeks preceding symptom onset in the child.

¶ Eight household contact exposures were identified (four were direct caregiver exposures, and four were both household contacts and direct caregivers).

** One mpox exposure source was identified as being with a close friend or acquaintance during which the child's exposure did not occur within the household.

†† Percentages were calculated using nonmissing data including "Yes" and "No" responses. Types of contact by persons with known exposure were determined by asking respondents to specify exposure type for any of the exposure settings reported. Responses were not mutually exclusive. One respondent reported two known exposures.

§§ Percentages were calculated using nonmissing data including "Yes" and "No" responses. Types of precautions were determined by asking respondents whether any of the precautions presented in the question were taken by the primary exposure source to prevent the spread of infection. Responses were not mutually exclusive. One respondent reported two known exposures.

mpox in a toddler (*4*), precautions taken might not have been sufficient to prevent transmission from caregivers to children.

The findings in this report are subject to at least four limitations. First, because timing of initiation of precautions relative to exposure was not collected, and the number of children and infants who did not acquire mpox after exposure is unknown, effectiveness of specific precautions could not be evaluated. Second, because pediatric infections during the 2022 outbreak were rare, the sample size is small, and generalizability is limited. Third, it is not possible to investigate racial disparity of mpox cases among children and in adults because of the small number of mpox cases among children. Finally, for some cases, exposure histories might be affected by misclassification because of recall error or social desirability bias.

This report adds to the information about mpox among children during the 2022 outbreak (*5*). Early diagnosis and implementation of infection control measures are critical to reducing transmission of mpox to children and infants. Household members or caregivers with mpox, including pregnant women and their health care providers, should be informed of transmission risks to children and infants. Protecting children at risk for mpox exposure requires that exposure prevention strategies be implemented without delay. These strategies include isolating household contacts with mpox, preventing contact among adults and children with mpox and other household members, ensuring persons with mpox aged >2 years wear a mask when possible, and limiting the number of persons caring for a child with an mpox infection. When caring for the child with mpox, direct contact with the child's rash should be avoided and gloves should be worn. In addition, postexposure prophylaxis should be considered for all members of the household.

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References

1. Hennessee I, Shelus V, McArdle CE, et al.; California Department of Public Health Monkeypox Pediatric Working Group; CDC Monkeypox Pediatric Working Group. Epidemiologic and clinical features of children and adolescents aged <18 years with monkeypox—United States, May 17–September 24, 2022. MMWR Morb Mortal Wkly Rep 2022;71:1407–11. PMID:36331124 https://doi.org/10.15585/mmwr.mm7144a4
2. Oakley LP, Hufstetler K, O'Shea J, et al.; CDC Mpox Analytics Team. Mpox cases among cisgender women and pregnant persons—United States, May 11–November 7, 2022. MMWR Morb Mortal Wkly Rep 2023;72:9–14. PMID:36602932 https://doi.org/10.15585/mmwr.mm7201a2
3. CDC. Science brief: detection and transmission of mpox (formerly monkeypox) virus during the 2022 clade IIb outbreak. Atlanta, GA: US Department of Health and Human Services, CDC; 2023. Accessed February 2, 2023. https://www.cdc.gov/poxvirus/mpox/about/science-behind-transmission.html
4. Desai AN, Thompson GR 3rd, Dodson D, et al. Mpox infection in children–infection control implications for household contacts. Open Forum Infect Dis 2023;10:ofad003. PMID:36846608 https://doi.org/10.1093/ofid/ofad003
5. Beeson AM, Haston J, McCormick DW, et al. Mpox in children and adolescents: epidemiology, clinical features, diagnosis, and management. Pediatrics 2023;151:e2022060179. PMID:36471498 https://doi.org/10.1542/peds.2022-060179

Notes from the Field

Chikungunya Outbreak — Paraguay, 2022–2023

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Local transmission of chikungunya virus (CHIKV) was first reported in the Americas during December 2013, followed by widespread regional transmission (*1*). CHIKV is transmitted primarily by *Aedes aegypti* and *Aedes albopictus* mosquitoes. Most infected persons (72%–97%) experience symptomatic illness, typically including fever and often severe polyarthralgia (which can persist for months or years) (*2*). Rare complications include neurologic, cardiac, or renal disease (*2*).

Paraguay reported its first autochthonous chikungunya case during 2015 (*3*). The subsequent outbreak, concentrated in the capital city of Asunción and the neighboring Central Department, resulted in 5,221 cases during 2015–2016.* A second outbreak (1,239 cases) occurred during 2018 in the north-central Amambay Department. Beginning the first week of October 2022, an increase in reported cases was again noted; this report provides preliminary information on this outbreak as of March 11, 2023.

During October 1, 2022–March 11, 2023, a total of 81,037 suspected, probable, or confirmed† chikungunya cases was recorded by the Paraguayan Ministry of Health§; among these, 75,911 (94%) occurred during 2023. Most cases occurred in Central Department (49,070; 61%) and Asunción (16,094; 20%). Cumulative national incidence was 1,073 cases per 100,000 population (3,088 per 100,000 population in Asunción).¶ Weekly case counts in Asunción and Central Department declined slightly after epidemiologic week 6, but an increasing number and proportion of cases were subsequently reported from outlying regions, including along borders with Brazil and Argentina.

Among 47,116 probable or confirmed cases,** 27,147 (58%) were in females, and the median age was 36 years (range = 0 days–103 years); 4,604 (10%) hospitalizations and 52 (<1%) deaths attributable to CHIKV infection were reported.†† Among 208 (0.4%) cases in infants aged ≤29 days (neonates), 140 hospitalizations and eight deaths were reported,§§ accounting for the highest case fatality rate (3.8%) among all age groups (Figure). Among fatal neonatal cases, the timing of symptom onset suggested intrapartum transmission in 75% and mosquitoborne transmission in 25%.¶¶ Among adults aged ≥60 years, 10,617 cases and 1,878 hospitalizations (41% of all hospitalizations) were reported. Within this group, 32 deaths occurred***; 23 (72%) and 13 (41%) decedents had documented cardiovascular disease and diabetes, respectively, and 20 (63%) had two or more comorbidities. The highest case fatality rate among adults aged ≥60 years occurred among those aged ≥80 years (0.6%; 11 of 1,719 cases).

CHIKV can cause explosive outbreaks and substantial morbidity in all age groups. Groups at risk for severe disease and death include older adults, persons with comorbidities, and infants. Prevention messages should focus on avoiding mosquito bites by wearing long-sleeved shirts and pants, using insect repellents, screening windows and doors, and covering cribs, strollers, and beds with netting. Mosquito breeding sites around homes should be eliminated by emptying, scrubbing, or covering water-holding containers. In addition, integrated vector surveillance and control measures are essential at the community level. Persons with suspected infection should prevent mosquito bites to reduce spread to others. These measures will also reduce the risk for infection from dengue and Zika viruses, which often co-circulate; dengue virus is currently co-circulating in Paraguay.

* https://www.mspbs.gov.py/dependencias/portal/adjunto/0a6e46-SE82023Alerta.pdf

† On the basis of the Paraguayan Ministry of Public Health and Social Welfare's case definition, a suspected case is illness in a person with abrupt onset of a temperature ≥99.5°F (≥37.5°C) and incapacitating arthralgia or arthritis not explained by another medical condition, or in a neonate with fever, irritability, or cutaneous eruption. A probable case is a clinically compatible case with an epidemiologic link to a confirmed case or a positive CHIKV immunoglobulin (Ig) M test result. A confirmed case is any case with evidence of CHIKV infection determined by reverse transcription–polymerase chain reaction (RT-PCR) testing or virus isolation.

§ The number of suspected cases reported here excludes cases that were discarded on the basis of a negative RT-PCR test result <7 days, or a negative IgM test result ≥7 days, after symptom onset.

¶ Incidence calculated using 2023 population projections from the Paraguayan National Census. https://www.ine.gov.py/microdatos/index.php?cant=99&tema=TODOS

** Probable and confirmed cases were used to describe demographic and clinical findings because data were more complete.

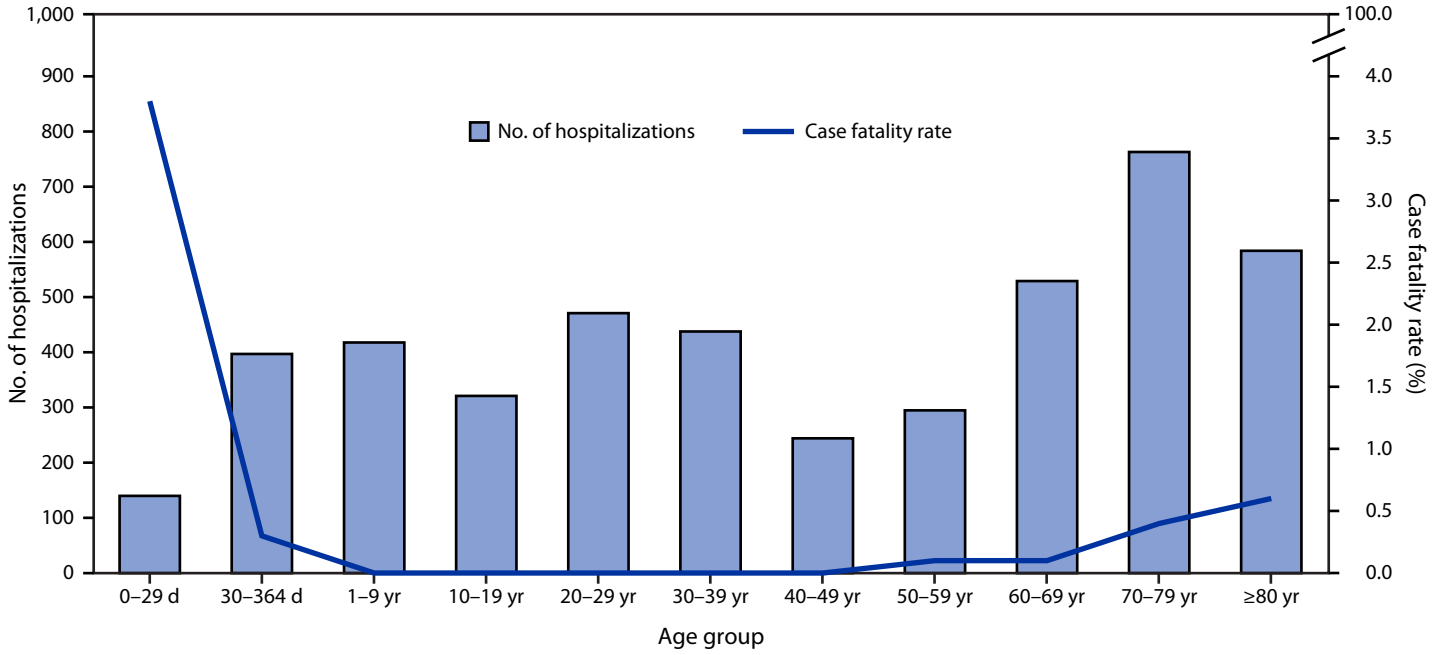
†† Pediatric and adult mortality committees met weekly to review comprehensive clinical information on deaths of patients with probable or confirmed chikungunya and classify the cause of death as attributable to 1) CHIKV infection, or 2) another cause in a patient with concurrent CHIKV infection.

§§ An additional eight deaths of neonates with probable or confirmed chikungunya were determined not attributable to chikungunya, and eight deaths among suspected, probable, or confirmed cases were pending a review of cause of death or laboratory results to confirm infection.

¶¶ Among eight neonates who died, symptom onset after birth was <7 days for six cases and >14 days for two cases.

*** An additional 136 deaths among persons aged ≥60 years with probable or confirmed chikungunya were determined not attributable to chikungunya, and 163 deaths among suspected, probable, or confirmed cases were pending a review of cause of death or laboratory results to confirm infection.

FIGURE. Number of hospitalizations (N = 4,604) and case fatality rate* among probable and confirmed chikungunya cases, by age group — Paraguay, October 1, 2022–March 11, 2023



* Deaths per 100 cases.

No antiviral treatment for chikungunya exists; however, timely dissemination of diagnosis and management guidance is crucial.††† Newborns with possible intrapartum exposure should be monitored in a hospital during the first week of life, because deterioration can occur rapidly (*4*). Infection prevention measures should be implemented in hospitals to limit spread to staff members and patients, including providing bed nets and repellent for inpatients with chikungunya and eliminating mosquito breeding sites from hospital grounds.

Humans are the primary reservoir during epidemics and can transport the virus to new areas; cases in travelers returning from Paraguay have been reported in several countries§§§ (*5*). If an infected person is bitten by a mosquito vector at their destination, a risk for local transmission exists. During 2022–2023, in the Americas, increases in chikungunya cases and spread outside historical transmission areas (e.g., Uruguay and parts of Argentina) have occurred.¶¶¶ Strengthened surveillance and preparedness are crucial (*5*). Although no vaccine is currently licensed, several are in the late stages of development and could have a role in reducing cases and deaths in future outbreaks (*2*).

††† https://www.paho.org/en/documents/preparedness-and-response-chikungunya-virus-introduction-americas

§§§ https://www.argentina.gob.ar/salud

¶¶¶ https://www.paho.org/en/documents/epidemiological-alert-increase-cases-and-deaths-chikungunya-region-americas

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References

1. Bettis AA, L'Azou Jackson M, Yoon IK, et al. The global epidemiology of chikungunya from 1999 to 2020: a systematic literature review to inform the development and introduction of vaccines. PLoS Negl Trop Dis 2022;16:e0010069. PMID:35020717 https://doi.org/10.1371/journal.pntd.0010069
2. de Lima Cavalcanti TYV, Pereira MR, de Paula SO, Franca RFO. A review on chikungunya virus epidemiology, pathogenesis and current vaccine development. Viruses 2022;14:969. PMID:35632709 https://doi.org/10.3390/v14050969
3. Gräf T, Vazquez C, Giovanetti M, et al. Epidemiologic history and genetic diversity origins of chikungunya and dengue viruses, Paraguay. Emerg Infect Dis 2021;27:1393–404. PMID:33900172 https://doi.org/10.3201/eid2705.204244

4. Gérardin P, Barau G, Michault A, et al. Multidisciplinary prospective study of mother-to-child chikungunya virus infections on the island of La Réunion. PLoS Med 2008;5:e60. PMID:18351797 https://doi.org/10.1371/journal.pmed.0050060

5. CDC. Health Alert Network: increased chikungunya virus activity in Paraguay and associated risk to travelers. Atlanta, GA: US Department of Health and Human Services, CDC; 2023. https://emergency.cdc.gov/han/2023/han00487.asp

Notes from the Field

Rift Valley Fever Outbreak — Mbarara District, Western Uganda, January–March 2023

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Rift Valley fever (RVF) is a zoonotic mosquito-borne viral hemorrhagic fever (VHF) caused by *Rift Valley fever virus* (RVFV). RVF is endemic throughout most of Africa and the Arabian Peninsula and causes considerable morbidity and mortality among domestic livestock (*1*,*2*). Human infection occurs through contact with infected animals or their products or through bites from infected mosquitoes, mainly *Aedes* and *Culex* spp. (*3*). Human infections are typically asymptomatic or mild, usually manifesting as acute influenza-like illnesses (*2*). Severe disease, including hemorrhagic signs, occurs in approximately 10% of cases, nearly 10%–20% of which are fatal (*2*). Because of its socioeconomic impact and epidemic potential, RVF is a priority zoonotic disease in Uganda (*4*).

On February 4, 2023, the Uganda National Public Health Emergency Operations Center was notified of a suspected viral hemorrhagic fever case in a male abattoir worker and meat roaster aged 42 years from Mbarara City, the second largest city in Uganda. The patient was evaluated at a private health facility on January 30, at which time he reported a 2-day history of influenza-like illness. He received antimalarial medication and was discharged. On February 1, because of worsening signs and symptoms (fever, vomiting, diarrhea, fatigue, anorexia, difficulty breathing, and abdominal, chest, muscle, and joint pain), the patient sought treatment at Mbarara Regional Referral Hospital (MRRH). On February 3, he experienced nosebleed, gingival hemorrhage, hematuria, and bloody stools, and voluntarily left MRRH to seek care at a second, private facility. Suspecting a viral hemorrhagic fever, clinicians isolated him, provided supportive care, and referred him back to MRRH, where he died on February 4. A postmortem blood sample tested at the Uganda Virus Research Institute for any *ebolavirus*, *marburgvirus*, *Crimean-Congo hemorrhagic fever virus*, and RVFV, was positive on February 5 for RVFV by reverse transcription–polymerase chain reaction (RT-PCR) (*5*), and immunoglobulin M (IgM) and immunoglobulin G (IgG) enzyme-linked immunosorbent assay (ELISA) (*3*).

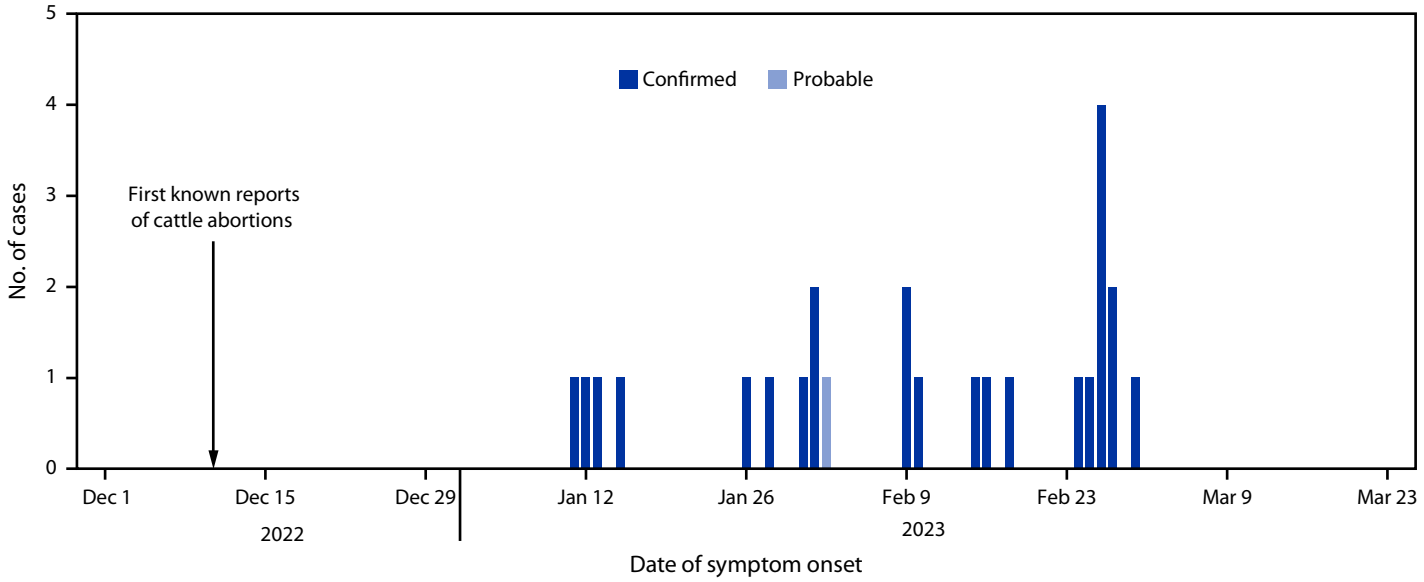
On February 7, the Mbarara District Task Force was activated to coordinate response efforts and was later joined by the National Rapid Response Team. A suspected RVF case was defined as the occurrence of fever with a negative malaria test and two or more signs or symptoms (headache, muscle pain, dizziness, blurred vision, nausea, vomiting, abdominal pain, or diarrhea) in a resident of or a visitor to Mbarara during or after December 2022. A probable case was defined as death in a person with suspected RVF and a history of livestock contact who died without laboratory testing; a confirmed case was laboratory-confirmed by RVFV RT-PCR or IgM ELISA.

Reports of spontaneous bovine (i.e., cattle) abortions and deaths began in December 2022 after unusually heavy rains during September–November. Retrospective case finding in the community identified 102 suspected RVF cases and one probable case during January–March 2023. Twenty-four suspected cases were subsequently laboratory-confirmed, 17 (71%) by RT-PCR and seven (29%) by IgM ELISA. The confirmed (24) and probable (one) cases were identified from 11 villages within five subcounties in Mbarara District. Symptom onset dates ranged from January 11 to March 1, 2023 (Figure). Median patient age was 36 years (IQR = 26–42 years), and four (16%) patients died. The most commonly reported signs and symptoms were fever (25 cases, 100%), general weakness (18, 72%), loss of appetite (16, 64%), and joint pain (15, 60%). Cases were linked to six cattle farms and three abattoirs in the affected areas. All patients reported contact with cattle that had died suddenly or had recently aborted; 15 (60%) worked on a farm where cattle abortions were reported.

Seventeen (68%) patients sought care, including 14 (82%) who visited one facility and three who visited two or more facilities before receiving a confirmed diagnosis. Eight (47%) patients who sought care were hospitalized. The average illness duration was 9 days (range = 5–29 days) among the 21 survivors and 6 days (range = 4–7 days) among the four fatalities. All known survivors have clinically recovered. Public health response to this outbreak is ongoing.

No RVF vaccine for use in humans is currently licensed. Prevention of RVF in humans requires control in animals and measures such as thorough cooking of meat and milk before consumption, use of personal protective equipment to avoid exposure to blood or tissues of infected animals, and protection against mosquitoes, and other blood-sucking insects. Vaccination is essential for prevention of animal RVFV infection; however, although the animal vaccine is approved for use in neighboring Kenya, Rwanda, and Tanzania, it has not yet been approved for use in Uganda. Enhanced vector control and improved health care provider, veterinary, and community education are urgently needed to improve surveillance and awareness on the ongoing threat of viral hemorrhagic fevers in humans and animals in Uganda.

FIGURE. Probable* (n = 1) and confirmed† (n = 24) human cases of Rift Valley fever — Mbarara District, Western Uganda, January–March 2023



* A probable case was defined as the occurrence of fever with a negative malaria test and two or more symptoms (headache, muscle pain, dizziness, blurred vision, nausea, vomiting, abdominal pain, or diarrhea) in a resident of or visitor to Mbarara during or after December 2022 who had a history of livestock contact and died without laboratory testing.

† A confirmed case was laboratory-confirmed using *Rift Valley fever virus* reverse transcription–polymerase chain reaction testing or a positive immunoglobulin M enzyme-linked immunosorbent assay test result.

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References

1. Meegan JM, Bailey CL. Rift valley fever. In: Monath TP, ed. The arboviruses: epidemiology and ecology. Boca Raton, FL: CRC Press; 2019.
2. Bird BH, Ksiazek TG, Nichol ST, Maclachlan NJ. Rift Valley fever virus. J Am Vet Med Assoc 2009;234:883–93. PMID:19335238 https://doi.org/10.2460/javma.234.7.883
3. Nyakarahuka L, de St Maurice A, Purpura L, et al. Prevalence and risk factors of Rift Valley fever in humans and animals from Kabale district in Southwestern Uganda, 2016. PLoS Negl Trop Dis 2018;12:e0006412. PMID:29723189 https://doi.org/10.1371/journal.pntd.0006412
4. Sekamatte M, Krishnasamy V, Bulage L, et al. Multisectoral prioritization of zoonotic diseases in Uganda, 2017: a One Health perspective. PLoS One 2018;13:e0196799. PMID:29715287 https://doi.org/10.1371/journal.pone.0196799
5. Bird BH, Bawiec DA, Ksiazek TG, Shoemaker TR, Nichol ST. Highly sensitive and broadly reactive quantitative reverse transcription-PCR assay for high-throughput detection of Rift Valley fever virus. J Clin Microbiol 2007;45:3506–13. PMID:17804663 https://doi.org/10.1128/JCM.00936-07

Erratum

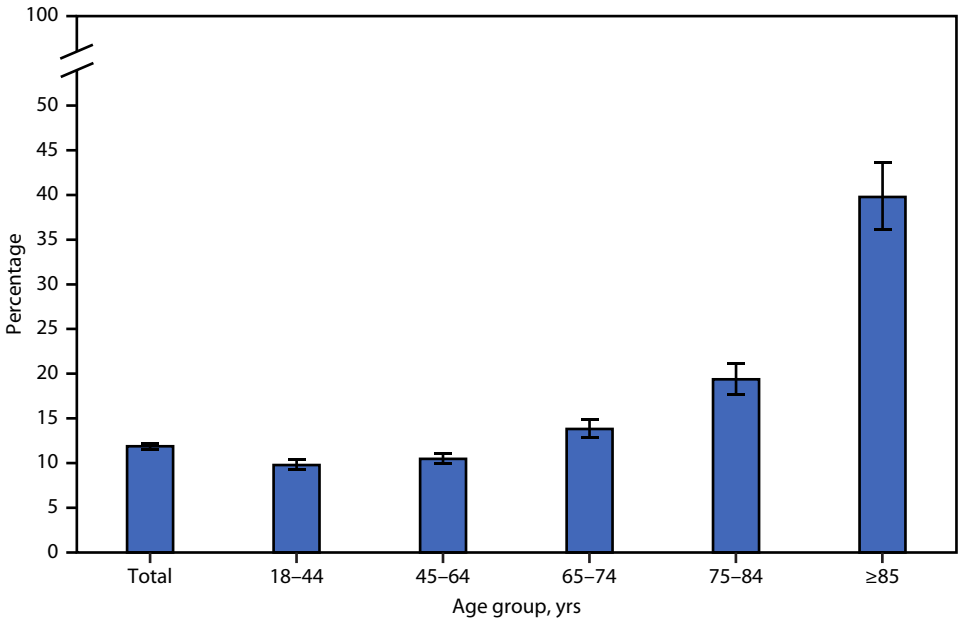
Vol. 72, No . 15

In the report, "*QuickStats*: Percentage of Adults Who Were in Families Having Problems Paying Medical Bills During the Previous 12 Months, by Race and Selected Hispanic Origin Subgroups — National Health Interview Survey, United States, 2020–2021," on page 414, in the graph, the error bars for the Black or African American, NH category should have denoted a 95% CI of **1.1–1.3** and for the White, NH category should have denoted a 95% CI of **0.4–0.5**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥18 Years Who Received Care at Home from a Friend or Family Member During the Past 12 Months,† by Age Group — National Health Interview Survey,§ United States, 2021



* With 95% CIs indicated by error bars.
† Based on a response to the question, "During the past 12 months, did you receive care at home from a friend or family member?" The definition of care was left up to respondent interpretation in most cases, but if asked, the interviewer could clarify that care encompasses a wide range of activities with which a person might need help, including personal and household tasks.
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

During 2021, 11.9% of adults aged ≥18 years received care at home from a friend or family member during the past 12 months. The percentage of adults who received care during the past 12 months was similar among adults aged 18–44 years (9.8%) and 45–64 years (10.5%), then increased with age to 13.8% among those aged 65–74 years, 19.4% among those aged 75–84 years, and more than doubled to 39.8% among those aged ≥85 years.

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

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