Wastewater Testing and Detection of Poliovirus Type 2 Genetically Linked to Virus Isolated from a Paralytic Polio Case — New York, March 9–October 11, 2022

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In July 2022, a case of paralytic poliomyelitis resulting from infection with vaccine-derived poliovirus (VDPV) type 2 (VDPV2)§ was confirmed in an unvaccinated adult resident of Rockland County, New York (1). As of August 10, 2022, poliovirus type 2 (PV2)† genetically linked to this VDPV2 had been detected in wastewater** in Rockland County and neighboring Orange County (1). This report describes the results of additional poliovirus testing of wastewater samples collected during March 9–October 11, 2022, and tested as of October 20, 2022, from 48 sewersheds (the community area served by a wastewater collection system) serving parts of Rockland County and 12 surrounding counties. Among 1,076 wastewater samples collected, 89 (8.3%) from 10 sewersheds of Rockland County and 12 surrounding counties (2). Some countries still use oral poliovirus vaccine (OPV); advantages to this approach include low cost, ease of use, and high efficacy in stopping outbreaks. However, in rare cases, the live attenuated virus in OPV can regain neurovirulence, circulate in underimmunized populations, and cause paralytic disease. A previous report confirmed that paralysis of the Rockland County patient resulted from infection with VDPV2, and that related viruses had been detected in wastewater collected from Orange and Rockland counties (1). Since then, the New York State Department of Health (NYSDOH); Nassau, Orange, Putnam, Rockland, Suffolk, Sullivan, Ulster, and Westchester counties’ health departments; New York City Department of Health and Mental Hygiene (NYC DOHMH); New York City Department of Environmental Protection; and CDC have expanded poliovirus wastewater testing as part of an emergency response. This report summarizes findings from the more extensive wastewater testing conducted in the New York metropolitan area as part of investigations to understand the extent of poliovirus circulation and to direct polio vaccination efforts.

Wastewater samples, including some originally collected for SARS-CoV-2 surveillance, were collected from a subset of sewersheds during March 9–October 11, 2022. Samples were collected approximately once or twice weekly from each site. Wastewater samples were processed using either

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§ A VDPV is a strain related to the attenuated live poliovirus contained in OPV. VDPV2s are OPV virus strains that are >0.6% divergent (or at least six nucleotide changes) from the OPV2 strain in the complete VP1 genomic region. https://polioeradication.org/wp-content/uploads/2016/09/Reporting-and-Classification-of-VDPV2s_Aug2016_EN.pdf
† The term PV2, referring to all serotype 2 polioviruses, is used throughout the report to indicate either a confirmed VDPV2 or a type 2 Sabin-like virus that is genetically related to the Rockland County patient. A Sabin-like poliovirus is a poliovirus that is related to one of the Sabin vaccine strains and whose nucleotide sequence in the genome region encoding the VP1 capsid protein differs from the related Sabin strain by 0–5 nucleotides for type 2 or by 0–9 nucleotides, for types 1 and 3.
** Wastewater, also referred to as sewage, includes water from household or building use (e.g., toilets, showers, and sinks) that can contain human fecal waste and water from nonhousehold sources (e.g., rain and industrial use); it does not include open drains or potable water. https://www.cdc.gov/healthywater/surveillance/wastewater-surveillance.html#how-wastewater-surveillance-works
†† https://www.cdc.gov/acute-flaccid-myelitis/index.html

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Since 1979, no cases of polio caused by wild poliovirus have originated in the United States. https://www.cdc.gov/polio/what-is-polio/polio-us.html
ultracentrifugation or polyethylene glycol precipitation followed by nucleic acid extraction. The extracts were forwarded to the Wadsworth Center (part of NYSDOH) or the New York City Public Health Laboratory (part of NYC DOHMH) where they were packaged and shipped to CDC. At CDC, total nucleic acids were screened for the presence of PV2 using the pan-poliovirus real-time reverse transcription–polymerase chain reaction (RT-PCR) assay, and positive samples were sequenced (4,5).

To investigate the number of indeterminate results from some of the New York City samples from large sewersheds (those servicing more than 700,000 residents), NYC DOHMH collected additional larger volume (500 mL) wastewater samples from two sewersheds on August 11, one receiving wastewater from parts of New York County, and another with combined wastewater from parts of Kings, New York, and Queens counties (two distinct upstream sub-sewersheds** were sampled, one feeding only from the New York County area and another

** Sub-sewersheds are upstream sampling locations within a larger sewershed.

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TABLE. Wastewater test results for poliovirus, by county — 13 counties, New York and New York City, March 9–October 11, 2022

| County                  | No. of sampling sites* | Estimated % of county population covered by sewershed | Dates samples collected | No. of sites with any PV2-positive sample | No. of samples tested | No. of PV2-positive samples† | Total | Genetic linkage to Rockland County patient§ | No. of negative samples |
|-------------------------|------------------------|------------------------------------------------------|------------------------|------------------------------------------|----------------------|-------------------------------|-------|---------------------------------------------|------------------------|
| Nassau                  | 4                      | 84.6                                                 | Mar 9–Oct 6            | 1                                        | 87                   | 2                             | 1     | 0                                          | 1                       |
| NYC-Bronx               | 1                      | 52.2                                                 | Jul 5–Oct 11           | 0                                        | 26                   | 1                             | 0     | 0                                          | 0                       |
| NYC-Kings               | 4                      | 76.1                                                 | May 31–Oct 11          | 2                                        | 129**                | 4                             | 2     | 1                                          | 0                       |
| NYC-New York            | 1                      | 38.7                                                 | Jul 5–Oct 11           | 0                                        | 26                   | 0                             | 0     | 0                                          | 0                       |
| NYC-Queens              | 4                      | 91.4                                                 | May 31–Oct 11          | 0                                        | 112                  | 0                             | 0     | 0                                          | 1                       |
| NYC-Bronx and New York† | 1                      | 46.2, 28.9                                           | July 5–Oct 11          | 0                                        | 26                   | 0                             | 0     | 0                                          | 0                       |
| NYC-Kings, New York, and Queens§§ | 1                      | 22.4, 31.9, 5.9                                       | May 31–Oct 11          | 1                                        | 36                   | 8                             | 4     | 3                                          | 1††                    |
| NYC-Richmond            | 2                      | 96.2                                                 | May 31–Oct 11          | 1                                        | 68                   | 0                             | 1     | 1                                          | 0                       |
| Orange                  | 8                      | 45.9                                                 | Mar 9–Oct 6            | 1                                        | 284                  | 4                             | 25    | 1                                          | 0                       |
| Putnam                  | 1                      | 4.6                                                  | Mar 16–Oct 5           | 0                                        | 20                   | 0                             | 0     | 0                                          | 0                       |
| Rockland                | 6                      | 96.1                                                 | Mar 9–Oct 6            | 2                                        | 126                  | 2                             | 43    | 0                                          | 0                       |
| Suffolk                 | 3                      | 19.1                                                 | Aug 15–Oct 4           | 0                                        | 14                   | 0                             | 0     | 0                                          | 0                       |
| Sullivan                | 3                      | 20.5                                                 | Jul 21–Oct 6           | 2                                        | 21                   | 0                             | 13    | 0                                          | 0                       |
| Ulster                  | 2                      | 20.4                                                 | Aug 31–Oct 6           | 0                                        | 18                   | 0                             | 0     | 0                                          | 0                       |
| Westchester             | 7                      | 83.6                                                 | Aug 28–Oct 6           | 0                                        | 83                   | 0                             | 0     | 0                                          | 0                       |
| Total                   | 48                     | 82.9                                                 | Mar 9–Oct 11           | 10                                       | 1,076**              | 21                            | 89    | 6                                          | 1                       |

Abbreviations: NYC = New York City; PV2 = poliovirus type 2.

* Sampling sites are sewersheds defined as the community area served by a wastewater collection system.
† Indeterminate results include those from samples that tested positive using real-time RT-PCR, but not enough viral material was available to complete sequencing.
§ In July 2022, paralytic poliomyelitis resulting from infection with vaccine-derived PV2 was confirmed in an unvaccinated adult resident of Rockland County, New York.
¶ Sequencing insufficient to determine relation to Rockland County patient.
** Totals include two samples from Kings County that were pending sequencing results as of October 20, 2022.
†† Sewershed includes portions of Bronx and New York counties.
§§ Sewershed includes portions of Kings, New York, and Queens counties.
††† Large-volume sample collected from the sub-sewershed serving parts of Kings and Queens counties tested positive, but the sub-sewershed serving New York County tested negative.
FIGURE 1. Wastewater* polio test results,† by jurisdiction§ (N = 1,053) — 13 counties in New York and New York City, March 9–October 11, 2022

New York City
Rockland County
Putnam County
Orange County
Nassau County
Sullivan County
Westchester County
Suffolk County
Ulster County

Negative  ● PV2 positive, genetically linked to patient  ▲ PV2 positive, not genetically linked to patient  □ PV2 positive, linkage to patient unknown

Abbreviation: PV2 = poliovirus type 2.

* Sampling sites are sewersheds defined as the community area served by a wastewater collection system.

† Testing was conducted to determine if a sample was negative or positive for PV2, and if positive for PV2, whether the PV2 was genetically linked to an unvaccinated paralytic poliomyelitis patient from Rockland County, New York identified in July 2022. Some samples had sequencing insufficient to determine relation to the Rockland County patient (i.e., linkage to patient unknown). Indeterminate results are excluded from this figure. Indeterminate results include those from samples that tested positive using real-time reverse transcription polymerase chain reaction, but not enough viral material was available to complete sequencing. Specimens pending sequencing results are also excluded.

§ Number of samples in each jurisdiction include New York City (408) and the following New York counties: Rockland (124), Putnam (20), Orange (280), Nassau (85), Sullivan (21), Westchester (83), Suffolk (14), and Ulster (18).

to the virus isolated from the patient; this sample was from one of the larger-volume samples. The other six PV2-positive New York City samples included one from Kings County that was not genetically linked to the virus isolated from the patient, and five from three different sewersheds serving parts of Kings, New York, and Richmond counties that were inadequate for sequencing. PV2-positive samples genetically linked to the virus isolated from the patient were collected on more than one occasion in Orange (June 13–October 6), Rockland (May 23–October 4), and Sullivan (July 21–October 5) counties. Only a single sample each from Nassau County on August 18 and the sub-sewershed serving parts of Kings and Queens counties on August 11 tested positive for a PV2 linked to virus isolated from the patient.

In addition to wastewater testing for poliovirus in New York, a multifaceted public health response is underway that includes efforts to enhance case detection and increase vaccination access and demand. Efforts to improve case detection include testing of persons with nonparalytic, nonspecific viral symptoms consistent with poliovirus infection††† and review of syndromic surveillance databases. Strategies to increase vaccination include communication campaigns, community engagement, vaccination clinics, and outreach to providers and patients, focused on communities with the lowest IPV coverage. On August 12, NYSDOH and NYC DOHMH issued a press release and health alert to guide the public and the health care community about the importance of polio vaccination, emphasizing the imperative to protect unvaccinated and undervaccinated children through vaccination.§§§ On September 9, New York declared a state of emergency,¶¶¶ which allowed additional health professionals (including certain emergency medical service providers, midwives, and pharmacists) to administer poliovirus vaccine in the state.

Discussion

Wastewater testing during March 9–October 11 has detected PV2 genetically linked to the virus isolated from the Rockland County patient in six of 13 New York counties where

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††† https://health.ny.gov/diseases/communicable/polio/docs/2022-09-28_health_advisory.pdf

§§§ https://www1.nyc.gov/site/doh/about/press/pr2022/nysdoh-and-nycdohm-wastewater-monitoring-finds-polio-urge-to-get-vaccinated.page

¶¶¶ https://health.ny.gov/press/releases/2022/2022-09-09_polio_immunization.htm
wastewater was tested. One county (Nassau) had only a single detection, and therefore was not considered to have evidence of a transmission event. Three counties (Orange, Rockland, and Sullivan) had repeated detections over the course of months in one or more sewersheds, suggesting some level of community transmission in these areas. Only a single large-volume wastewater sample collected on August 11 from Kings and Queens counties in New York City tested positive for a PV2 genetically linked to virus isolated from the patient. However, this finding, coupled with the repeated PV2-positive results from the lower volume samples collected from the broader sewershed catchment areas serving parts of Kings, New York, and Queens counties during June 5–September 6 for which sequencing was not possible, suggests that PV2 could be circulating in Kings and Queens counties as well.

Wastewater testing in conjunction with high-quality AFM surveillance, has helped clarify the scope of the polio outbreak in New York, which indicates community transmission in a five-county area near the only identified symptomatic patient. Some researchers and public health agencies have had interest
Summary

What is already known about this topic?
In July 2022, a case of paralytic poliomyelitis was confirmed in an unvaccinated adult Rockland County, New York resident; environmental sampling found evidence of poliovirus transmission.

What is added by this report?
Wastewater testing has identified circulating polioviruses genetically related to virus isolated from the Rockland County patient in at least five New York counties.

What are the implications for public health practice?
Public health efforts to prevent polio should focus on improving coverage with inactivated polio vaccine. Although most persons in the United States are sufficiently immunized, unvaccinated or undervaccinated persons living or working in Kings, Orange, Queens, Rockland, or Sullivan counties, New York should complete the polio vaccination series to prevent additional paralytic cases and curtail transmission.

in expanding wastewater testing for poliovirus beyond the current outbreak area; however, additional effort is needed to understand the limitations and implications of wastewater testing for poliovirus outside the context of a localized emergency response and epidemiologic investigation of a confirmed polio case. The impact of sewershed system design and size on result interpretation needs further characterization. According to the World Health Organization’s guidelines for environmental surveillance of poliovirus circulation,**** sampling sites chosen for testing should represent selected populations at high risk for infection and paralytic disease. A robust national AFM surveillance system must be maintained with reporting of any suspected case of AFM to the appropriate public health authorities and collection of stool samples from any person with a suspected case. All U.S. children should receive IPV in accordance with the routine childhood immunization schedule (8). Most adults in the United States were vaccinated as children and are therefore likely to be protected from paralytic polio; however, any unvaccinated or undervaccinated adult or child living or working in Kings, Orange, Queens, Rockland, or Sullivan counties, New York should complete the IPV series now (9).

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**** [https://polioeradication.org/wp-content/uploads/2016/07/WHO_V-B_03.03_eng.pdf](https://polioeradication.org/wp-content/uploads/2016/07/WHO_V-B_03.03_eng.pdf)
reaction equipment for public health testing purposes from QIAGen. Nancy McGraw reports an uncompensated leadership in the New York State Association of County Health Officials. Andrew Knecht reports uncompensated membership on the editorial board of the American Journal of Preventive Medicine–Focus. Daniel Lang reports uncompensated membership on the New York State Water Quality Council. No other potential conflicts of interest were disclosed.

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