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Update on Vaccine-Derived Poliovirus Outbreaks — Worldwide, July 2019–February 2020

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Circulating vaccine-derived polioviruses (cVDPVs) can emerge in areas with low poliovirus immunity and cause outbreaks* of paralytic polio (*1*–*5*). Among the three types of wild poliovirus, type 2 was declared eradicated in 2015 (*1*,*2*). The use of trivalent oral poliovirus vaccine (tOPV; types 1, 2, and 3 Sabin strains) ceased in April 2016 via a 1-month–long, global synchronized switch to bivalent OPV (bOPV; types 1 and 3 Sabin strains) in immunization activities (*1*–*4*). Monovalent type 2 OPV (mOPV2; type 2 Sabin strain) is available for cVDPV type 2 (cVDPV2) outbreak response immunization (*1*–*5*). The number and geographic breadth of post-switch cVDPV2 outbreaks have exceeded forecasts that trended toward zero outbreaks 4 years after the switch and assumed rapid and effective control of any that occurred (*4*). New cVDPV2 outbreaks have been seeded by mOPV2 use, by both suboptimal mOPV2 coverage within response zones and recently mOPV2-vaccinated children or contacts traveling outside of response zones, where children born after the global switch are fully susceptible to poliovirus type 2 transmission (*2*–*4*). In addition, new emergences can develop by inadvertent exposure to Sabin OPV2-containing vaccine (i.e., residual response mOPV2 or tOPV) (*4*). This report updates the January 2018–June 2019 report with information on global cVDPV outbreaks during July 2019–February 2020 (as of March 25, 2020)† (*2*). Among 33 cVDPV outbreaks reported during July 2019–February 2020, 31 (94%) were cVDPV2; 18 (58%) of these followed new emergences. In mid-2020, the Global Polio Eradication Initiative (GPEI) plans to introduce a genetically stabilized, novel OPV type 2 (nOPV2) that has a lower risk for generating VDPV2 than does Sabin mOPV2; if nOPV2 is successful in limiting new VDPV2 emergences, GPEI foresees the replacement of Sabin mOPV2 with nOPV2 for cVDPV2 outbreak responses during 2021 (*2*,*4*,*6*).

Detection of cVDPV Type 1

No poliovirus genetically linked to the Papua New Guinea cVDPV type 1 (cVDPV1) emergence (PNG-MOR-1§) was detected after November 2018 (*1*,*2*). In Indonesia, the most

* In this report, a cVDPV outbreak is defined as two or more independent isolations (through acute flaccid paralysis [AFP] or environmental surveillance or from a healthy community member following a confirmed AFP case) of genetically linked VDPVs. The number of outbreaks is equivalent to the number of cVDPV emergences. In summaries, a given cVDPV emergence/outbreak is counted once regardless of the number of countries affected following transmission beyond national borders.

† Data as of March 25, 2020, for all emergences except ETH-ORO-1, ETH-ORO-2, ETH-ORO-3, ETH-SOM-1, and SOM-BAN-1, (as of March 24, 2020) and CHA-NDJ-1, NIE-JIS-1, NIE-KGS-1, NIE-KGS-2, NIE-SOS-6, and TOG-SAV-1 (as of March 27, 2020).

§ Names designate the country and geographic region of the emergence and the number of emergences in each geographic region.

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recent cVDPV1 outbreak isolate was from February 2019 (IDN-PAP-1), and in Myanmar (Burma), the most recent were from August 2019 (MMR-KAY-1) (*2*) (Table) (Figure 1). During the reporting period, a new cVDPV1 emergence (PHL-NCR-2) was first detected in environmental surveillance (sewage) samples collected in July 2019 in the National Capital Region of the Philippines. Genetically linked virus was isolated from sewage samples collected in Sabah State, Malaysia, in June and November 2019; however, delays in sample processing resulted in findings not being released until December 2019. The most recent isolate linked to PHL-NCR-2 was detected in a specimen from a patient from Malaysia with acute flaccid paralysis (AFP) onset in January 2020.

Detection of cVDPV2

During July 2019–February 2020, among 31 active cVDPV2 outbreaks, 18 (58%) followed new emergences; one outbreak in Malaysia and the Philippines (PHL-NCR-1) was detected during the reporting period, although genetic sequencing analyses indicate that the emergence occurred years earlier and genetically linked viruses circulated undetected by surveillance (Table) (Figure 1) (*1*,*2*). Twenty-four (77%) of the 31 active outbreaks affected African countries; seven of these (29%) resulted in international spread (Figure 2).

Western Africa. The previously described cVDPV2 emergence in Nigeria (NIE-JIS-1) continued to circulate during the reporting period (*1*,*2*); the most recent NIE-JIS-1 isolations in Niger and Nigeria were detected among specimens from AFP patients in April and October 2019, respectively. Detection of genetically linked virus from AFP patients' specimens and through environmental surveillance occurred in Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Ghana, and Togo during the reporting period. Since its first detection in Nigeria in January 2018, NIE-JIS-1 emergence has resulted in 101 cases in seven countries (*1*,*2*). Ongoing transmission of previously reported cVDPV2 emergences (NIE-KGS-1 and NIE-KGS-2) and of a new cVDPV2 emergence (NIE-SOS-6) was detected in Nigeria (*2*). No polioviruses genetically linked to other previously described emergences (NIE-SOS-3, NIE-SOS-4, and NIE-SOS-5) (*1*,*2*) were detected during the reporting period. A new emergence (TOG-SAV-1) in Togo was first detected in November 2019, and a genetically linked virus was isolated from a specimen obtained from an AFP patient in Côte d'Ivoire in February 2020.

Central Africa. Five Central African countries were affected by cVDPV2 outbreaks during July 2019–February 2020. Each country had a minimum of two cVDPV2 emergences circulating during the reporting period, with the Central African Republic (CAR) having five.

In Angola, no poliovirus genetically linked to the previously described cVDPV2 emergence (ANG-LNO-1) was detected after May 2019 (*2*). However, polioviruses genetically linked to previously described emergences (ANG-HUI-1 and ANG-LNO-2) continued to circulate during the reporting period within Angola, resulting in 78 cases (ANG-HUI-1)

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TABLE. Circulating vaccine-derived polioviruses (cVDPVs) detected, by serotype, source and other selected characteristics — worldwide, July 2019–February 2020

Country	Emergence designation*	Years detected†	Serotype	No. of isolates§ July 2019–February 2020			Capsid protein VP1 divergence from Sabin OPV strain**(%)	Date of latest outbreak case, healthy child specimen, or environmental sample††
				From AFP cases	From other human sources (non-AFP)¶	From environmental surveillance		
Afghanistan	PAK-GB-1	2020	2	0	0	10	1.1–2.0	Feb 5, 2020
Angola	ANG-HUI-1	2019–2020	2	76	2	13	0.7–1.8	Feb 9, 2020
Angola	ANG-LNO-2	2019	2	14	1	0	1.1–2.2	Dec 25, 2019
Angola	ANG-MOX-1	2019	2	12	2	0	0.8–1.6	Dec 18, 2019
Angola	ANG-LUA-1	2019	2	34	3	14	0.7–1.5	Dec 27, 2019
Benin	NIE-JIS-1	2019–2020	2	8	0	0	3.3	Jan 16 , 2020
Burkina Faso	NIE-JIS-1	2019–2020	2	1	3	0	3.7	Jan 11, 2020
Cameroon	CHA-NDJ-1	2019	2	0	0	2	1.1	Dec 16, 2019
Cameroon	NIE-JIS-1	2019	2	0	0	1	3.3	Dec 2, 2019
Cameroon	CAR-BNG-1	2020	2	1	0	0	2.2	Jan 30, 2020
CAR	CAR-BAM-1	2019	2	3	2	6	0.8–2.1	Nov 20, 2019
CAR	CAR-BER-1	2019	2	3	3	1	0.8–1.2	Dec 8, 2019
CAR	CAR-BIM-2	2019	2	0	0	3	1.3–2.2	Sep 11, 2019
CAR	CAR-BIM-3	2019	2	2	7	0	0.8–1.6	Aug 23, 2019
CAR	CAR-BNG-1	2019–2020	2	9	3	10	0.7–1.9	Feb 5, 2020
Chad	NIE-JIS-1	2019–2020	2	5	7	2	2.6–4.5	Feb 5, 2020
Chad	CHA-NDJ-1	2019–2020	2	8	3	10	0.7–2.5	Feb 5, 2020
China	CHN-XIN-1	2018–2019	2	0	1	0	3.0	Aug 18, 2019
Côte d'Ivoire	NIE-JIS-1	2019–2020	2	0	0	31	2.8–4.0	Feb 11, 2020
Côte d'Ivoire	TOG-SAV-1	2020	2	1	0	0	2.0	Feb 10, 2020
DRC	DRC-HLO-2	2019	2	13	5	0	1.0–1.7	Dec 13, 2019
DRC	DRC-KAS-3	2019–2020	2	18	6	0	1.3–2.2	Feb 8, 2020
DRC	DRC-SAN-1	2019	2	26	1	0	0.7–1.8	Nov 30, 2019
DRC	ANG-LUA-1	2019–2020	2	12	3	0	0.7–1.3	Jan 22, 2020
Ethiopia	SOM-BAN-1	2019	2	3	0	0	5.4–5.6	Aug 13, 2019
Ethiopia	ETH-ORO-1	2019–2020	2	11	3	1	1.1–2.6	Feb 12, 2020
Ethiopia	ETH-ORO-2	2019–2020	2	3	0	0	1.2–1.5	Jan 26, 2020
Ethiopia	ETH-ORO-3	2019–2020	2	1	1	0	2.0–2.2	Feb 21, 2020
Ethiopia	ETH-SOM-1	2019	2	0	1	2	1.5	Dec 30, 2019
Ghana	NIE-JIS-1	2019–2020	2	24	29	50	1.8–4.0	Feb 15 , 2020
Malaysia	PHL-NCR-1	2019	2	0	0	2	6.8–7.1	Nov 19, 2019
Malaysia	PHL-NCR-2	2019–2020	1	3	0	8	3.6–3.9	Jan 24, 2020
Myanmar§§	MMR-KAY-1	2019	1	2	5	0	3.4–3.6	Aug 21, 2019
Nigeria	NIE-JIS-1	2018–2019	2	1	2	2	2.4–2.5	Oct 9, 2019
Nigeria	NIE-KGS-1	2019–2020	2	2	1	5	0.9–1.5	Jan 26, 2020
Nigeria	NIE-KGS-2	2019	2	1	3	0	0.7–0.8	Aug 8, 2019
Nigeria	NIE-SOS-6	2019	2	0	0	1	1.1	Sep 11, 2019
Pakistan	PAK-GB-1	2019–2020	2	41	18	65	0.7–2.0	Feb 10, 2020
Pakistan	PAK-GB-2	2019	2	0	2	1	0.7–1.3	Aug 28, 2019
Pakistan	PAK-GB-3	2019	2	1	1	0	0.9–1.0	Aug 22, 2019
Pakistan	PAK-KOH-1	2019	2	1	1	2	0.7–1.3	Nov 12, 2019
Pakistan	PAK-TOR-1	2019–2020	2	2	4	4	0.7–1.5	Jan 3, 2020
Philippines	PHL-NCR-1	2019–2020	2	14	6	30	6.8–7.8	Jan 24, 2020
Philippines	PHL-NCR-2	2019	1	1	1	22	3.3–4.4	Nov 28, 2019
Somalia	SOM-BAN-1	2017–2020	2	0	0	10	5.7–6.4	Feb 4, 2020
Togo	NIE-JIS-1	2019–2020	2	11	1	0	2.7–4.1	Jan 23, 2020
Togo	TOG-SAV-1	2019–2020	2	3	2	0	1.4–1.9	Feb 1, 2020
Zambia	ZAM-LUA-1	2019	2	1	2	0	1.0–1.1	Sep 25, 2019
Zambia	ANG-MOX-1	2019	2	1	0	0	1.1	Nov 25, 2019
Total cVDPV	—¶¶	—¶¶	—¶¶	**373**	**135**	**308**	—¶¶	—¶¶

Abbreviations: AFP = acute flaccid paralysis; CAR = Central African Republic; DRC = Democratic Republic of the Congo; OPV = oral poliovirus vaccine.

* Outbreaks list total cases clearly associated with cVDPVs; emergences indicate independent cVDPV outbreaks and designate the location of the emergence and the number of emergences in a geographic region.

† Total years detected.

§ Total VDPV-positive specimens obtained from AFP patients and total VDPV-positive environmental (sewage) samples as of March 25 2020, for all emergences except the following: 1) ETH-ORO-1, ETH-ORO-2, ETH-ORO-3, ETH-SOM-1, and SOM-BAN-1 (as of March 24, 2020) and 2) CHA-NDJ-1, NIE-JIS-1, NIE-KGS-1, NIE-KGS-2, NIE-SOS-6, and TOG-SAV-1 (as of March 27, 2020).

¶ Contacts and healthy child sampling as of March 25, 2020, for all emergences except for the following: 1) ETH-ORO-1, ETH-ORO-3, and ETH-SOM-1 (as of March 24, 2020) and 2) CHA-NDJ-1, NIE-JIS-1, NIE-KGS-1, NIE-KGS-2, and TOG-SAV-1 (as of March 27, 2020).

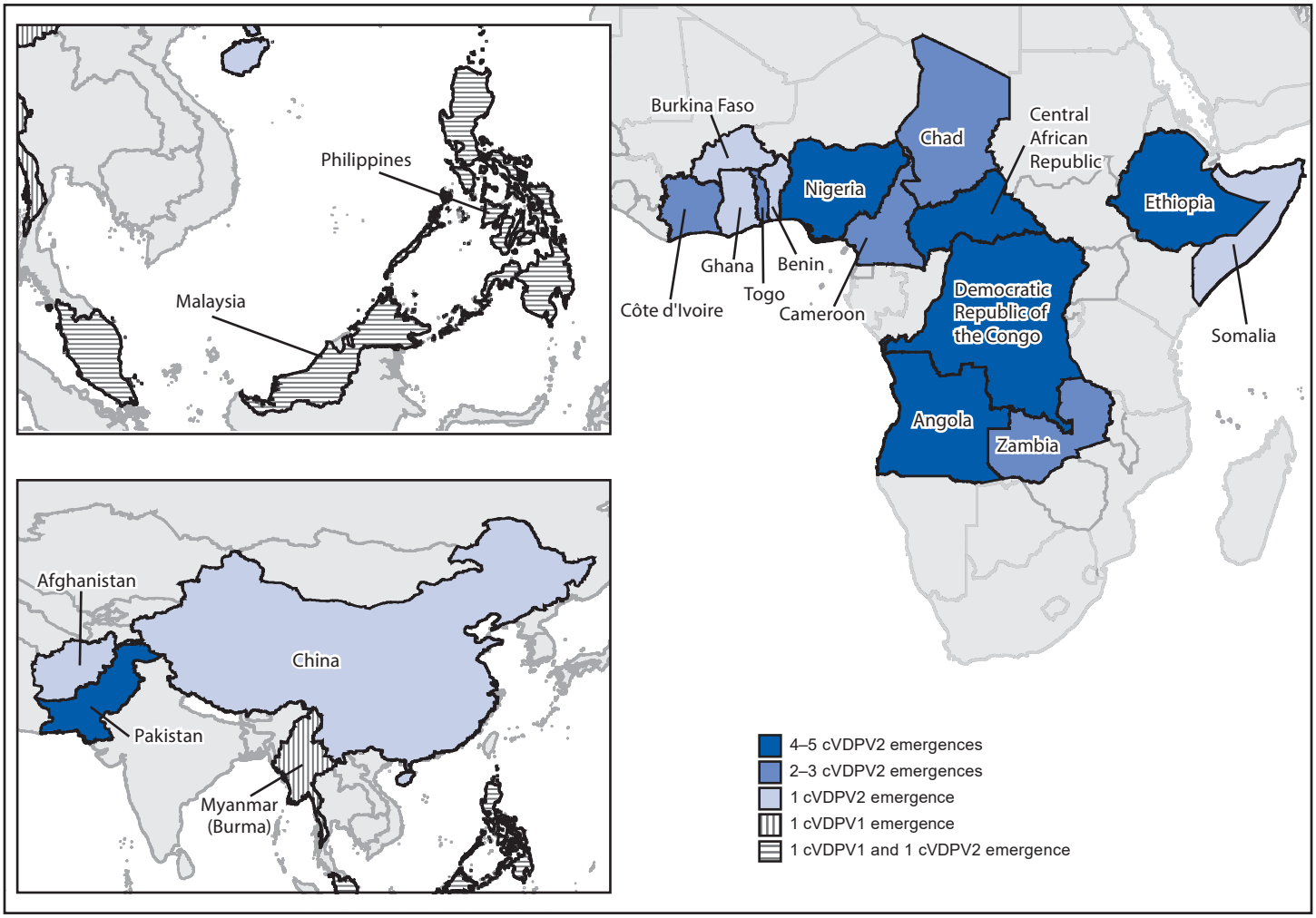
** Percentage of divergence is estimated from the number of nucleotide differences in the VP1 region from the corresponding parental OPV strain.

†† For AFP cases, dates refer to date of paralysis onset; for contacts, healthy children, and environmental (sewage) samples, dates refer to date of collection.

§§ U.S. State Department country name is Burma.

¶¶ Not cumulative data.

FIGURE 1. Ongoing circulating vaccine-derived poliovirus (cVDPV) outbreaks — worldwide, July 2019–February 2020*



Abbreviations: cVDPV1 = cVDPV type 1; cVDPV2 = cVDPV type 2.
* Data as of March 24–27, 2020.

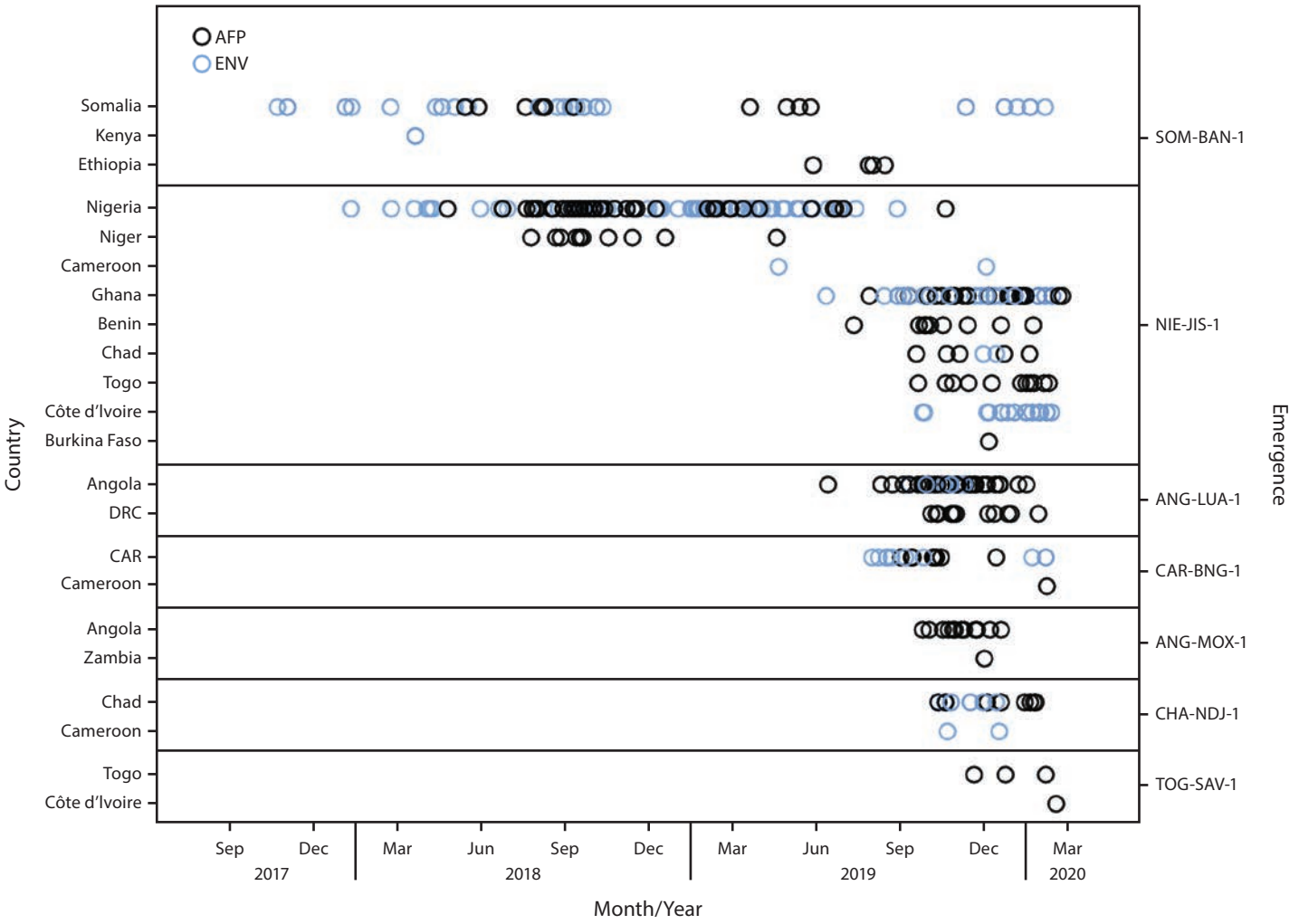
and 15 cases (ANG-LNO-2) since first detection (*2*). In addition, two new emergences were detected in June (ANG-LUA-1) and September (ANG-MOX-1) 2019, resulting in a total of 46 cVDPV2 cases in Angola; the two emergences also circulated in the Democratic Republic of the Congo (DRC; ANG-LUA-1) and Zambia (ANG-MOX-1). The detection of concurrent and independent cVDPV2 emergences in Angola might be associated with mOPV2 response–related supplementary immunization activities (SIAs; vaccination campaigns) in neighboring DRC or related to other Sabin OPV2 inadvertent exposure in Angola; investigation is ongoing.

In CAR, the previously described CAR-BAM-1 and CAR-BIM-2 emergences continued to circulate during the reporting period, resulting in three cases and six detections of CAR-BAM-1 and three detections of CAR-BIM-2 through environmental surveillance (*2*). No polioviruses genetically linked to the previously described CAR-BAM-2 or CAR-BIM-1 emergences were detected after June 2019 (*2*). Three new emergences (CAR-BER-1, CAR-BIM-3, and CAR-BNG-1) were detected during the reporting period and resulted in a total of 14 cases in CAR. Virus genetically linked to CAR-BNG-1 was isolated from a specimen obtained from an AFP patient in Cameroon with paralysis onset in January 2020.

In Chad, circulation of a new emergence (CHA-NDJ-1) was first detected in October 2019. Genetically linked viruses were continually detected in specimens from AFP patients in Chad into 2020 and from environmental surveillance in Cameroon and Chad through the end of 2019.

In DRC, the previously described emergences, DRC-HLO-2, DRC-KAS-3, and DRC-SAN-1, continued to circulate, resulting in 20, 21, and 32 cases, respectively, since detection (*2*). During the reporting period, cVDPV2 genetically linked to the Angola ANG-LUA-1 emergence was detected in specimens obtained from 12 AFP patients in DRC.

FIGURE 2. Acute flaccid paralysis (AFP) cases and environmental samples positive for circulating vaccine-derived poliovirus type 2 associated with outbreaks ongoing during July 2019–February 2020 that involved international spread since emergence, by outbreak and country — Africa, October 2017–February 2020*,†



Abbreviations: CAR = Central African Republic; DRC = Democratic Republic of the Congo; ENV = environmental surveillance.
* Dates (month/year) refer to the date of specimen collection. For samples collected on the same dates, symbols will overlap; thus, not all isolates are visible.
† Data as of March 25, 2020, for all emergences except the following: 1) SOM-BAN-1 (as of March 24, 2020) and 2) CHA-NDJ-1, NIE-JIS-1, and TOG-SAV-1 (as of March 27, 2020).

No evidence of continued circulation of the other previously described emergences (DRC-HKA-1, DRC-HLO-1, DRC-KAS-1, DRC-KAS-2, DRC-MAN-1, DRC-MON-1, and DRC-TPA-1) was found (*1*,*2*).

Southern Africa. In Zambia, the ZAM-LUA-1 emergence was detected in specimens obtained from an AFP patient and two contacts during July–September 2019. In addition, cVDPV2 linked to the ANG-MOX-1 emergence was detected in a specimen obtained from an AFP patient with paralysis onset in November 2019. In Mozambique, no transmission related to the previously described MOZ-ZAM-2 emergence has been detected since December 2018 (*2*).

Horn of Africa. During July 2019–February 2020, cVDPV2 genetically related to the previously described SOM-BAN-1 emergence, which was first detected in October 2017 in Banadir Province, Somalia (*1*–*3*), continued to circulate. During this reporting period, genetically linked virus was detected from specimens from three AFP patients in Ethiopia and in 10 sewage samples from Banadir. In Ethiopia, four new cVDPV2 emergences (ETH-ORO-1, ETH-ORO-2, ETH-ORO-3, and ETH-SOM-1) were detected during this period among specimens from 15 AFP patients and through environmental surveillance in Addis Ababa and the Somali region.

Pakistan and Afghanistan. The PAK-GB-1 emergence was the first of five total cVDPV2 emergences (PAK-GB-1, PAK-GB-2, PAK-GB-3, PAK-KOH-1, and PAK-TOR-1) detected in Pakistan during the reporting period. PAK-GB-1 has resulted in 41 AFP cases in Pakistan and has been

isolated through environmental surveillance in Pakistan and Afghanistan as recently as February 2020. The last detections of the PAK-GB-2 and PAK-GB-3 cVDPV2s were in August 2019. PAK-KOH-1 and PAK-TOR-1 emergences were detected from specimens obtained from AFP patients and through environmental surveillance during September 2019–January 2020. Current genetic evidence indicates that the 2016 mOPV2 outbreak response SIAs in Pakistan did not initiate these cVDPV2 outbreaks. Possible origins include international importations from areas using mOPV2 or inadvertent use of residual tOPV or mOPV2 (*4*).

China. The CHN-XIN-1 emergence was first isolated through environmental surveillance in Xinjiang province in April 2018; genetically linked virus was last detected in Sichuan province in August 2019 from the stool specimen of a community contact of an AFP patient who had paralysis onset in April 2019 (*2*).

Malaysia and the Philippines. During the reporting period, the PHL-NCR-1 emergence was identified from a specimen obtained from an AFP patient with paralysis onset in June 2019 in Mindanao Province, the Philippines. Subsequently, genetically linked virus was detected among specimens from 13 additional AFP patients in the Philippines and through environmental surveillance in both Malaysia and the Philippines during July 2019–February 2020.

Outbreak Control

As of the end of February 2020, no transmission was detected for ≥13 months for previously reported outbreaks related to one cVDPV1 emergence in Papua New Guinea (PNG-MOR-1), one cVDPV3 emergence in Somalia (SOM-BAN-2), and six cVDPV2 emergences in DRC (DRC-HLO-1, DRC-MAN-1, DRC-MON-1, and DRC-HKA-1), Mozambique (MOZ-ZAM-2), and Syria (designation not assigned), indicating probable outbreak cessation (*1*–*3*,*5*,*7*). Emergences of cVDPV in Angola (ANG-LNO-1); CAR (CAR-BAM-2 and CAR-BIM-1); DRC (DRC-KAS-1, DRC-KAS-2, and DRC-TPA-1); Indonesia (IDN-PAP-1); and Nigeria (NIE-SOS-3, NIE-SOS-4, and NIE-SOS-5) have had no genetically linked isolations for 7–12 months, indicating possible outbreak cessation (*1*,*2*,*5*,*7*).

Discussion

After outbreak detection, prompt and effective mOPV2 vaccination of children will interrupt cVDPV2 transmission and limit emergence of new VDPV2 strains in outbreak response zones. Although many previously identified cVDPV2 outbreaks have been interrupted or controlled as forecasted (*1*–*4*), GPEI has been challenged by the increased number of outbreaks from newly seeded VDPV2 emergences during January 2018–February 2020, following mOPV2 SIAs that did not reach sufficient coverage; in addition, there are protracted cVDPV2 outbreaks from prior emergence that have not been successfully controlled for the same reason (*1*–*4*). In areas where no mOPV2 has yet been used, approximately four birth cohorts that are fully susceptible to mucosal poliovirus type 2 infection have accumulated since the April 2016 tOPV-to-bOPV switch (*1*,*2*,*4*).

The utility of environmental surveillance to complement AFP surveillance has been demonstrated by detections of continued circulation after a long absence in detection of confirmed AFP cases (e.g., SOM-BAN-1 in Somalia) and of circulation before detection of confirmed AFP cases (e.g., NIE-JIS-1 in Ghana); some outbreak transmission has been detected only through environmental surveillance (e.g., NIE-SOS-6 in Nigeria) (*8*).

To address these challenges, GPEI adopted the 2020–2021 Strategy for the Response to Type 2 Circulating Vaccine-Derived Poliovirus as an addendum to the Polio Endgame Strategy 2019–2023 (*6*). The response strategy aims to improve the quality of mOPV2 SIAs through enhanced technical support, enactment of full international health emergency procedures, and enhanced population protection from paralysis through periodic intensification of routine immunization with bOPV and injectable inactivated poliovirus vaccine. After accelerated development and clinical testing of nOPV2 (*9*), which has a substantially lower risk for reversion to neurovirulence (*2*,*9*), this vaccine is expected to be available in mid-2020 for initial outbreak responses under emergency use listing requirements (*10*). If wider outbreak response use is allowed and ample supplies are available by the end of 2020, nOPV2 will replace Sabin mOPV2 in outbreak response to prevent new VDPV2 emergences (*6*). This time line and the course of ongoing and newly emergent cVDPV outbreaks could be negatively affected during the coronavirus disease 2019 (COVID-19) pandemic because of changes in priorities for use of health care resources and decreased immunization activities.[¶] Cessation of all OPV use after certification of polio eradication will eliminate the risk of VDPV emergence (*2*,*4*).

[¶] GPEI has offered its global technical and material assets to support the COVID-19 pandemic response and has recommended that preventive and response polio SIAs be suspended until June 1, 2020, or later. AFP and environmental surveillance activities should continue to the extent possible and according to countries' COVID-19 contexts, as well as preparations for the use of nOPV2. http://polioeradication.org/news-post/global-polio-eradication-and-covid-19/.

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Summary

What is already known about this topic?

Circulating vaccine-derived polioviruses (cVDPVs) can emerge in settings with low poliovirus immunity and can cause paralysis.

What is added by this report?

Thirty-one ongoing and new cVDPV type 2 (cVDPV2) outbreaks were documented during July 2019–February 2020; nine outbreaks spread internationally. New cVDPV2 outbreaks were often linked to poor coverage with monovalent Sabin oral poliovirus vaccine (OPV) type 2 during outbreak response campaigns.

What are the implications for public health practice?

The Global Polio Eradication Initiative plans to introduce a genetically stabilized, novel OPV type 2 for outbreak response in mid-2020 and expand use in 2021. Cessation of all OPV use after certification of polio eradication will eliminate the risk of VDPV emergence.

WHO-Regional Office for the Americas, WHO-European Region Office, WHO-Western Pacific Region Office, WHO-South-East Asian Region Office, and WHO-African Region Office; staff members, Polio Eradication Branch, Global Immunization Division, Center for Global Health, CDC; Qi Chen, Hongmei Liu, Silvia Penaranda, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, CDC; Geospatial Research, Analysis, and Services Program, Agency for Toxic Substances and Disease Registry, Division of Emergency Operations, Center for Preparedness and Response, CDC.

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Cleaning and Disinfectant Chemical Exposures and Temporal Associations with COVID-19 — National Poison Data System, United States, January 1, 2020–March 31, 2020

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On April 20, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

On January 19, 2020, the state of Washington reported the first U.S. laboratory-confirmed case of coronavirus disease 2019 (COVID-19) caused by infection with SARS-CoV-2 (*1*). As of April 19, a total of 720,630 COVID-19 cases and 37,202 associated deaths* had been reported to CDC from all 50 states, the District of Columbia, and four U.S. territories (*2*). CDC recommends, with precautions, the proper cleaning and disinfection of high-touch surfaces to help mitigate the transmission of SARS-CoV-2 (*3*). To assess whether there might be a possible association between COVID-19 cleaning recommendations from public health agencies and the media and the number of chemical exposures reported to the National Poison Data System (NPDS), CDC and the American Association of Poison Control Centers surveillance team compared the number of exposures reported for the period January–March 2020 with the number of reports during the same 3-month period in 2018 and 2019. Fifty-five poison centers in the United States provide free, 24-hour professional advice and medical management information regarding exposures to poisons, chemicals, drugs, and medications. Call data from poison centers are uploaded in near real-time to NPDS. During January–March 2020, poison centers received 45,550 exposure calls related to cleaners (28,158) and disinfectants (17,392), representing overall increases of 20.4% and 16.4% from January–March 2019 (37,822) and January–March 2018 (39,122), respectively. Although NPDS data do not provide information showing a definite link between exposures and COVID-19 cleaning efforts, there appears to be a clear temporal association with increased use of these products.

The daily number of calls to poison centers increased sharply at the beginning of March 2020 for exposures to both cleaners and disinfectants (Figure). The increase in total calls was seen across all age groups; however, exposures among children aged ≤5 years consistently represented a large percentage of total calls in the 3-month study period for each year (range = 39.9%–47.3%) (Table). Further analysis of the increase in calls from 2019 to 2020 (3,137 for cleaners, 4,591 for disinfectants), showed that among all cleaner categories, bleaches accounted for the largest percentage of the increase (1,949; 62.1%), whereas nonalcohol disinfectants (1,684; 36.7%) and hand sanitizers (1,684; 36.7%) accounted for the largest percentages of the increase among disinfectant categories. Inhalation represented the largest percentage increase from 2019 to 2020 among all exposure routes, with an increase of 35.3% (from 4,713 to 6,379) for all cleaners and an increase of 108.8% (from 569 to 1,188) for all disinfectants. Two illustrative case vignettes are presented to highlight the types of chemical exposure calls managed by poison centers.

Case 1

An adult woman heard on the news to clean all recently purchased groceries before consuming them. She filled a sink with a mixture of 10% bleach solution, vinegar, and hot water, and soaked her produce. While cleaning her other groceries, she noted a noxious smell described as "chlorine" in her kitchen. She developed difficulty breathing, coughing, and wheezing, and called 911. She was transported to the emergency department (ED) via ambulance and was noted to have mild hypoxemia and end-expiratory wheezing. She improved with oxygen and bronchodilators. Her chest radiograph was unremarkable, and she was discharged after a few hours of observation.

Case 2

A preschool-aged child was found unresponsive at home and transported to the ED via ambulance. A 64-ounce bottle of ethanol-based hand sanitizer was found open on the kitchen table. According to her family, she became dizzy after ingesting an unknown amount, fell and hit her head. She vomited while being transported to the ED, where she was poorly responsive. Her blood alcohol level was elevated at 273 mg/dL (most state laws define a limit of 80 mg/dL for driving under the influence); neuroimaging did not indicate traumatic injuries. She was admitted to the pediatric intensive care unit overnight, had improved mental status, and was discharged home after 48 hours.

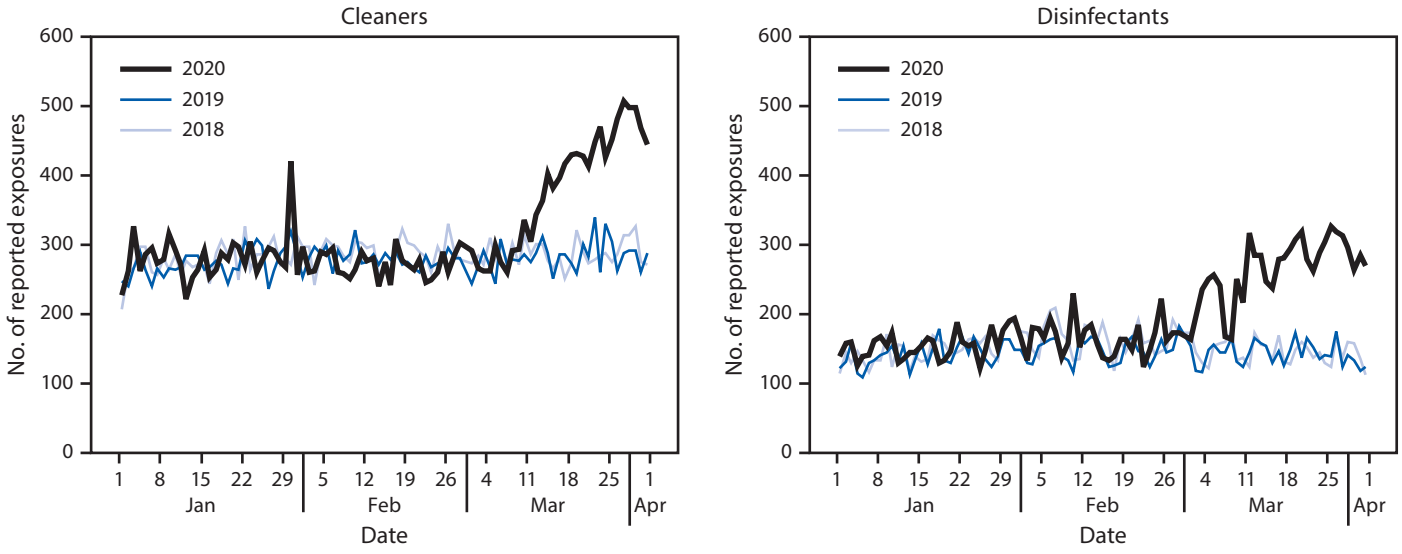
The findings in this report are subject to at least two limitations. First, NPDS data likely underestimate the total incidence and severity of poisonings, because they are limited to

*Total cases include 1,282 probable cases, and total deaths include 4,226 probable associated deaths.

persons calling poison centers for assistance. Second, data on the direct attribution of these exposures to efforts to prevent or treat COVID-19 are not available in NPDS. Although a causal association cannot be demonstrated, the timing of these reported exposures corresponded to increased media coverage of the COVID-19 pandemic, reports of consumer shortages of cleaning and disinfection products (*4*), and the beginning of some local and state stay-at-home orders.

Exposures to cleaners and disinfectants reported to NPDS increased substantially in early March 2020. Associated with increased use of cleaners and disinfectants is the possibility of improper use, such as using more than directed on the label, mixing multiple chemical products together, not wearing protective gear, and applying in poorly ventilated areas. To reduce improper use and prevent unnecessary chemical exposures, users should always read and follow directions on the label, only use water at room temperature for dilution (unless stated otherwise on the label), avoid mixing chemical products, wear eye and skin protection, ensure adequate ventilation, and store chemicals out of the reach of children.

FIGURE. Number of daily exposures to cleaners and disinfectants reported to U.S. poison centers — United States, January–March 2018, 2019, and 2020*,†



* Excluding February 29, 2020.
† Increase in exposures to cleaners on January 29, 2020, came from an unintentional exposure to a cleaning agent within a school.

TABLE. Number and percentage of exposures to cleaners and disinfectants reported to U.S. poison centers, by selected characteristics — United States, January–March 2018, 2019, and 2020

	No. (%)					
	Cleaners			Disinfectants		
Characteristic	2018	2019	2020	2018	2019	2020
Total	**25,583 (100.0)**	**25,021 (100.0)**	**28,158 (100.0)**	**13,539 (100.0)**	**12,801 (100.0)**	**17,392 (100.0)**
Age group (yrs)						
0–5	10,926 (42.7)	10,207 (40.8)	10,039 (35.7)	7,588 (56.0)	6,802 (53.1)	8,158 (46.9)
6–19	2,655 (10.4)	2,464 (9.8)	2,516 (8.9)	1,803 (13.3)	1,694 (13.2)	2,358 (13.6)
20–59	8,072 (31.6)	8,203 (32.8)	9,970 (35.4)	2,659 (19.6)	2,791 (21.8)	4,056 (23.3)
≥60	1,848 (7.2)	1,936 (7.7)	2,356 (8.4)	929 (6.9)	848 (6.6)	1,455 (8.4)
Unknown	2,082 (8.1)	2,211 (8.8)	3,277 (11.6)	560 (4.1)	666 (5.2)	1,365 (7.8)
Exposure route*						
Ingestion	16,384 (64.0)	15,710 (62.8)	16,535 (58.7)	11,714 (86.5)	10,797 (84.3)	13,993 (80.5)
Inhalation	4,747 (18.6)	4,713 (18.8)	6,379 (22.7)	540 (4.0)	569 (4.4)	1,188 (6.8)
Dermal	4,349 (17.0)	4,271 (17.1)	4,785 (17.0)	1,085 (8.0)	1,078 (8.4)	1,695 (9.7)
Ocular	3,355 (13.1)	3,407 (13.6)	3,802 (13.5)	984 (7.3)	1,067 (8.3)	1,533 (8.8)
Other/Unknown	182 (0.7)	169 (0.7)	166 (0.6)	89 (0.7)	95 (0.7)	147 (0.8)

* Exposure might have more than one route.

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Notes from the Field

Outbreak of Human Immunodeficiency Virus Infection Among Persons Who Inject Drugs — Cabell County, West Virginia, 2018–2019

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In January 2019, West Virginia Bureau for Public Health (WVBPH) surveillance staff members noted an increase in diagnoses of human immunodeficiency virus (HIV) infection among persons who inject drugs in Cabell County, West Virginia (population approximately 91,900*). Cabell County, part of a medium-sized metropolitan statistical area and home to the city of Huntington (population approximately 46,000†), had historically high rates of substance use disorder but low rates of HIV infection (*1*). During 2013–2017, an annual average of two diagnoses of HIV infection had occurred among Cabell County persons who inject drugs; however, in 2018, 14 diagnoses occurred, including seven in the fourth quarter.

WVBPH requested assistance from CDC for a public health investigation and response. WVBPH, the Cabell-Huntington Health Department (CHHD), and CDC investigated to characterize the outbreak and guide public health interventions. Initial investigation found that at the time this increase in diagnoses of HIV infection was detected, access to HIV testing and preexposure prophylaxis (PrEP) in Cabell County was limited. Although a harm reduction program, including access to sterile syringes, had been operating at CHHD since September 2015, stricter requirements, including proof of Cabell County residency, were initiated in May 2018, which limited access to these services. Moreover, knowledge about HIV, the outbreak, and treatment for substance use disorder was low, and initiation of treatment for HIV or substance use disorder among persons who inject drugs was also low.

Interventions to address these challenges were rapidly scaled up by staff members from WVBPH, CHHD, CDC, and community partners. A case was defined as a new diagnosis of HIV infection during January 1, 2018–October 9, 2019 in 1) a person who injects drugs (regardless of other risk factors), who resided or was homeless in Cabell County at diagnosis, whose HIV diagnosis occurred in Cabell County, or who reported injecting drugs or accessing syringe services in Cabell County; or 2) a sex or needle-sharing partner of someone meeting criterion 1; or 3) a person whose HIV-1 polymerase sequence was linked at a genetic distance of ≤0.5% to that of a person meeting criterion 1 (*2*).

CDC staff members provided surge capacity to interview persons with a new diagnosis of HIV and offer HIV prevention services to approximately 600 identified partners and social contacts of these persons. Screening events were conducted to test persons at high risk, provide health education, and link or reengage persons in HIV care. The team worked with local hospitals, clinics, substance use disorder treatment providers, and community-based organizations to scale up HIV testing at locations where persons who inject drugs accessed services. A social network strategy driven by peer recruitment was implemented to reach persons who inject drugs who were not already engaged in the harm reduction program and their sexual and social contacts. The team also partnered with local infectious disease providers and support staff members to improve linkage to HIV and hepatitis C virus care and reengagement for persons who were no longer in care. Interviews were conducted with persons who inject drugs who also reported exchanging sex for money or drugs to identify barriers (e.g., stigma, discrimination, and location and hours of services) that might hinder access to prevention services and to guide service delivery. In addition, the team expanded access to PrEP by training new providers and supporting PrEP implementation at CHHD and two community health systems.

As of January 26, 2020, a total of 82 persons had met the case definition (Table). Among 61 (74%) persons with a $CD4^+$ count measured ≤3 months after diagnosis, median $CD4^+$ count was 583 (range = 6–1,057), indicating that many infections were recent. Among 50 persons who had an available HIV-1 polymerase sequence test result, 46 (92%) were part of a single cluster of closely related infections, indicating rapid transmission. As a result of the combined response activities, approximately 450 new clients enrolled in the harm reduction program, including approximately 50 persons living with HIV infection. CDC assisted in the development of educational campaigns and materials related to HIV infection, substance use disorder, stigma, PrEP, safe injection, and safe syringe and needle disposal for persons who inject drugs and community members. WVBPH and CHHD continue to work together in this response, and WVBPH is improving preparedness for detecting and responding to other clusters and outbreaks statewide through enhanced surveillance.

* https://www.census.gov/quickfacts/cabellcountywestvirginia.
† https://www.census.gov/quickfacts/huntingtoncitywestvirginia.

TABLE. Characteristics of persons with outbreak-associated human immunodeficiency virus infection — Cabell County, West Virginia, January 1, 2018–October 9, 2019*

Characteristic	No. (%)
Total	**82 (100)**
Sex	
Male	49 (60)
Female	33 (40)
Age group (yrs)	
<20	0 (0)
20–39	61 (74)
≥40	21 (26)
Race/Ethnicity	
White, non-Hispanic	75 (92)
Black, non-Hispanic	1 (1)
Hispanic	1 (1)
Other	5 (6)
Transmission category	
Injection drug use	75 (92)
Male-to-male sex and injection drug use	6 (7)
Male-to-male sex	1 (1)
Exchanged sex for money or drugs	24 (29)
Laboratory evidence of current or past hepatitis C virus infection	72 (88)

* Data were last updated on January 26, 2020.

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

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Notes from the Field

Multiple Cruise Ship Outbreaks of Norovirus Associated with Frozen Fruits and Berries — United States, 2019

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From July to September 2019, cruise line X experienced sudden, unexplained outbreaks (>3% of the passenger population) of acute gastroenteritis (AGE) among passengers on 10 cruise ships sailing in Europe. The rapid onset of vomiting and diarrhea followed by recovery within 24 hours were consistent with norovirus infection. Investigations by the cruise line throughout the summer yielded no clear source of the outbreaks even after extensive food testing. On September 18, 2019, CDC's Vessel Sanitation Program (VSP) was notified of an outbreak of AGE on cruise ship A of cruise line X, sailing into U.S. jurisdiction (defined as passenger vessels carrying ≥13 passengers sailing to the United States from a foreign port) from Germany to New York City (*1*). By the end of the 19-day voyage on September 23, a total of 117 of 2,046 (5.7%) passengers and eight of 610 (1.3%) crew members met the case definition for AGE (three or more loose stools within a 24-hour period or more than normal for the patient, or vomiting plus one other sign or symptom including fever, diarrhea, bloody stool, myalgia, abdominal cramps, or headache). Four stool specimens were collected and tested for norovirus at CDC's National Calicivirus Laboratory; three tested positive for norovirus by quantitative reverse transcription–polymerase chain reaction (RT-PCR). No outbreak source was determined after a field investigation by a VSP team on September 22.

The following month, on October 7, CDC's VSP was notified of two more outbreaks in U.S. jurisdiction. The first outbreak occurred on another ship (ship B) of cruise line X sailing to and from New York City along the eastern seaboard and affected 85 (3.9%) of 2,166 passengers and 10 (1.6%) of 612 crew members; the second outbreak occurred on ship A sailing from Montreal to New York City and affected 83 (3.7%) of 2,251 passengers and 10 (1.6%) of 610 crew members. VSP again conducted outbreak investigations on October 12 (ship B) and October 13 (ship A). Five stool specimens from ship B and two from ship A were collected for laboratory testing. During the field investigations, cruise line X's public health officials reported to VSP that after reviewing food questionnaires completed by ill passengers on ship B, nearly 80% of completed questionnaires implicated a smoothie made from frozen fruits and berries. Because of the epidemiologic link and because berries have been implicated in past outbreaks (*2*,*3*), CDC requested assistance from the Food and Drug Administration (FDA) to collect frozen fruit and berry items from ship B for norovirus testing. Food item lot numbers from ship B matched those from the same frozen fruit and berry items on ship A.

Overall, nine of 11 stool samples from the three outbreak voyages on ships A and B tested positive for norovirus by quantitative RT-PCR at CDC; these included three of four from ship A's first voyage, four of five from ship B, and two of two from ship A's second voyage. The samples were typed as GII.2[P16]. FDA tested 16 frozen fruit and berry items, and three items tested positive for norovirus: raspberries (norovirus genogroup II), tropical fruit cocktail (norovirus genogroup I), and berry mix (norovirus genogroup I). Norovirus sequences from the stool samples and from raspberries were 97.5% similar. After removal of the fruit items, no further outbreaks were reported on cruise line X.

Upon further review of food provisioning, cruise line X determined that its food vendor had purchased several containers (nearly 22,000 pounds) of frozen raspberries of the same lot from a supplier in China beginning the end of June 2019. These raspberries had been supplied to the entire fleet of cruise line X. Both the epidemiologic and laboratory data implicated the raspberries as the cause of the outbreaks. As a result of these findings, on November 11, the World Health Organization issued a recall notice* for frozen raspberries traced back to China. This investigation highlights the importance of AGE surveillance at sea to prevent transmission of AGE illness through U.S. ports and to identify contaminated foods at sea that had not yet been implicated on land.

* https://webgate.ec.europa.eu/rasff-window/portal/?event=notificationDetail&NOTIF_REFERENCE=2019.3843.

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Aron Hall, Division of Viral Diseases, National Center for Immunizations and Respiratory Diseases, CDC; Meghan Holst, ORISE fellow, Division of Environmental Health Science and Practice, National Center for Environmental Health, CDC; Nicole Vaught, Food and Drug Administration (FDA); Yuyan Liang, Tracy Portelli, FDA; FDA food laboratories.

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Erratum

Vol. 69, No. SS-4

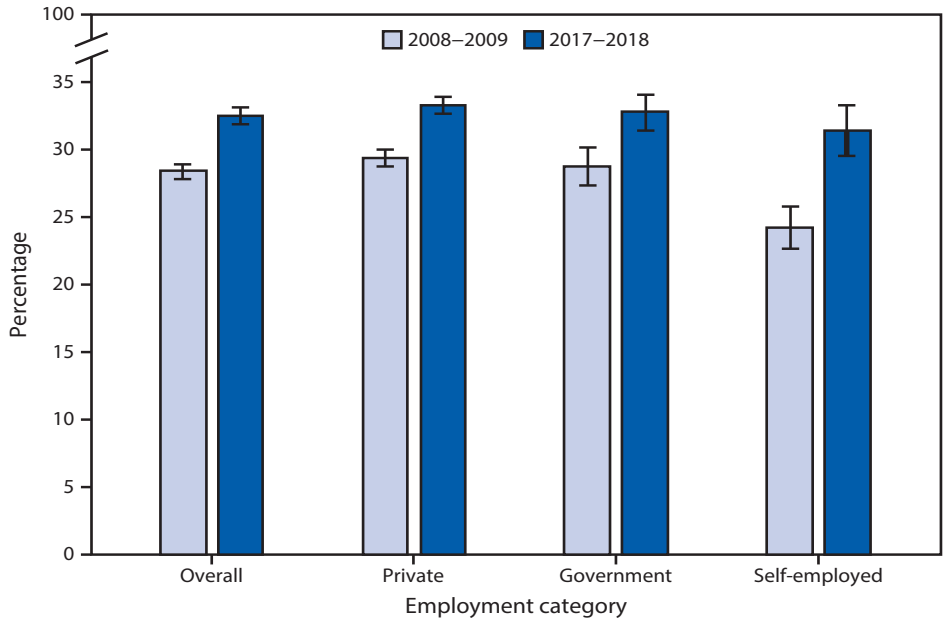
In the Surveillance Summary "Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2016," errors occurred in the Abstract and Table 2 and Table 3.

On page 1 in Results, the percentage of girls with intellectual disability should have been **39%.** On page 11, the second footnote of Table 2 should have referenced **Supplementary Table 7**. On page 11, the fourth column header in Table 3 should have been IQ **≤70**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Currently Employed Adults Aged ≥18 Years Who Reported an Average of ≤6 Hours of Sleep† per 24-Hour Period, by Employment Category§ — National Health Interview Survey, United States, 2008–2009 and 2017–2018¶



* With 95% confidence intervals shown with error bars.
† Based on responses to the following question: "On average, how many hours of sleep do you get in a 24-hour period?"
§ Based on responses to a question that asked for the category that best described the respondent's current job or work situation. Only selected categories are shown. Federal, state, and local government employees were aggregated in the government category.
¶ Estimates were based on household interviews of a sample of the noninstitutionalized U.S. civilian population and are derived from the National Health Interview Survey Sample Adult component.

The percentage of employed adults who reported an average of ≤6 hours of sleep per 24-hour period increased from 28.4% during 2008–2009 to 32.6% during 2017–2018. During this period, increases were noted among private sector employees (29.5% to 33.3%), government employees (28.8% to 32.8%), and the self-employed (24.3% to 31.4%). A lower percentage of the self-employed reported ≤6 hours of sleep compared with private sector and government employees during 2008–2009. The smaller differences by employment categories noted during 2017–2018 were not statistically significant.

Source: National Health Interview Survey, 2008–2009 and 2017–2018. https://www.cdc.gov/nchs/nhis.htm.

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