The Pivotal Decision That Led to a Resurgence of Polio

In 2016, the global health authorities removed a type of poliovirus from the oral vaccine. The virus caused a growing number of outbreaks and has now arrived in Gaza.

By Apoorva Mandavilli

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The poliovirus that paralyzed a child in Gaza, the first case in the region in 25 years, has traveled a long path.

It most likely arose in Nigeria and made its way to Chad, where it was first detected in 2019, according to genetic analysis. It emerged in Sudan in 2020 and then found a foothold in Egypt, in unvaccinated pockets of Luxor and North Sinai — next door to Gaza.

This journey was the consequence of a fateful decision by global health organizations to pare down the oral polio vaccine in 2016. The move, now called "the switch," was intended to help eradicate the disease.

Instead, the change has led to outbreaks of polio in dozens of countries and has paralyzed more than 3,300 children. A formal evaluation, commissioned by the global polio eradication program and led by two independent experts, was unflinching in its assessment: "The switch was an unqualified failure."

One consequence now is the furious scramble to vaccinate hundreds of thousands of children in a decimated conflict zone, just the sort of environment in which polio thrives. It's not yet clear whether the virus can be contained in Gaza.

Health workers carry polio vaccines during a campaign in central Gaza. So far, the workers have succeeded in immunizing many more children than expected. Eyad Baba/Agence France-Presse — Getty Images

By most measures, the campaign to end polio has been extremely successful. Vaccination has cut down the number of cases worldwide by more than 99.9 percent and is estimated to have prevented more than 20 million cases of paralysis.

There are three types of naturally occurring or “wild-type” polioviruses. Type 1 persists only in Afghanistan and Pakistan. Type 2 was last reported in 1999 and was declared eradicated in September 2015. Type 3 was eradicated in October 2019.

Before 2016, the oral vaccine contained live but weakened viruses of all three types, designed to prod the body to a broad immune response. Children who received the oral vaccine shed the weakened viruses in their feces, an expected consequence.

But when some of these vaccine-derived Type 2 viruses circulated among clusters of children who had not been immunized, the pathogens on occasion slowly reverted to a form that causes paralysis. The odds were very low: Vaccine-associated paralysis occurs roughly once in every 2.7 million doses administered.

Still, because of this rare possibility, the Global Polio Eradication Initiative — a partnership of several groups including the World Health Organization, Rotary International and the Bill & Melinda Gates Foundation — decided to remove Type 2 virus from the vaccine after the wild-type virus was eradicated.

The switch, in April 2016, was a remarkable event, with 155 countries and territories simultaneously replacing triple-hit vaccines with two-hit ones in two weeks.

At the time, there had already been some reports of Type 2 vaccine-derived polio, and officials expected more. So they stockpiled doses of another oral vaccine targeted only to Type 2 to be used to snuff out outbreaks.

And they planned for low-income countries to switch to the injected polio vaccine, which is used in richer and middle-income nations. It uses a dead virus and so cannot cause disease.

The strategy was sound, even many of the harshest critics say. But the execution, particularly in the crucial first years, was bungled.

Even though the global health authorities have spent nearly $2 billion responding to outbreaks, cases of vaccine-derived Type 2 polio have increased tenfold since before 2016. This is the virus that has reached Gaza, and the territory is not alone.

At least eight countries are battling outbreaks of vaccine-derived polio this week. Because one in about 200 infected children becomes paralyzed, even a single case of paralysis — as in Gaza — suggests widespread transmission of the virus.

Door-to-door vaccination campaigns are most effective, as they ensure that no child is missed. But they cannot be carried out in Gaza, where many families have been displaced. Haitham Imad/EPA, via Shutterstock

But calling the switch a failure now is Monday morning quarterbacking, said Dr. Hamid Jafari, W.H.O.'s director of polio eradication for the eastern Mediterranean region.

"It looks really awful, but it wasn't like people were making these decisions with their eyes closed," he said.

There were unexpected speed bumps in executing the plan, he noted, including delays in vaccine availability, intense conflicts and the Covid-19 pandemic, which derailed immunization programs worldwide.

"A lot of things were planned and were expected to fall into place that didn't," he said. "These are things that are beyond the control of anyone."

Outside experts say those factors may have contributed to the failure, but they lay the blame squarely with a sluggish and tentative response to the Type 2 outbreaks.

Outbreaks can best be stopped by using the oral vaccine. The injected vaccine is excellent at preventing paralysis, but it does not prevent spread of the virus and is cumbersome to administer.

By contrast, oral vaccines are delivered as two drops on the tongue, are inexpensive and rapidly strengthen immune defenses in the intestines, where the poliovirus multiplies.

But this has presented global health officials with a dilemma. To extinguish an outbreak of Type 2 vaccine-derived polio, health workers need to quickly immunize large numbers of children with the oral Type 2 vaccine.

But continued use of that vaccine leaves open the possibility of further outbreaks. That concern led officials to focus on using as little Type 2 vaccine as possible to control outbreaks, said Kimberly M. Thompson, president of Kid Risk, a nonprofit that applies mathematical modeling to childhood diseases, including polio.

“They were trying to do this surgical strike kind of approach” instead of being fast and aggressive, she said. “That was a big mistake.”

The approach also had the unintended effect of causing distrust in the vaccine, making countries even more hesitant to use it when needed. But “it was never the vaccine, it was always the poor implementation,” said Dr. Roland Sutter, one of the experts who led the analysis, which described the switch as an “unqualified failure.”

“The language, the words, are very deliberate,” he said.

“If we would have done a good job in the first year and second year with outbreak control, I think we would have a very different conversation,” he added.

In talking of eradicating polio, many experts continue to make a distinction between wild Type 2 virus and the vaccine-derived one. But by the time the vaccine-derived virus has regained enough virulence enough to cause paralysis,

Dr. Sutter said, “no virologist would tell you that there is a difference.”

The eradication campaign is also overly optimistic about eradicating wild Type 1 virus from Afghanistan and Pakistan, which are notoriously difficult to manage because of inaccessible topography and nomadic populations, he said.

“The narrative that’s being promoted is that we are very, very close again in Pakistan, Afghanistan as well,” Dr. Sutter added. “And we are not close.”

A health worker administering polio vaccine drops to children in Lahore, Pakistan, in 2022. Arif Ali/Agence France-Presse — Getty Images

In some ways, the eradication goal is farther away than it was in 2016.

Because children who received the oral vaccine after 2016 are not protected from Type 2 poliovirus, it now has more opportunities to set off a chain of infections, Dr. Thompson said.

Other factors, including conflict zones and weak routine immunization programs, continue to prevent eradication. Vaccine hesitancy, growing populations and overcrowding further complicate matters.

Before the war, polio would have found little purchase in Gaza, where vaccination rates hovered around 99 percent. By mid-2024, the rate had dropped to about 86 percent, below the threshold needed to prevent outbreaks.

No signs of polio have been seen in North Sinai since December. By then, the virus may have already made its way into Gaza, where it found exactly the conditions — many unvaccinated children packed together in unsanitary situations — that allow it to thrive.

Vaccination campaigns are best conducted door to door to ensure that no child is missed. But that is not possible in Gaza, where many homes have been destroyed and people are moving in search of relatives or safe havens.

The Israeli government did not acquiesce to the W.H.O.'s requests to vaccinate over a period of seven days and to begin the campaign first in the north and finish in the south, which has the largest population of unvaccinated children.

Instead, health officials were told to start the campaign in the central zone and finish in the north.

Michael Ryan, executive director of the World Health Organization's Health Emergencies Program, during a U.N. Security Council meeting about a pause in military operations for polio vaccinations in Gaza. David Dee Delgado/Reuters

So far, the campaign has succeeded in immunizing many more children than expected. That may be because the W.H.O. underestimated the number of children who needed the vaccine or because some families traveled from other parts of Gaza to get the vaccine, Dr. Jafari said.

Experts with the eradication program remain optimistic that the world can eradicate all types of polio, everywhere.

The vaccine in Gaza is a newer version of the Type 2 oral vaccine, which relies on a weakened virus that is less likely to regain virulence. It has cut the risk of vaccine-derived outbreaks by 80 percent, said Dr. Ananda Bandyopadhyay, deputy director for polio at the Bill & Melinda Gates Foundation.

The children immunized for the first time in Gaza remain vulnerable to Type 1 polio, should that virus find its way into the region from Pakistan or Afghanistan, where it still circulates.

Later this month, a W.H.O. committee will discuss potentially using the Type 2 oral vaccine alongside the one that targets Types 1 and 3, at least in some areas at high risk.

“One has to still figure out as to how exactly you do that,” Dr. Bandyopadhyay said.

Apoorva Mandavilli is a reporter focused on science and global health. She was a part of the team that won the 2021 Pulitzer Prize for Public Service for coverage of the pandemic. More about Apoorva Mandavilli

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