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World Hepatitis Day — July 28, 2019

World Hepatitis Day, observed each year on July 28, was established to raise awareness and promote understanding of viral hepatitis around the world. The theme of this year's World Hepatitis Day is "Invest in Eliminating Hepatitis," underscoring the need to increase commitment for hepatitis response. In 2015, an estimated 257 million persons were living with hepatitis B and 71 million with hepatitis C worldwide (*1*).

Persons who inject drugs are at highest risk for hepatitis C virus (HCV) infection. Globally, an estimated 15.6 million persons aged 15–64 years inject drugs, 52% of whom are HCV-antibody positive (*2*). This issue of *MMWR* features a report on the progress in the country of Georgia toward prevention and detection of HCV infection, and linkage to treatment, of persons with HCV infection who inject drugs (*3*). Georgia's hepatitis C elimination program, launched in 2015, was recently named the world's first Centre of Excellence in Viral Hepatitis Elimination by the European Association for the Study of the Liver International Liver Foundation. Access to hepatitis C testing and treatment for persons who inject drugs is critical to achieving elimination in countries where persons who inject drugs account for a significant proportion of HCV infection. Additional information and resources about viral hepatitis are available at https://www.cdc.gov/hepatitis.

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Progress in Testing for and Treatment of Hepatitis C Virus Infection Among Persons Who Inject Drugs — Georgia, 2018

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In April 2015, the country of Georgia, with a high prevalence of hepatitis C virus (HCV) infection (5.4% of the adult population, approximately 150,000 persons), embarked on the world's first national elimination program (*1*,*2*). Nearly 40% of these infections are attributed to injection drug use, and an estimated 2% of the adult population currently inject drugs, among the highest prevalence of injection drug use in the world (*3*,*4*). Since 2006, needle and syringe programs (NSPs) have been offering HCV antibody testing to persons who inject drugs and, since 2015, referring clients with positive test results to the national treatment program. This report summarizes the results of these efforts. Following implementation of the elimination program, the number of HCV antibody

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tests conducted at NSPs increased from an average of 3,638 per year during 2006–2014 to an average of 21,551 during 2015–2018. In 2017, to enable tracking of clinical outcomes among persons who inject drugs, NSPs began encouraging clients to voluntarily provide their national identification number (NIN), which all citizens must use to access health care treatment services. During 2017–2018, a total of 2,780 NSP clients with positive test results for HCV antibody were identified in the treatment database by their NIN. Of 494 who completed treatment and were tested for HCV RNA ≥12 weeks after completing treatment, 482 (97.6%) were cured of HCV infection. Following the launch of the elimination program, Georgia has made much progress in hepatitis C screening among persons who inject drugs; recent data demonstrate high cure rates achieved in this population. Testing at NSPs is an effective strategy for identifying persons with HCV infection. Tracking clients referred from NSPs through treatment completion allows for monitoring the effectiveness of linkage to care and treatment outcomes in this population at high risk, a key to achieving hepatitis C elimination in Georgia. The program in Georgia might serve as a model for other countries.

The Georgian Harm Reduction Network began operating and receiving hepatitis C testing data from NSPs in 2006. As of 2016, 16 NSPs were operating in 13 cities across Georgia. During 2017–2018, with additional resources provided by the Global Fund to Fight AIDS, Tuberculosis and Malaria, two additional NSP centers and eight mobile NSP units became operational, increasing coverage to approximately 50 of 79 municipalities countrywide. The Georgian Harm Reduction Network also provides diverse services* to persons who inject drugs to improve their health outcomes (*5*).

Persons who inject drugs and who test positive with a rapid HCV antibody test at NSPs are offered case management support and referred to authorized treatment sites for testing to confirm active HCV infection.† Since 2017, those persons who agree to treatment referral are asked to provide their 11-digit NIN to the NSP so that further clinical management can be confirmed and documented in the national program treatment database. Once at the treatment center, those patients with confirmed infection are enrolled in the treatment program and, if eligible for treatment, prescribed a direct-acting antiviral regimen according to national treatment guidelines (*6*). Within 12–24 weeks of completing treatment, patients are instructed to return to the treatment site for HCV RNA testing to determine whether sustained viral response (i.e., virologic cure) was achieved. Demographics, diagnostics, and treatment outcomes are recorded in real-time in the national program treatment database.

For this analysis, program records from the Georgian Harm Reduction Network were reviewed to ascertain annual HCV

* Services provided though the Georgian Harm Reduction Network include distribution of sterile injecting equipment, condoms, and naloxone; voluntary counselling and testing for hepatitis C, human immunodeficiency virus, hepatitis B, and syphilis; peer-to-peer education; raising prevention awareness among persons who inject drugs; and advocacy for increased access to NSPs.
† Positive for HCV RNA or HCV core antigen.

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antibody screening and positivity frequencies at NSPs during January 2006–December 2018 among persons who inject drugs; age group and sex distribution data were available from NSPs for 2015–2018. NSPs entered testing and service provision data into a database, which were validated by data management specialists at the Georgian Harm Reduction Network. Deduplication of test results was not conducted during 2006–2013 because of insufficient resources; during 2014–2018, deduplication of results was performed for each calendar year. Data for HCV antibody-positive persons who inject drugs who provided their NIN to NSPs during January 1, 2017–December 31, 2018, were linked to the national program treatment database to ascertain the hepatitis C care cascade, which summarizes the sequential steps in care. Because this analysis constituted a program evaluation, institutional review board oversight was not indicated.

During 2006–2018, NSPs provided 118,943 HCV antibody tests to persons who inject drugs, 48,228 (40.5%) of which were positive (Figure 1). During the years preceding program implementation (2006–2014), 32,738 (average 3,638 per year) tests were conducted; nearly half (49.6%; 16,247) were positive. Following implementation of the elimination program (2015–2018), the average number of antibody tests performed each year among persons who inject drugs increased approximately 500%, to 21,551. Among the 86,205 HCV antibody tests provided during this period, 31,981 (37.1%) were positive. Males accounted for 96.1% of tests, and persons aged 30–39 years were the most frequently tested age group (33.7%). In 2018, the HCV antibody prevalence among persons aged 18–29 years was 5.5%, the lowest among all age groups during 2015–2018. HCV antibody positivity was 37.8% among males and 24.0% among females tested at NSPs during 2015–2018.

During 2017–2018, among 12,163 HCV antibody-positive test results from 11,424 clients at NSPs, 2,780 (24.3%) persons were identified by their NIN in the national treatment database, 1,626 (58.5%) of whom received a follow-up diagnostic test for active HCV infection (Figure 2). Among those tested, 1,370 (84.3%) had active HCV infection. Of those with active infection, 1,029 (75.1%) initiated treatment, 892 (86.7%) of whom completed treatment and were eligible for sustained viral response testing. Of these, 494 (55.4%) returned for sustained viral response testing, 482 (97.6%) of whom achieved cure.

Discussion

Hepatitis C testing at NSPs in Georgia is an effective strategy for identifying persons with HCV infection. During the 3 years following the launch of the elimination program in Georgia in 2015, the number of HCV antibody tests performed at NSPs increased nearly fivefold, and the number of persons with positive test results doubled, compared with the number with positive test results during 2006–2014. Further, voluntary

FIGURE 1. Number of tests for hepatitis C virus (HCV) antibody conducted and positive test results among persons who inject drugs — Georgian Harm Reduction Network, Georgia, 2006–2018

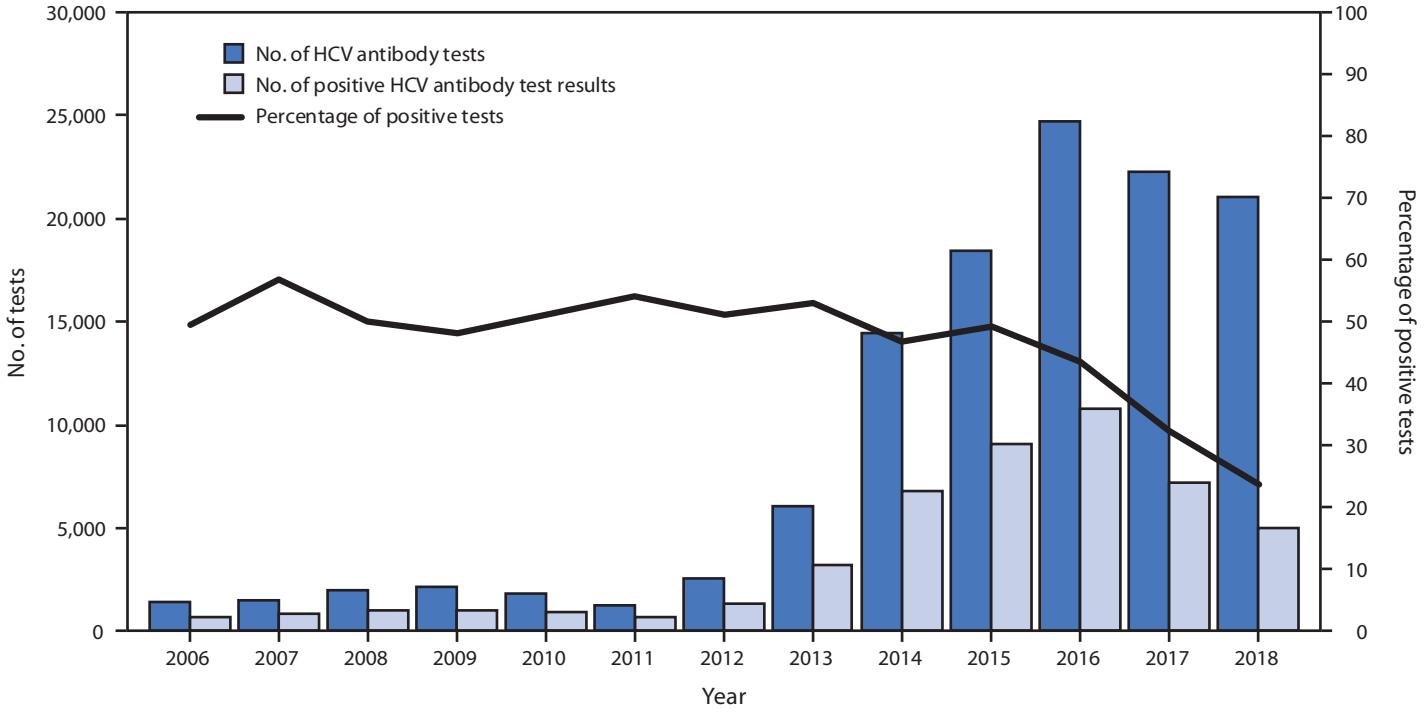
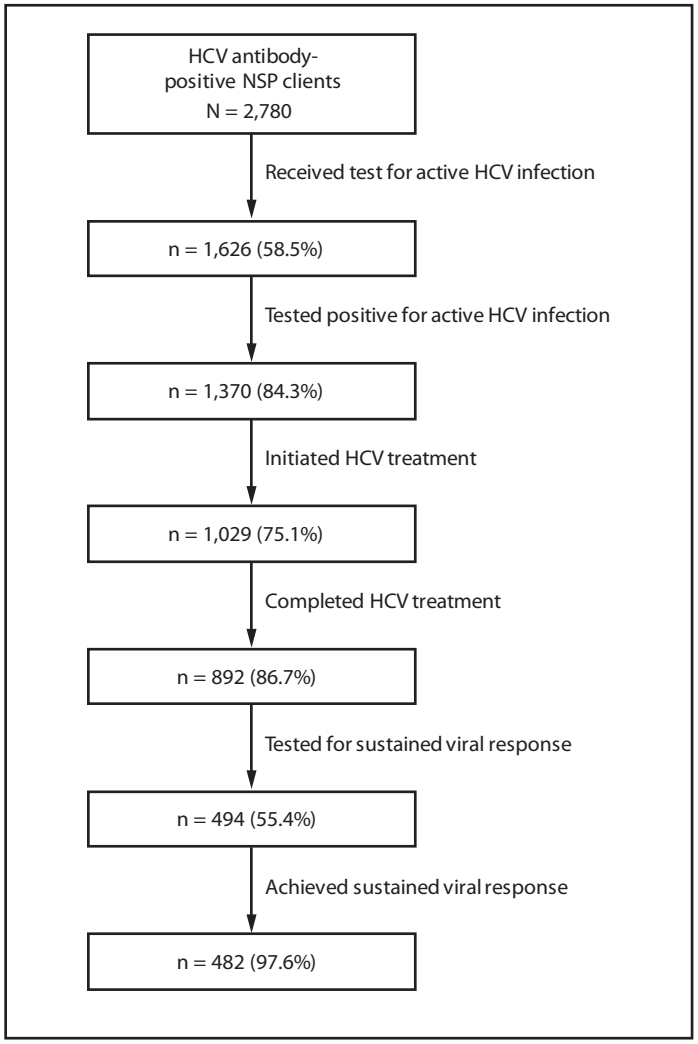


FIGURE 2. Hepatitis C virus (HCV) testing* and treatment outcomes among persons who inject drugs referred by needle and syringe programs (NSPs) to the national hepatitis C treatment program, as identified by their national identification numbers — Georgia, 2017–2018



* HCV RNA or HCV core antigen.

use of the NIN among persons who inject drugs and receive services at NSPs permitted monitoring the linkage to care and treatment, as well as treatment outcomes, among this population at high risk. The number of tests performed annually at NSPs peaked in 2016, and the percentage of positive test results has been trending down since the launch of the elimination program in 2015. The reasons for the decrease in testing after 2016 are unclear but might represent a decreasing pool of persons who inject drugs and remain unaware of their HCV infection status. The decrease in the proportion of positive test results at NSPs during 2016–2018 suggests that a higher proportion of persons who inject drugs screened in recent years have not yet had exposure to HCV. This interpretation is supported by the finding that among all age groups, those aged 18–29 years had the lowest HCV antibody positivity prevalence in 2018 and might attest to the effectiveness of the prevention measures provided by NSPs. Given the estimate of approximately 50,000 persons who inject drugs in Georgia and that nearly 120,000 HCV antibody tests have been conducted at NSPs (with approximately 50,000 positive HCV antibody test results) since 2006, it is likely that the majority of persons who inject drugs in Georgia have been tested at least once for HCV antibody.

Fewer than one fourth of persons who inject drugs agreed to provide their NIN to NSPs for the purpose of tracking clinical outcomes. Stigma related to drug use and fear of adverse legal, social, and economic consequences might discourage persons from disclosing their NIN to NSPs before accessing hepatitis C care and treatment (*6*). To avoid revealing their injection drug use status in the national registry and treatment database, persons could opt to visit treatment sites without divulging their affiliation with NSP services. At present, no incentives are offered by NSPs to motivate persons to provide their NIN. Without the NIN, persons who inject drugs cannot be tracked throughout the cascade of hepatitis C care, and the degree to which elimination efforts are proceeding in this population is hard to ascertain. A study is currently underway to examine the feasibility and effectiveness of providing screening, care, and treatment services at NSPs.

The findings in this report are subject to at least three limitations. First, data from NSP screening and the treatment programs could not be independently verified and could be subject to data entry errors. Second, resources were unavailable to deduplicate NSP test records before 2014; thus, it is not known whether each HCV antibody test during 2006–2013 represented a single person screened. Finally, because only a small proportion of screening data from NSPs were linked to

Summary

What is already known about this topic?

Georgia, with a high prevalence of hepatitis C virus (HCV) infection and a high prevalence of injection drug use, launched a hepatitis C elimination program in 2015. Since 2006, needle and syringe programs (NSPs) have offered HCV antibody testing for persons who inject drugs.

What is added by this report?

Following the launch of the hepatitis C elimination program, the number of HCV antibody tests performed at NSPs has increased fivefold, and the number of persons with positive test results has doubled.

What are the implications for public health practice?

Hepatitis C testing at NSPs is an effective strategy for identifying persons with HCV infection. The program in Georgia might serve as a model for other countries.

treatment data, this analysis could not fully assess the effectiveness of linkage from NSP screening to the national care and treatment program.

Strategies to engage persons who inject drugs in hepatitis C prevention, care, and treatment are needed to ensure elimination in Georgia. Lessons from Georgia could inform other countries with a high prevalence and similar epidemiology of hepatitis C.

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All authors have completed and submitted the ICMJE form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Progress Toward Poliomyelitis Eradication — Nigeria, January 2018–May 2019

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The number of wild poliovirus (WPV) cases in Nigeria decreased from 1,122 in 2006 to six WPV type 1 (WPV1) in 2014 (*1*). During August 2014–July 2016, no WPV cases were detected; during August–September 2016, four cases were reported in Borno State. An insurgency in northeastern Nigeria had resulted in 468,800 children aged <5 years deprived of health services in Borno by 2016. Military activities in mid-2016 freed isolated families to travel to camps, where the four WPV1 cases were detected. Oral poliovirus vaccine (OPV) campaigns were intensified during August 2016–December 2017; since October 2016, no WPV has been detected (*2*). Vaccination activities in insurgent-held areas are conducted by security forces; however, 60,000 unvaccinated children remain in unreached settlements. Since 2018, circulating vaccine-derived poliovirus type 2 (cVDPV2) has emerged and spread from Nigeria to Niger and Cameroon; outbreak responses to date have not interrupted transmission. This report describes progress in Nigeria polio eradication activities during January 2018–May 2019 and updates the previous report (*2*). Interruption of cVDPV2 transmission in Nigeria will need increased efforts to improve campaign quality and include insurgent-held areas. Progress in surveillance and immunization activities will continue to be reviewed, potentially allowing certification of interruption of WPV transmission in Africa in 2020.

Security Situation

A violent insurgency that arose in 2009 and was followed by insurgents seizing territory beginning in 2012 in Borno, Adamawa, and Yobe states (and bordering areas of Cameroon, Chad, and Niger) led to the internal displacement of 1.8 million persons (*3*). By 2016, this conflict created a humanitarian crisis in which an estimated 468,800 children aged <5 years resided in insurgent-held areas in Borno with no health services, including vaccination and surveillance activities (*2*). Since December 2016, movement of populations within and out of Borno insurgent-held areas has continued with increasing numbers of persons now living in areas outside insurgents' control; however, many settlements remain inaccessible (Figure).

Routine Childhood Immunization

National coverage levels for the third dose of poliovirus vaccine (Pol3) delivered through routine immunization services by age 12 months have been <60% since 2002,* with lower rates in northern states. A 2016 survey indicated that Pol3 coverage nationally was 33% and <25% in seven of 13 northern states (*4*).

Poliovirus Surveillance

Acute flaccid paralysis surveillance. The quality of polio surveillance is assessed by nonpolio AFP (NPAFP) rates and stool collection adequacy.† Targets for Nigeria are an NPAFP rate of three or more cases per 100,000 population aged <15 years per year and stool collection adequacy ≥80% of AFP cases. In 2018, the national NPAFP rate was 9.6, and stool adequacy was 95%. As of May 31, 2019, the annualized national 2019 NPAFP rate was 8.0, and stool adequacy was 95%. In Borno, in 2018, the NPAFP rate was 24.5 with 85% stool adequacy; the annualized 2019 NPAFP rate is 19.6 and stool adequacy is 87%.

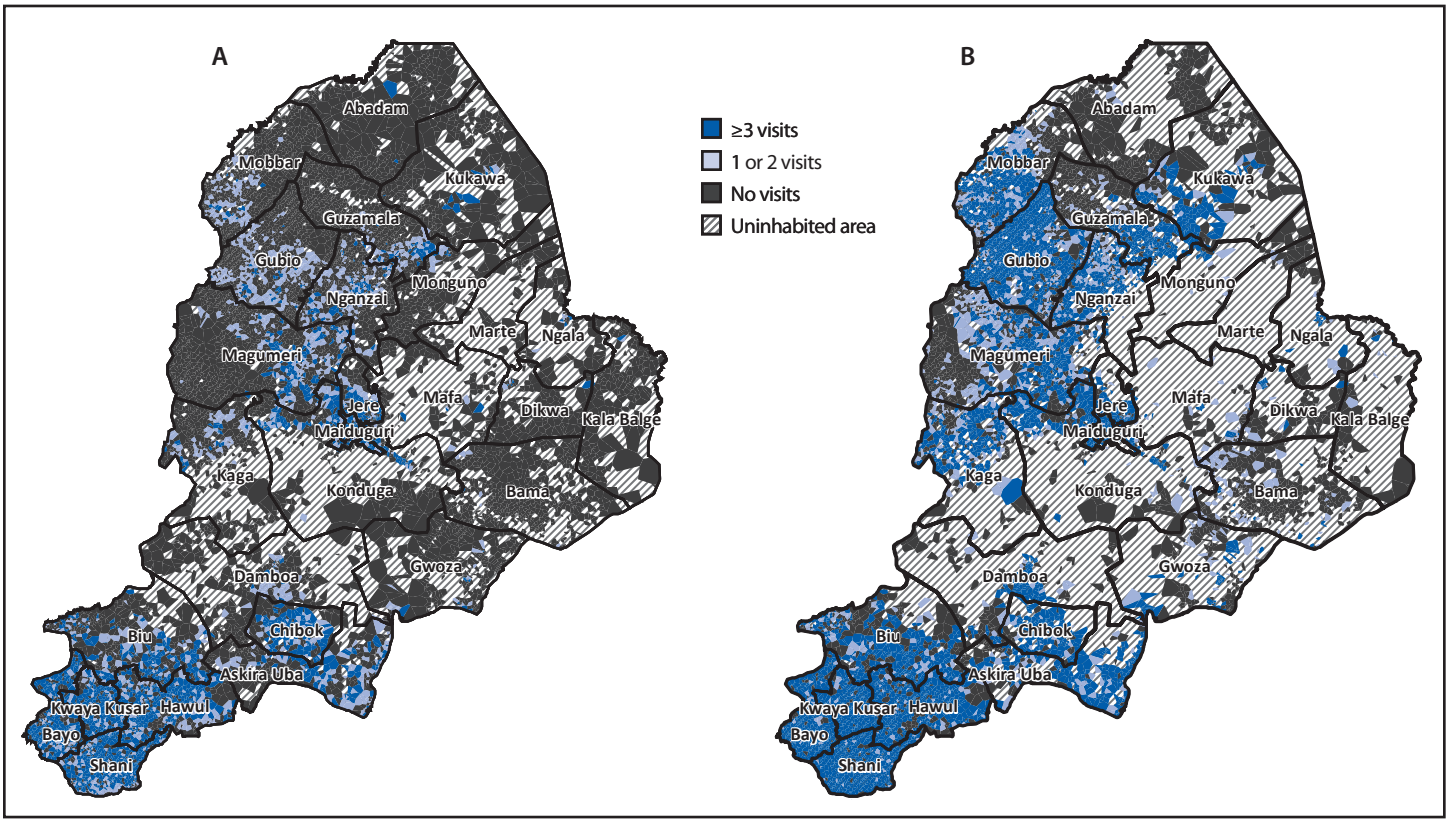
The destruction of health facilities after the insurgency disrupted health facility–based surveillance in Borno. Community informants help identify AFP cases in insurgent-held areas in Borno, particularly since February 2018. As of May 31, 2019, a total of 1,018 community informants in Borno reported 220 verified AFP cases during 2018–2019. Stool specimens are obtained when patients with AFP and their families temporarily leave insurgent-held areas for evaluation in safe areas; in 2018, stool adequacy for these AFP cases was 61% and in 2019, 79% to date.

Environmental surveillance. To supplement AFP surveillance, sewage samples are tested for polioviruses (*5*). During January 2018–May 2019, 25 (68%) of Nigeria's 37 states had at least one environmental surveillance site for a total of

* https://data.unicef.org/topic/child-health/immunization/.

† An annual non-polio AFP detection rate of ≥1 case per 100,000 population aged <15 years in countries in WHO regions certified as polio-free, or ≥2 in all other countries reflects the sensitivity of AFP surveillance. Stool adequacy refers to the collection of adequate stool specimens (i.e., two stool specimens collected >24 hours apart, within 14 days of paralysis onset, with arrival at the laboratory in good condition [cool and without leakage or desiccation]) from ≥80% of reported AFP patients and reflects the quality of case investigation. http://polioeradication.org/polio-today/polio-now/surveillance-indicators/.

FIGURE. Inhabited settlements reached with bivalent oral poliovirus vaccine using standard house-to-house, Reaching Every Settlement,* and Reaching Inaccessible Children† approaches during August–December 2016 (A) and August 2016–May 2019 (B), by number of cumulative vaccination visits reaching children aged <5 years — Borno State, Nigeria, August 2016–May 2019§,¶



* Reaching Every Settlement is an approach in which security escorts enable vaccinators to reach children in insurgent-held areas.
† Reaching Inaccessible Children is an approach in which trained military personnel vaccinate children in settlements that only they can access.
§ During August–December 2016, 52.4% of the population resided in settlements reached by vaccination teams three or more times, 15.5% in settlements reached one or two times, and 32.1% in settlements that were not reached; during August 2016–May 2019, 88.3% of the population resided in settlements that were reached three or more times, 4.4% in settlements reached one or two times, and 7.3% in settlements that were not reached.
¶ The amount of uninhabited area increased during August 2016–May 2019 because of population migration from insurgent-held areas to accessible areas.

113 functional sites; no WPV and 85 cVDPV2 isolates were detected through environmental surveillance.

cVDPV2 Outbreaks

Since 1988, widespread use of trivalent OPV (tOPV, containing Sabin serotypes 1, 2, and 3) reduced the number of polio cases >99% globally. WPV type 2 was declared globally eradicated in 2015 (*6*,*7*). In low-immunization settings, transmission of attenuated Sabin poliovirus contained in OPV can result in genetic reversion to VDPVs that can cause paralysis. When community transmission occurs, VDPVs are categorized as circulating (cVDPVs) (*8*). During 2006–2015, >94% of confirmed cVDPVs worldwide were cVDPV2 (*8*). To decrease the risk for cVDPV2, a globally synchronized switch from tOPV to bivalent OPV (bOPV, containing serotypes 1 and 3) occurred in April 2016 (*8*). Injectable inactivated poliovirus vaccine (IPV, containing serotypes 1, 2, and 3) was introduced into all OPV-using countries to provide individual protection from type 2 poliovirus paralysis (*9*). Both vaccines confer individual protection; however, IPV does not decrease fecal poliovirus shedding among children with infection, whereas OPV induces intestinal immunity and prevents shedding. Monovalent OPV type 2 (mOPV2) vaccine is available for cVDPV2 outbreak response (*10*). Since January 2018 (as of June 25, 2019), two independent cVDPV2 outbreaks have occurred (Table 1).

Emergence in Jigawa State. Eight cVDPV2-positive sewage samples collected during January 10–October 17, 2018, in Jigawa were genetically linked to four cVDPV2 cases with paralysis onset during April 15–October 13, 2018. This outbreak has spread to 11 other states, totaling 41 cVDPV2 cases and 71 sewage isolates. Genetically related poliovirus was also isolated from 11 AFP patients in Niger Republic, with onset

TABLE 1. Number of circulating vaccine-derived poliovirus type 2 (cVDPV2) cases, by acute flaccid paralysis (AFP) cases and environmental surveillance (ES) isolates in affected states — Nigeria, January 2018–May 2019*

Affected state	No. of cVDPV2 cases						cVDPV2 emergence outbreak source†	Date of most recent cVDPV2 case onset/ES specimen collection	
	Jan–Dec 2018		Jan–May 2018		Jan–May 2019				
	AFP	ES	AFP	ES	AFP	ES		AFP	ES
Bauchi	0	5	0	0	0	0	NIE-JIS-1	—§	Nov 5, 2018
Borno	6	5	0	0	1	16	NIE-JIS-1	Feb 14, 2019	Apr 2, 2019
Gombe	0	1	0	1	0	0	NIE-JIS-1	—	Apr 9, 2018
Jigawa	4	8	3	7	0	0	NIE-JIS-1	Oct 13, 2018	Jun 20, 2018
Kaduna	1	3	0	0	0	0	NIE-JIS-1	Sep 10, 2018	Dec 11, 2018
Kano	0	1	0	0	0	2	NIE-JIS-1	—	Mar 6, 2019
Katsina	16	0	0	0	0	0	NIE-JIS-1	Oct 22, 2018	—
Kwara	1	0	0	0	5	13	NIE-JIS-1	Mar 29, 2019	May 23, 2019
Lagos	0	1	0	0	0	6	NIE-JIS-1	—	May 10, 2019
Niger	0	0	0	0	1	0	NIE-SOS-3	Mar 18, 2019	—
Ogun	0	0	0	0	1	0	NIE-JIS-1	Mar 9, 2019	—
Sokoto	0	14	0	14	0	0	NIE-SOS-3	—	Jun 26, 2018
Taraba	1	0	0	0	0	0	NIE-JIS-1	Nov 2, 2018	—
Yobe	5	8	1	1	0	2	NIE-JIS-1	Nov 21, 2018	Feb 20, 2019
Total	**34**	**46**	**4**	**23**	**8**	**39**	—	—	—

Abbreviation: AFP = acute flaccid paralysis.
* As of June 25, 2019. In 2017, no WPV nor cVDPV2 cases or isolates were reported.
† After the global switch from trivalent oral poliovirus vaccine (tOPV, containing Sabin types 1, 2, and 3) to bivalent OPV (bOPV, containing types 1 and 3), new emergences of cVDPV2 are identified by a three-letter country code, followed by three letters representing either state, province, or region, and a digit indicating the outbreak number in that state, province, or region.
§ Dashes indicate not applicable.

July 18, 2018–April 3, 2109, and from one sewage sample collected April 4, 2019, in Cameroon.

Emergence in Sokoto State. A VDPV2 isolate was identified in a sewage sample collected January 30, 2018, in Sokoto; subsequent samples from three sites in 2018 yielded genetically related cVDPV2s. Genetically related cVDPV2 was isolated from an AFP patient in Niger State, with onset March 18, 2019.

Vaccination Activities

In 2018, two national supplementary immunization activities (SIAs)[§] with bOPV, one subnational SIA with bOPV in five states, two subnational SIAs in seven states using bOPV and fractional IPV, and three subnational SIAs in two states using bOPV and fractional IPV were conducted. One subnational SIA using bOPV has been conducted in seven states to date in 2019. Two subnational SIAs were conducted in two states using bOPV and fractional IPV. Gombe was the only state with three subnational SIAs to date in 2019 (Table 2).

Since December 2016, little change has occurred in the areas not accessible by standard house-to-house SIA teams in Borno. Two novel approaches for immunizing children in insurgent-held areas in Borno were implemented (*2*). Reaching Every Settlement utilizes security escorts to enable vaccinators to reach children in some settlements in insurgent-held areas, and Reaching Inaccessible Children enables vaccination of children by trained military personnel in settlements only accessible by these personnel (*2*). Satellite imagery is used to estimate population sizes in settlements and vaccination team movements are tracked using geographic information systems, providing data on geographic reach by these immunization approaches (Figure). Since January 2018, approximately 140,000 children in insurgent-held settlements were vaccinated during 13 Reaching Every Settlement rounds with bOPV and approximately 85,000 children aged <5 years were vaccinated with mOPV2 in response to cVDPV2 outbreaks. During five Reaching Inaccessible Children rounds, 71,370 children were vaccinated with bOPV. As of May 2018, among approximately 104,330 children aged <5 years remaining in insurgent-held areas, 43,840 (42.0%) have received at least 1 bOPV dose. Most unreached children reside in settlements scattered over a wide geographic area. Overall, among children aged <5 years in insurgent-held settlements that have been reached, 79.8% and 26.2% have been offered ≥3 doses of bOPV by Reaching Every Settlement or Reaching Inaccessible Children rounds, respectively.

During January 2018–May 2019, Nigeria conducted multiple mOPV2 outbreak response SIAs in states affected by cVDPV2 and neighboring states (Table 2). The quality of outbreak response SIAs as assessed by post-campaign lot quality assurance sampling surveys has been variable; the national average for mOPV2 SIAs ranged from 64% to 90% of sampled local government areas reaching the target 90% threshold of

§ SIAs are mass immunization campaigns conducted over several days to boost population immunity in areas with weak routine childhood immunization services and suboptimal coverage. The goal of SIAs is to reach every child aged <5 years with OPV, regardless of their vaccination status. http://polioeradication.org/who-we-are/strategic-plan-2013-2018/supplementary-immunization/.

TABLE 2. Number of supplementary immunization activities (SIAs) by state, vaccine formulation, and quality assessment of response SIAs — Nigeria, January 2018–May 2019*

State	2018			2019			Date of most recent mOPV2 SIA, 2019	% LGAs passing 90% threshold on LQAS[§,¶]
	bOPV	bOPV + fIPV[†]	mOPV2	bOPV	bOPV + fIPV	mOPV2		
Abia	2	—**	—	—	—	—	—	—
Adamawa	4	—	1	1	—	2	May 4	80–100
Akwa Ibom	2	—	—	—	—	—	—	—
Anambra	2	—	—	—	—	—	—	—
Bauchi	3	1	5	1	—	2	May 4	73–100
Bayelsa	2	—	—	—	—	—	—	—
Benue	2	—	1	—	—	1	Jan 26	89–100
Borno	4	1	2	1	—	1	May 25	87–100
Cross River	2	—	—	—	—	—	—	—
Delta	2	—	—	—	—	—	—	—
Ebonyi	2	—	—	—	—	—	—	—
Edo	2	—	—	—	—	—	—	—
Ekiti	2	—	—	—	—	1	May 18	100
Enugu	2	—	—	—	—	—	—	—
Federal Capital Territory	3	—	1	—	—	1	Jan 29	50–67
Gombe	3	—	3	1	2	2	Apr 27	73–100
Imo	2	—	—	—	—	—	—	—
Jigawa	3	1	4	—	2	1	Apr 27	44–85
Kaduna	3	—	1	—	—	2	Apr 13	80–90
Kano	3	1	3	—	—	3	May 25	78–100
Katsina	3	1	3	1	—	2	May 4	40–90
Kebbi	2	—	1	—	—	2	April 13	73–93
Kogi	2	—	—	—	—	—	—	—
Kwara	2	—	—	—	—	4	May 25	20–60
Lagos	2	—	—	—	—	1	May 18	38
Nasarawa	3	—	1	—	—	1	Jan 29	20–70
Niger	2	—	1	—	—	3	May 18	70–90
Ogun	2	—	—	—	—	1	May 18	50
Ondo	2	—	—	—	—	1	May 18	88
Osun	2	—	—	—	—	1	May 18	100
Oyo	2	—	—	—	—	3	May 18	50–100
Plateau	2	—	1	—	—	2	May 4	78–100
Rivers	2	—	—	—	—	—	—	—
Sokoto	3	1	5	—	2	2	Apr 13	75–100
Taraba	3	—	1	1	—	2	May 4	94–100
Yobe	4	1	3	1	1	1	May 25	71–88
Zamfara	4	—	1	—	—	2	Apr 13	40–60

Abbreviations: bOPV = bivalent oral poliovirus vaccine; fIPV = fractional dose inactivated poliovirus vaccine; LGAs = local government areas; LQAS = lot quality assurance sampling; mOPV2 = monovalent oral poliovirus vaccine type 2.

* As of June 25, 2019.

† bOPV contains types 1 and 3; fIPV is an intradermal administration of 0.10 ml of IPV.

§ LQAS is a random sampling methodology used to assess quality of vaccination campaigns.

¶ Among all sampled LGAs at state level for all mOPV2 outbreak response SIAs.

** Dashes indicate not applicable.

estimated proportion of children vaccinated. A limited number of mOPV2 doses have been given in insurgent-held areas by Reaching Every Settlement during mid-2016–mid-2019; therefore, approximately 104,330 children aged <5 years have had no exposure to type 2 OPV.

Discussion

During 2003–2014, Nigeria reported the majority of WPV cases in Africa and was the origin of most WPV importation outbreaks (*1*,*6*). Polio eradication activities were aggressively enhanced in 2012–2014. The last WPV type 3 isolated worldwide was in Nigeria in November 2012. The patient with the most recent WPV1 case in Nigeria had paralysis onset in August 2016 (*2*), even as previously silent areas in Borno have incrementally increased surveillance with community informants. Progress in decreasing the number of unvaccinated children in insurgent-held areas resulted from improved vaccination reach by novel approaches and net population migration from insurgent-held areas to accessible areas. Additional surveillance sensitivity assessments in Nigeria and other African countries are underway, potentially to allow certification of interruption of WPV transmission by the African Regional Certification Commission in 2020. However, active cVDPV2 transmission continuing into 2020 in Nigeria or eight other

Summary

What is already known about this topic?

The latest wild poliovirus (WPV) case in Nigeria occurred in August 2016 and was reported in September 2016, in Borno State.

What is added by this report?

The number of children living in insurgent-held areas in Borno who have not had access to poliovirus vaccines was reduced by 87% during December 2016–May 2017. Trained community members living in insurgent-held areas have reported suspected polio cases with no WPV identified on virologic testing, which suggests that WPV transmission might have been interrupted in Nigeria. However, outbreaks caused by type 2 circulating vaccine-derived poliovirus (cVDPV2) are spreading internationally.

What are the implications for public health practice?

Improved polio mass campaign quality is required to achieve interruption of all cVDPV2 transmission in Nigeria.

countries on the continent with active cVDPV2 outbreaks might complicate the certification process.

Nigeria experienced multiple cVDPV2 outbreaks during 2005–2015 as well as ongoing transmission after cVDPV2 importation in 2013 because of vulnerability to emergence and spread of cVDPV2 from the predominant use of mOPV1, mOPV3 and bOPV during 2005–2014 SIAs, coupled with chronically low routine tOPV coverage (*6*). In addition, tOPV SIAs before the tOPV-to-bOPV switch were not sufficiently effective in all areas.

Children remaining in insurgent-held areas of Borno have remained inaccessible to mOPV2 administration by standard house-to-house SIAs for the cVDPV2 outbreak response; administration of mOPV2 in those areas will require Reaching Every Settlement and Reaching Inaccessible Children. Although mOPV2 is the tool to stop cVDPV2 outbreaks, it also carries the risk of seeding new emergences of cVDPV2 in areas with low-quality SIAs. Increased efforts for appropriate planning and supervision of subsequent SIAs will be important in ensuring optimal response quality necessary to interrupt cVDPV2 transmission and emergence.

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Notes from the Field

Targeted Biomonitoring for GenX and Other Per- and Polyfluoroalkyl Substances Following Detection of Drinking Water Contamination — North Carolina, 2018

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In June 2017, local health departments asked the North Carolina Department of Health and Human Services (NCDHHS) to provide health information and guidance regarding 2,3,3,3,-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoate (GenX) and other per- and polyfluoroalkyl substances (PFAS) that had been detected in the Cape Fear River, an important drinking water source (*1*). PFAS are a group of man-made chemicals that have been used in industry and consumer products worldwide since the 1950s. Most PFAS do not break down in the environment and can accumulate over time, resulting in increased human exposures. Limited studies in humans have indicated that some PFAS might affect reproduction, development, and the immune system and increase the risk for certain types of cancer (*2*). The source of GenX and other PFAS contamination in the Cape Fear River was a PFAS chemical manufacturing facility. After further investigation, the North Carolina Department of Environmental Quality identified GenX and other PFAS in surface water, air, and private wells close to the facility. As of April 2018, 837 private wells within a 5-mile radius of the facility had been tested; 207 (25%) had GenX levels exceeding the NCDHHS provisional drinking water health goal of 140 parts per trillion (ppt),* with a maximum measured GenX concentration of 4,000 ppt. The manufacturer began providing bottled water to residents living in homes with a well that exceeded the NCDHHS provisional drinking water health goal. In August 2018, NCDHHS worked with local health departments and asked CDC to quantify GenX and other PFAS in serum and urine specimens from a convenience sample of residents near the facility.

NCDHHS identified households near the facility with the highest concentrations of GenX in their private drinking water wells. One adult and, if available, one minor (aged 12–17 years) from each household were invited to participate. Participants had to have lived in their home full-time, used their well as their primary drinking water source before GenX detection (2017), and had no known occupational PFAS exposure. NCDHHS staff members made three call attempts to each household before contacting the next eligible household. Because the investigation was deemed to be public health epidemiologic surveillance and not research, this work was deemed exempt from institutional review board review.

Participants provided blood and spot urine specimens and completed a structured interview regarding demographics, residence history, and potential sources of PFAS exposure. CDC analyzed serum for 17 PFAS and urine for 16 PFAS. All laboratory analyses were conducted using CDC laboratory methods and established procedures for quality assurance and control (*3*). When possible, participants' PFAS concentrations were compared with population estimates from the National Health and Nutrition Examination Surveys (NHANES) from 2015–2016 or 2013–2014 (*4*).

Among 47 contacted households, 25 (53%) were eligible and agreed to participate. Thirty residents (25 adults and five minors) participated. Participants ranged in age from 14 to 79 years (median = 52 years); half were male. All participants had lived in the county for at least 10 years and had been using bottled water for drinking for 4–14 months before specimen collection.

GenX was not detected in serum (Table) or urine of any participants. Nine PFAS were detected in serum. Median serum concentrations of perfluorohexane sulfonic acid (PFHxS, 2.1 μg/L) and linear perfluorooctane sulfonic acid (n-PFOS, 5.5 μg/L) were markedly higher than were those in NHANES participants (1.2 μg/L and 3.2 μg/L, respectively). The remaining seven PFAS were found at concentrations similar to or lower than those in NHANES specimens. Serum PFAS concentrations did not differ by sex, age, or number of years living in the county. One PFAS (perfluorohexanoic acid) was detected in one participant's urine (0.4 μg/L) close to the limit of detection (*5*); the other 15 PFAS tested in urine were not detected.

GenX was not detected in specimens from participants with documented drinking water exposure. This might be because participants had switched to bottled water months earlier and might indicate that GenX has a relatively short half-life in humans. Compared with the general population, the higher concentrations of two historically used PFAS (PFHxS and n-PFOS) with relatively long biologic half-lives might reflect residents' higher past or ongoing environmental exposures.

The results of this investigation provided community members with information about what was detectable in their blood and urine after learning that their drinking water was

* https://ncdenr.s3.amazonaws.com/s3fs-public/GenX/NC%20DHHS%20Risk%20Assessment%20FAQ%20Final%20Clean%20071417%20PM.pdf.

TABLE. Comparison of serum concentrations of per- and polyfluoroalkyl substances (PFAS) in the U.S. population with concentrations among participants (N = 30) residing near a PFAS manufacturing facility where PFAS were detected — North Carolina, 2018

PFAS	Abbreviation	Limit of detection (LOD)	Serum concentrations (μg/L)				
			Participants (N = 30)			U.S. population*	
			Median	Minimum	Maximum	Median	95th percentile
2,3,3,3,-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoate	GenX	0.1	—†	—	—	Not measured	
perfluorobutane sulfonic acid	PFBS	0.1	—	—	—	—	—
perfluorohexanoic acid	PFHxA	0.1	—	—	—	Not measured	
perfluorobutanoic acid	PFBA	0.1	—	—	—	Not measured	
perfluoroheptanoic acid	PFHpA	0.1	—	—	0.6	—	0.2
perfluoropentanoic acid	PFPeA	0.1	—	—	—	Not measured	
4,8-dioxa-3H-perfluorononanoat	ADONA	0.1	—	—	—	Not measured	
9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	9Cl-PF3ONS	0.1	—	—	—	Not measured	
2-(N-methyl-perfluorooctane sulfonamido) acetic acid	MeFOSAA	0.1	—	—	0.6	—	0.6
perfluorohexane sulfonic acid	PFHxS	0.1	2.1	0.7	6.7	1.2	4.9
linear perfluorooctanoic acid	n-PFOA	0.1	1.8	0.4	7.3	1.5	4.1
branched perfluorooctanoic acids	Sb-PFOA	0.1	—	—	—	—	—
perfluorodecanoic acid	PFDA	0.1	0.2	—	1.3	0.1	0.7
perfluoroundecanoic acid	PFUnDA	0.1	—	—	0.5	—	0.4
perfluoromethylheptane sulfonic acids (methyl branched PFOS)	Sm-PFOS	0.1	1.2	0.2	7.4	1.5	5.7
linear perfluorooctane sulfonic acid	n-PFOS	0.1	5.5	1.4	34.6	3.2	12.8
perfluorononanoic acid	PFNA	0.1	0.6	—	2.1	0.6	1.9

* CDC. Fourth national report on human exposure to environmental chemicals: updated tables, January 2019, volume one. Atlanta, GA: US Department of Health and Human Services, CDC; 2019. https://www.cdc.gov/exposurereport/pdf/FourthReport_UpdatedTables_Volume1_Jan2019-508.pdf.
† Below the LOD (applies to all of the dashes in cells of the table).

contaminated with PFAS and how to discuss their results with their primary health care provider. In addition, participants were provided general information about potential health effects from PFAS exposures. These findings might be useful to community members, public health agencies, and researchers investigating PFAS exposures and potential human health implications in the future.

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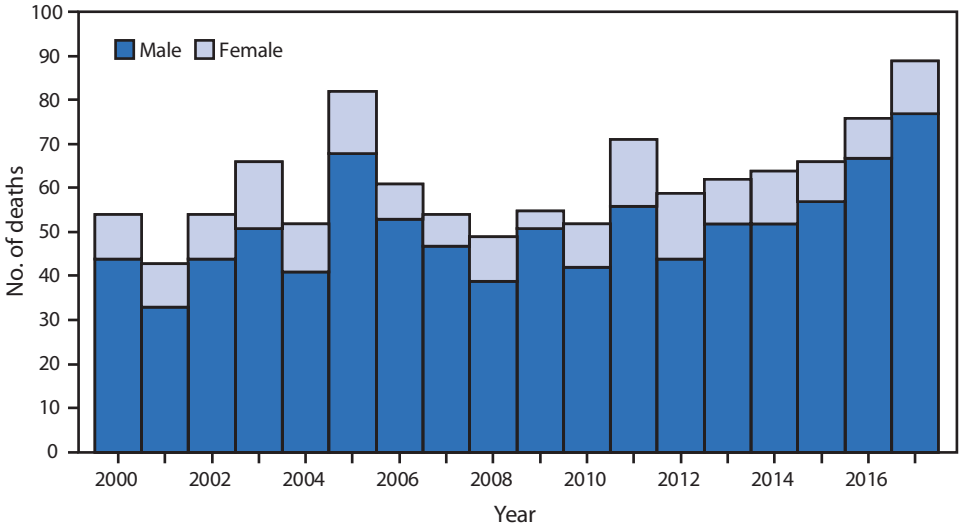
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Number of Deaths from Hornet, Wasp, and Bee Stings,* Among Males and Females — National Vital Statistics System, United States,† 2000–2017



* Deaths from hornet, wasp, and bee sting as underlying cause of death are coded as X23 in the *International Classification of Diseases, Tenth Revision*.
† Among U.S. residents only.

During 2000–2017, a total of 1,109 deaths from hornet, wasp, and bee stings occurred, for an annual average of 62 deaths. Deaths ranged from a low of 43 in 2001 to a high of 89 in 2017. Approximately 80% of the deaths were among males.

Source: National Vital Statistics System. Underlying cause of death data, 1999–2017. https://wonder.cdc.gov/ucd-icd10.html.

Reported by: Jiaquan Xu, MD, jiaquanxu@cdc.gov, 301-458-4086.

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