CENTER FOR VACCINE INNOVATION AND ACCESS

Advancing novel polio vaccines

Protection against polio resurgence

On the cusp of global eradication

Poliomyelitis (polio) is a highly infectious disease caused by a virus that can invade the nervous system and cause permanent paralysis. Thanks to vaccination efforts, we are closing in on the virus. The number of polio cases per year is down by more than 99 percent since the inception of the Global Polio Eradication Initiative in 1988; wild polio types 2 and 3 have been eradicated; and in late summer 2020, the WHO African Region was certificated wild polio-free.

Of the wild types of polio, only type 1 remains in the last polio-endemic countries: Afghanistan and Pakistan.

As the world narrows its focus on stamping out the last pockets of poliovirus, global stakeholders are also laying a necessary foundation for tools that will enable complete eradication and minimize the risk of polio making a comeback.

PATH and partners are working to develop novel oral polio vaccines that have the potential to serve as an improved tool to halt outbreaks. Photo: PATH/Gabe Bienczycki.

Polio vaccines: the state of the field

Improvements in hygiene and sanitation have helped minimize exposure to the polio virus and thus the number of polio cases, but the only way to truly prevent the disease is through vaccination.

Inactivated polio vaccines (IPV) and oral polio vaccines (OPV) have propelled us to historically low levels of polio incidence, but new tools are needed for the last mile of disease eradication.

OPV is highly effective in high-burden regions and during disease outbreaks because it protects the individual and halts person-to-person disease transmission. However, on very rare occasions in under-immunized populations, the live, attenuated (weakened) virus used in OPV can mutate and circulate in a community. This is known as circulating vaccine-derived poliovirus (cVDPV). cVDPVs that develop from the ongoing, necessary use of currently available OPV add a complicating factor to ending polio transmission for good, due to the potential of cVDPVs to cause future outbreaks. However, if a population is fully immunized, they will be protected against both vaccine-derived and wild polioviruses.

IPV is highly effective at preventing disease and does not carry the risk of generating cVDPVs, but it also does not confer the same type of immunity that prevents person-to-person transmission, necessary in controlling outbreaks. It is also much more expensive than OPV and more difficult for untrained health workers to deliver in settings where the vaccines are needed most.

Novel oral polio vaccines: closing polio's last loophole

To stamp out the last pockets of wild and vaccine-derived polio and protect against potential outbreaks, PATH and partners are advancing novel oral polio vaccine candidates (nOPVs) against poliovirus types 1, 2, and 3. Like the currently available OPVs, the nOPV candidates are designed to prevent person-to-person disease transmission, without carrying the same risk of seeding new vaccine-derived polio cases. Since the attenuated (weakened) type 2 strain in the currently available OPV causes the majority of cVDPV outbreaks, the program advanced research on nOPV2 first.

Based on promising Phase 1 and 2 clinical trial data, and on the urgent need to address cVDPV2 outbreaks, the World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) on immunization endorsed the nOPV2 Working Group's framework for initial use of nOPV2 under WHO's Emergency Use Listing (EUL) procedure. The EUL involves careful and rigorous analysis of available data to enable early, targeted use of yet-to-be licensed products for a Public Health Emergency of International Concern, which polio has been since 2014.

In parallel, the nOPV program continues to conduct clinical trials to complete the traditional licensure and WHO prequalification applications, which will ensure long-term accessibility to nOPV2.

In collaboration with key global partners, PATH is also advancing research and development of nOPV for polio types 1 and 3.

Ending polio—and maintaining long-term protection

The 2020 milestone of Africa's wild polio-free certification is an inspiration. If the global community succeeds in ending polio, it will mark only the second time in history that an infectious disease in humans was eradicated, the first being smallpox in 1979. We are very close, but we will succeed only if we invest in the tools necessary to completely stamp out the virus, without the same risk of future outbreaks. nOPVs hold great promise for ensuring that we can make polio a thing of the past—and make certain it stays there.

Publications

De Coster I, et al. Safety and immunogenicity of two novel type 2 oral poliovirus vaccine candidates compared with a monovalent type 2 oral poliovirus vaccine in healthy adults: two clinical trials. *The Lancet Journal.* 2021; 397: 39-50. https://doi.org/10.1016/S0140-6736(20)32541-1

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Van Damme P, De Coster I, Bandyopadhyay A, et al. Poliopolis: pushing boundaries of scientific innovations for disease eradication. *Future Microbiology*. 2019;14(15). https://doi.org/10.2217/fmb-2019-0196

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Yeh MT, Bujarki E, Dolan PT, et al. Engineering the Live-Attenuated Polio Vaccine to Prevent Reversion to Virulence. *Cell Host & Microbe*. 2020;27(5):736–751. https://www.sciencedirect.com/science/article/pii/S1931312820302304?via%3Dihub

nOPV2 program partners

Bio Farma manufactures nOPV and applied for the Emergency Use Listing for nOPV2.

The University of Antwerp sponsored Phase 1 and 2 trials for nOPV2 and corresponding comparator trials.

Fighting Infectious Diseases in Emerging Countries sponsored a Phase 2 trial of nOPV2 and corresponding comparator trials.

icddr,b sponsors a Phase 2 clinical trial for nOPV2.

PATH sponsors a Phase 3 trial for nOPV2 and a Phase 1 trial for nOPV1 and 3.

University of California, San Francisco, the **UK National Institute for Biological Standards and Control,** the **US Centers for Disease Control and Prevention**, and the **US Food and Drug Administration** developed the nOPV candidates.

The **US Centers for Disease Control and Prevention** led the work for primary laboratory assessment from the clinical trial samples.

The **Bill & Melinda Gates Foundation** provided funding support to all research, development and manufacturing activities thus far.

The **Global Polio Eradication Initiative** and its partner agencies are coordinating the planning and preparatory activities for the roll out nOPV2.

PATH

PATH is a global organization that works to accelerate health equity by bringing together public institutions, businesses, social enterprises, and investors to solve the world's most pressing health challenges. With expertise in science, health, economics, technology, advocacy, and dozens of other specialties, PATH develops and scales solutions—including vaccines, drugs, devices, diagnostics, and innovative approaches to strengthening health systems worldwide.

path.org

Mailing Address
PO Box 900922
Seattle, WA 98109 USA

Street Address
2201 Westlake Avenue
Suite 200
Seattle, WA 98121 USA

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