



Short Communication



Polio returns to the USA: An epidemiological alert

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ABSTRACT

On July 21, 2022, the USA witnessed the first case of poliomyelitis after 3 decades of its eradication. Poliomyelitis is a crippling disease that results from infection with any one of the three related poliovirus types (referred to as types P1, P2, and P3), members of the enterovirus (picornavirus) family. The New York State Department of Health confirmed that a case of paralytic poliomyelitis was reported from a 20-year-old Hungarian traveller residing in Rockland County. The detected viral sequence has been found to have vaccine-derived poliovirus type 2 (VDPV2) suggesting an origin from the live attenuated oral polio vaccine (OPV). Since immunisation remains the only preventable measure, this article explores suggestions from the Centers for Disease Control and Prevention on reliable Inactivated (killed) polio vaccination in high-risk patients along with early case detection and treatment. In light of the above-mentioned findings, this research further details future recommendations like cessation of the OPV, encouragement of inactivated polio vaccine (IPV) in vaccination schedules, sensitive epidemiological surveillance system and appropriate training for healthcare providers. The affected countries have been further advised to have effective outbreak response strategy plans in place so that they can respond and stay prepared for such outbreaks in the future.

1. Introduction

Poliomyelitis is an incurable and serious infectious disease caused by poliovirus [1]. It can cause acute muscle paralysis, permanent central nervous system damage, and even death [2]. As per the World Health Organization (WHO), death occurs in about 5–10% of patients who become permanently paralyzed due to immobilization of their breathing muscles [3]. The human gastrointestinal tract is considered the foremost reservoir of the infection; the route of transmission is oral-oral and/or oral-fecal [4]. Patients are considered highly infectious during a period of seven to ten days before and after the first day of symptoms [4]. However, the infection continues to be spread for up to two or three weeks through feces [3]. The virus can be detected in stools for five weeks or in the nasopharynx for five days after the first onset of

symptoms [4]. Initial symptoms could be fever, headache, nausea, fatigue, vomiting, pain, and stiffness of the neck [3]. According to the CDC, there are three different types of wild polio; type 1, 2, and 3⁵. Because polio still has no available cure, prevention remains the key. Prevention is being successfully achieved through the two available vaccines (oral polio vaccine and inactivated polio vaccine) which are both effective and safe [3]. Moreover, after launching the Global Polio Eradication Initiative (GPEI) in 1988, WHO reports that poliomyelitis cases have decreased from 350,000 in the year 1988 to only 6 confirmed cases in the year 2021 [3]. The first polio outbreak in the United States of America (USA) was in the late 1940s [6]. Poliovirus disease reached its highest incidence in the USA in the year 1952 with a total number of 20,000 paralytic polio cases [7]. The last polio case in the USA was in 1993 which was brought to the country by travelers [6]. Surprisingly,

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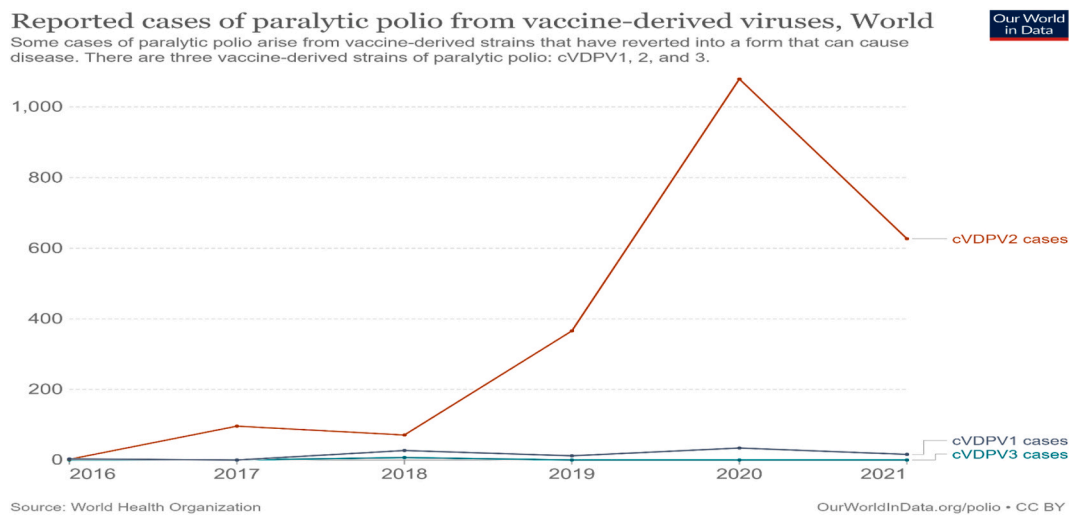


Fig. 1. Level of reported cases of paralytic polio from vaccine-derived viruses between 2016 and 2021. [12].

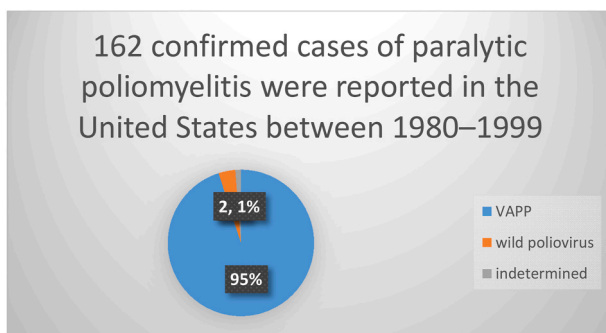


Fig. 2. A chart explaining the origin of confirmed polio cases in the USA between the years 1980 and 1999. (drawn by the author).

the CDC confirmed on July 21st, 2022, a new case of polio in Rockland County, New York [6]. The patient was not previously vaccinated and the public health workers in the state are working to know how was this man infected [6].

2. Epidemiology and outbreak of polio in the USA

Wild poliovirus was eradicated from the USA 30 years ago and since then no case has been detected originally as a wild virus from USA citizens according to CDC [8]. However, multiple cases were detected known to be brought by travellers carrying the virus [8]. The first outbreak, the USA witnessed was in the late 1940s harbouring the lives of thousands of USA citizens yet the number significantly decreased beyond the year 1955 after the introduction of inactivated Polio vaccine [9]. Since late 1979, no case of wild-type poliomyelitis was detected in the USA and until the year 1999, only 162 cases were identified with a rate of 6 cases per year [9]. Most of the mentioned cases in that era were vaccine-associated paralytic poliomyelitis (VAPP) derived from the Sabin strain found in the oral poliovirus vaccine (OPV) [9]. Despite the efforts placed to eradicate this disease from the USA entirely, especially after declining the OPV to decrease the VAPP. Surprisingly on July 21, 2022, a case of paralytic poliomyelitis in an unvaccinated traveller residing in Rockland County was reported to the New York State Department of Health [10]. According to the USA CDC, sequencing of the virus from the detected case is VDPV2 vaccine-derived poliovirus type 2 and this might suggest that the virus affecting the 20-year aged man travelling from Hungary might be from an OPV [10]. It appears that the rates of polio vaccination in the USA have declined in recent years

and even before the novel coronavirus disease 2019 (COVID-19) pandemic to below 95% coverage and with the burdens, the COVID-19 pandemic has thrown on the healthcare service it seems that the vaccination rates are in decline threatening in a potential outbreak, especially after the arrival of a wild or even VAPP [10,11](See Fig. 1) and (Fig. 2). Therefore, the CDC has advised people to vaccinate their children and high-risk population to overcome the high-risk situation and maintain enough herd immunity [8,11].

3. Aetiology of polio

Poliovirus was discovered in wastewater samples collected from two distinct locations in Orange County in June and July, according to the New York State Department of Health [13]. The results follow the paralysis and hospitalization of an adult who was not immunized with polio in Rockland County last month [13]. According to the CDC, there have been no new cases of polio in the USA since 1979 [13]. The United States has not officially confirmed an infection since 2013 until the case in Rockland County [13]. The case in Rockland County contracted a strain of polio from the OPV, which shows that the line of transmission did not start in the USA [13]. The OPV contains a weak variant of the virus that can still multiply [13]. Therefore, those who take the OPV are at risk of transmitting the virus to others [13]. However, the OPV hasn't been used in the USA in over 20 years [13]. People who receive the inactivated polio shot cannot spread the illness to others because the vaccination employs a virus strain that cannot replicate [13]. Moreover, the case in New York has been genetically related, according to Global Polio Laboratory Network (GPLN), to two isolates of Sabin-like type 2 (SL2) that were found in early June samples from Rockland County, as well as to the recently discovered VDPV2 found in environmental samples from London, UK [14]. New Yorkers need to understand that this does not indicate that the specific case discovered in New York has a history of travel to the UK [14].

Note that polio is a highly contagious disease that spreads from person to person; a person can spread the virus even if they are healthy [14]. Polio can enter the USA with just one traveller carrying the illness [6]. Those most susceptible to infection include the non-vaccinated for polio, those who didn't complete the recommended number of vaccinations and those going to places where they might be in danger of contracting polio [6].

Current efforts to Mitigate Polio in the USA:

July 21, 2022: The CDC is working with the New York State Department of Health on their investigation into a case of polio in an unvaccinated person from Rockland County, New York [6]. To stop the

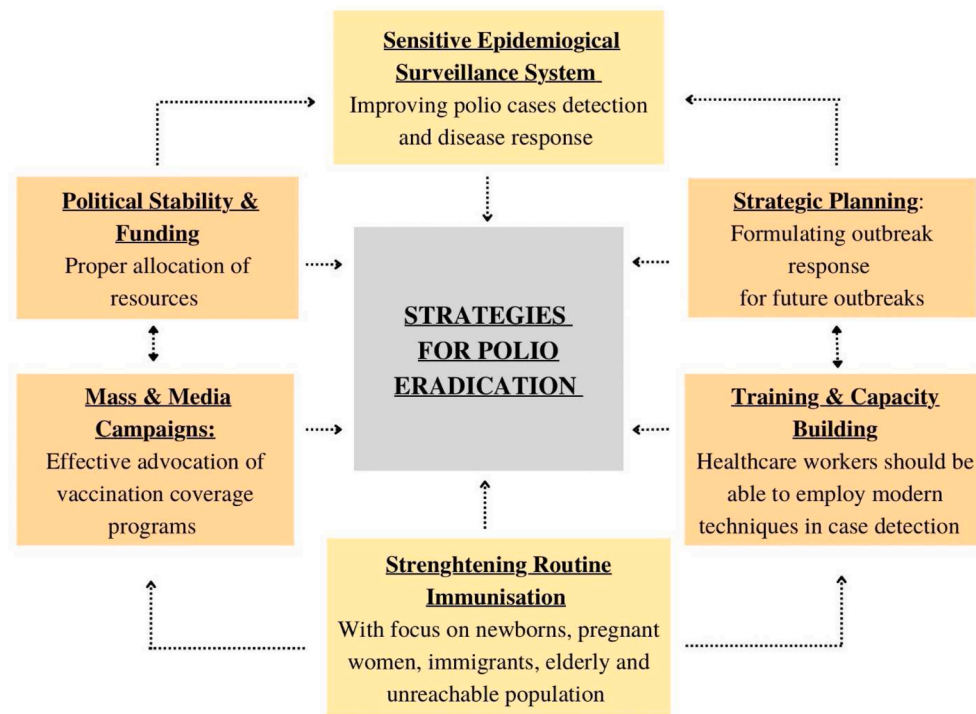


Fig. 3. Strategies for Polio eradication

spread of polio to people who haven't received the recommended vaccinations or who haven't received them at all, public health professionals are working to determine how and where the person became ill [6]. They are also offering the community protective measures like vaccination services [6]. Polio has no known treatment, but it can be avoided with a reliable immunization [6]. The wild poliovirus has been eradicated in this nation for more than 30 years thanks to the polio vaccine, committed medical experts, and vigilant parents who vaccinate their children on time [6]. This indicates that the wild poliovirus is not continuously transmitted throughout the year in the USA [6]. Maintaining strong immunity (protection) against polio in the population through vaccination is the greatest strategy to keep individuals safe from the disease [6] (See Fig. 3). In Rockland County, samples from June were found to have the polio virus, according to an examination from the CDC [6].

New York wastewater samples are shared with the GPLN, which consists of the CDC and the World Health Organization (WHO), as part of continuous surveillance activities [14]. All unvaccinated residents of New York, especially those who are pregnant, 2 months of age or older, and those who have not finished their previous polio vaccination series, should get immunized right away [14]. The largest risk of exposure is among unvaccinated New Yorkers who reside in Rockland County, work there, attend school there, or travel there [14]. Polio has no known cure or treatment, but it can be avoided with a reliable immunization [14].

4. Recommendations

Amid the COVID-19 pandemic which has affected healthcare services globally, routine polio vaccination rates have continued to decline [18]. Therefore efforts to achieve and maintain high rates of polio vaccination coverage (>95%) within the population effective advocating high and homogeneous vaccination coverage programs is highly emphasized [20]. This can be achieved by strengthening routine administration of inactivated polio vaccines (IPV) to children under 15 years located in high-risk areas, this is a powerful preventive measure and has been a key achievement strategy for eliminating polio cases in the past 30 years of polio-free in the USA [16]. Improving polio cases detection and disease

response through a sensitive epidemiological surveillance system will allow timely detection and investigation of acute flaccid paralysis (AFP) which is a presenting feature of poliomyelitis cases among children who are under 15 years in high-risk population [19]. It can only be possible if direct detection using modern laboratory with new technologies and tools for poliovirus detection and characterization, but also training healthcare workers at all levels to employ modern techniques in detection and case notification will be important in sample tracking and transportation by targeting geographical areas with the most pronounced delays [15] [[,30] [-36]. To stop all cases of paralytic poliomyelitis due to VDPV2, we highly recommend the cessation of the OPV and encourage IPV use in the vaccination program schedules [16]. Effective implementation of this policy will prevent polio cases due to OPV uses among children, since the current epidemiological alert is like to OPV [16]. As far as poliomyelitis epidemiological alert is concerned, countries and member states are advised to have outbreak response strategic plans in place so that to be prepared to respond in a timely fashion to the occurrence of an imported wild poliovirus (WPV) or vaccine-derived poliovirus case or the emergence of VDPV2 in their counties [17]. These recommendations can be applied in other countries especially the low and middle-income countries as a preparatory strategy to respond immediately to poliomyelitis cases in the future [21] [-29] (See Fig. 4).

5. Conclusion

On July 21, 2022, the USA witnessed the first case of poliomyelitis after nearly 3 decades of its eradication. Despite the efforts to prevent any further outbreaks, a case of paralytic poliomyelitis in a traveller residing in Rockland County was reported to the New York State Department of Health. According to the US CDC, the detected sequence has been found to have VDPV2 vaccine-derived poliovirus type 2 and this might suggest that the origin of the virus affecting the 20-year aged man travelling from Hungary might be from the OPV. Since poliomyelitis is a highly contagious disease with no available cure, prevention remains the key. As a result, the CDC has recommended reliable immunisation to all New York residents especially those who are

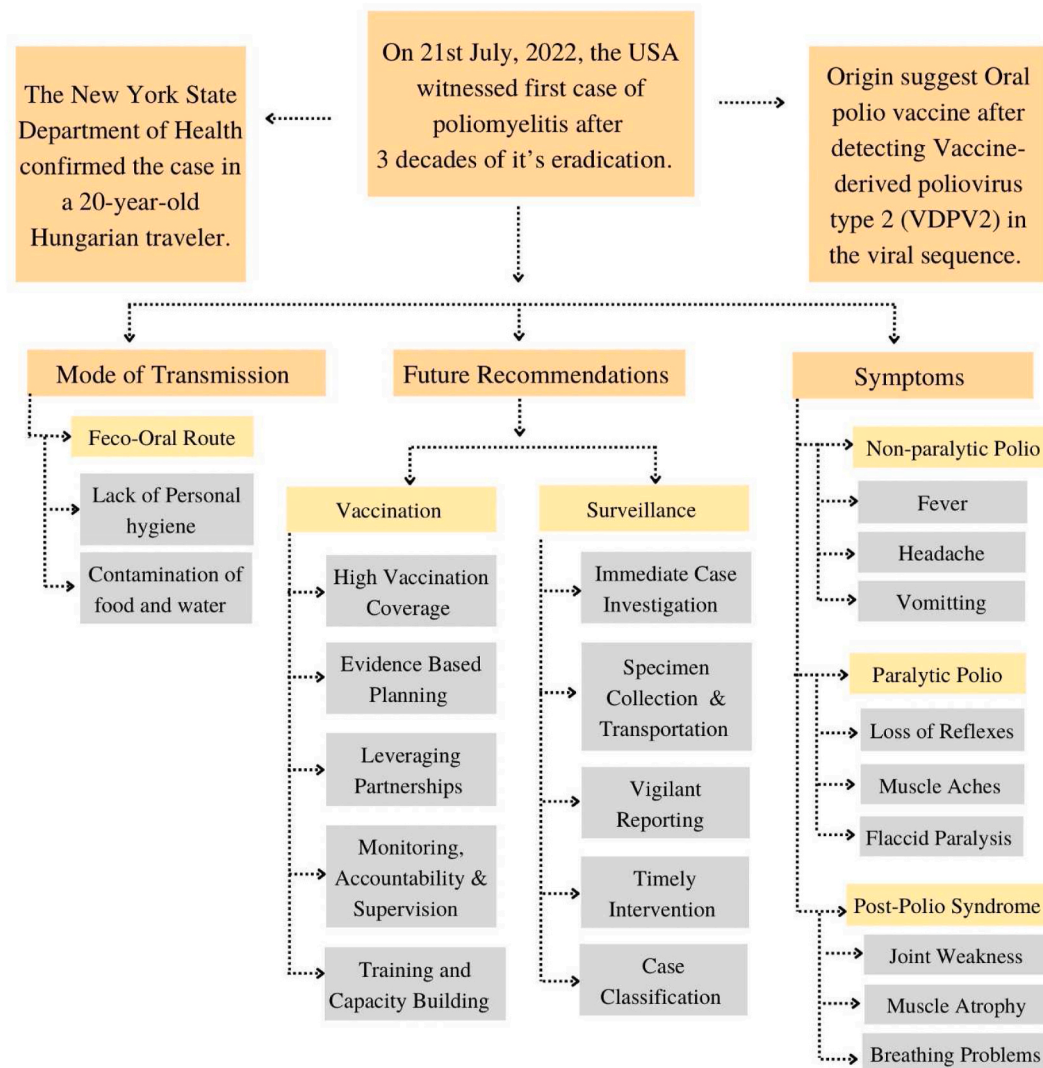


Fig. 4. Summarizing polio in the USA and suggested recommendations.

pregnant, 2 months of age or older, and those who have not finished their previous polio vaccination series. Wastewater samples were also shared with GPLN consisting of CDC and WHO as part of continuous surveillance activities. In response to the current situation, we highly recommend the cessation of OPV and encourage IPV use in the vaccination program schedules. Improving polio cases detection and disease response through a sensitive epidemiological surveillance system will allow timely detection and investigation of AFP due to poliomyelitis. Appropriate training for healthcare providers to employ modern techniques in detection and sample collection is necessary to tackle cases in challenging geographical areas. Lastly, we strongly advise the affected countries including low and middle-tier countries, to have effective outbreak response strategy plans in place so that they can respond and stay prepared for such outbreaks in the future.

Ethical approval

Not Applicable.

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Author contributions

Olivier Uwishema: Conceptualization, Project administration, Writing-review and Designing.

Mortada Abbass: Collection and assembly of data.

Olivier Uwishema: Reviewed and edited the first draft, supervisor.

Jack Wellington MSc (LSHTM) FGMS: Reviewed and edited the second draft.

Chinyere Vivian Patrick Onyeaka: Reviewed and edited the final draft, Supervisor.

Manuscript writing: All authors.

Final approval of manuscript: All authors.

Fig. 3: Strategies for Polio eradication was drawn and analyzed by authors Anushree Rai [1,5] and Olivier Uwishema^{1,2,3*}

Fig. 4 summarizing polio in the USA and suggested recommendations was drawn and analyzed by authors Anushree Rai [1,5] and Olivier Uwishema^{1,2,3*}

Decalartion of competing interest

No conflicts of interest declared.

Consent

Not Applicable.

Registration of research studies

1. Name of the registry: Not Applicable
2. Unique Identifying number or registration ID: Not Applicable
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): Not Applicable

Guarantor

Olivier Uwishema; Principal Investigator (PI).

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