

Polio provocation: solving a mystery with the help of history

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During the summer of 1951, a medical mystery in the USA erupted into a crisis, stimulating professional debate and public anxiety. The issue was polio provocation, a health risk facing unvaccinated children in polio endemic regions. Leading specialists were at a loss to explain the condition. As the poliovirus was widespread before the discovery of an effective vaccine in 1955, evidence that some paediatric injections could incite polio infection and paralysis led to extraordinary shifts in health policy and calculated efforts to mitigate the risk. At the core of this discussion were physicians and public health researchers, whose efforts to formulate a clinical theory drove both policy and the impetus for scientists to unravel the underlying mechanism.

During the 1940s and 1950s, physicians and public health researchers in the USA, UK, Canada, and Australia sought to understand the nature of polio and how it attacked the grey matter of the spinal cord. Through clinical observation and reporting, older causation theories, which implicated poor sanitation or immigrant populations, were slowly replaced by a range of new possibilities, such as the effect of fatigue, diet, or hygiene. While personal characteristics and precipitating factors were examined, some physicians noticed a correlation between certain interventions and polio paralysis.

One of the first medical procedures implicated in the causation of polio was tonsil surgery. A study of more than 2000 case histories in the 1940s by the Harvard Infantile Paralysis Commission concluded that tonsillectomies led to a significant risk of respiratory paralysis due to bulbar polio. Although proponents of the theory did not entirely oppose tonsillectomies, they

cautioned that such interventions should be avoided during epidemics. Reflecting the growing body of evidence that tonsillectomies could provoke polio, many doctors in the USA adjusted their surgical procedures to account for disease-endemic factors. “The policy of the United States Army”, Major-General E A Noyes acknowledged in 1948, “has been to stop tonsil and adenoid operations during epidemics”. Even though laboratory technology at the time was not sufficiently advanced to unravel the mechanism, published evidence affected clinical practice.

Concerns about tonsillectomies coincided with indications that paediatric injections could also incite polio paralysis. Evidence of this correlation was first published by German doctors, who noted that children who had received treatment for congenital syphilis later became paralysed in the injected limb. Although further studies from Italy and France corroborated this link, it was not until the end of World War II that injection-induced polio emerged as a public health concern. The application of epidemiological surveillance and statistical methods enabled researchers to trace the steady rise in polio incidence along with the expansion of immunisation programmes for diphtheria, pertussis, and tetanus. A report that emerged from Guy's and Evelina Hospitals, London, in 1950, found that 17 cases of polio paralysis developed in the limb injected with pertussis or tetanus inoculations. Results published by Australian doctor Bertram McCloskey also showed a strong association between injections and polio paralysis. Meanwhile, in the USA, public health researchers in New York and Pennsylvania reached similar conclusions. Clinical evidence, derived from across three continents, had established a theory that required attention.

Several ideas were posited by health professionals in an effort to understand how immunisations for diphtheria, tetanus, and pertussis seemed to provoke polio infection. One theorist posited that injections injured human tissues and predisposed them to viral infection. A further theory advanced by Harold K Faber of the Stanford University School of Medicine argued that the ubiquitous poliovirus, already present on the skin of many children, was being driven into the body during immunisations and thus seeded deep into the tissue. The lack of certainty heightened anxiety and brought the issue to mainstream attention.

Medical journals and newspapers became sites of contestation. Not all doctors agreed with the alarmist tone and critiqued the findings as either coincidental or based on insufficient data. Meanwhile, American newspapers advised parents to postpone vaccinations during warm

weather or epidemics, citing evidence that some children developed polio within a month of injection. As debates swirled and publicity mounted, parents were asked to weigh the potential risks of immunisations with their benefits.

The impressive volume of literature on polio provocation by the 1950s fuelled changes in health policy. US health organisations and charities, including the National Foundation for Infantile Paralysis, the American Academy of Pediatrics, and the American Public Health Association, accommodated the possibility of polio provocation and encouraged health professionals to avoid “indiscriminate” injections and “booster shots” during epidemics. In New York City, child health stations were closed and laws mandating paediatric vaccinations before school attendance were relaxed. Most health professionals reformed their immunisation practices and accepted that seasonal factors and cycles of disease were important to consider before immunising children.

Just as anxiety surrounding polio provocation crested, a series of related scientific discoveries fuelled its rapid decline. The introduction of the Salk vaccine in 1955 and the Sabin vaccine in 1962 ushered in an era of polio prevention, which parents and health professionals greeted with a combination of relief and enthusiasm. Once polio vaccination programmes established herd immunity among children and adults, the corresponding risk of toxoid-based injections inciting polio paralysis was effectively eliminated. Orthodox public health and surgical practices were restored. Although medical scientists failed to understand the epidemiological mechanism behind polio provocation, the Salk and Sabin vaccines pushed the issue to the margins of clinical attention.

Concern about polio provocation lay dormant for decades, but resurfaced in the 1980s when large international aid agencies, such as Rotary International and WHO, expanded their immunisation programmes in low-income nations. In some areas of Africa, where polio was endemic, public health workers began to report cases of paralysis after immunisations against common childhood diseases. Since these observations were decades removed from earlier published findings, many health professionals supposed they were witnessing a new phenomenon.

Consultation of archived clinical research helped to bring renewed attention to polio provocation. British microbiologist H Vivian Wyatt became intrigued by the reports emerging from Africa, and turned to archived medical journals in search of a possible explanation. Upon discovering the coverage of polio provocation from the 1950s, Wyatt reasoned that aid workers were witnessing the spectre of a forgotten clinical theory. He published his findings in history and public health journals, arguing that the theory appeared to be scientifically plausible and that the localisation of paralysis could be correlated with injections. Wyatt hoped this work would stimulate a renewed scientific effort to unlock the mechanism of polio provocation and inspire more circumspect immunisation practices in polio endemic regions.

Published historical accounts drew some attention to the matter, but it was not until severe epidemics erupted in India during the 1990s that fresh clinical evidence became available. One study from rural India found that injections seemed to have a role in causing paralytic polio. A subsequent assessment upheld this assertion in concluding that the primary risk factor for paralysis was receiving an injection within 30 days of onset. Health professionals in India struggled to verify the data and weigh its implications. Akin to the debates of the 1950s, some researchers rejected the evidence, whereas others cautioned that injections in endemic countries should be conducted only when all other therapeutic options were exhausted. However, without laboratory findings that showed how injections could provoke polio, the debate continued to rage.

The abundance of historical clinical research on polio provocation combined with indications of its re-emergence roused medical researchers to unravel the cause. The state of virology and immunology were sufficiently advanced by the 1990s to allow for a systematic investigation. In 1998, State University of New York researchers Matthias Gromeier and Eckard Wimmer published a pioneering article on the mechanism of injection-induced polio paralysis. Through their laboratory work, they discovered that tissue injury produced by an injection aided the poliovirus to infect the body and readily journey to the spinal cord. For the first time, health professionals working in polio endemic regions had scientific evidence that paediatric injections could incite paralysis.

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Hypodermic syringe with bottle of diphtheria vaccine

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Substantiation of the theory seemed to vindicate the cautious policies of the 1950s and the importance of maintaining herd immunity against polio. In countries where the virus was controlled through vaccination programmes, the risk of polio provocation was insignificant. However, in regions where polio was endemic, immunisation sequence mattered until eradication of the virus was achieved. The discovery showed that polio vaccination was vital to the wider success of public health programmes and that it needed to be undertaken before other paediatric immunisations to reduce the risk of provoking polio. By resolving a lingering clinical enigma, medical science gave new gravitas to the global polio eradication effort and elevated the vaccine to a pillar of the public health arsenal.

The long history of polio provocation highlights the importance of published clinical evidence in shaping health policy and spurring medical research. Far from being bibliographic curios, archived medical journals contained the remnants of a neglected theory and important observations relevant to a contemporary concern. Historical record and interpretation ultimately grounded conceptions of polio provocation and added weight to fresh discoveries. By building on knowledge, physicians and public health researchers forged a momentum to solve a mystery, which ultimately helped to reduce suffering and save lives.

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