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Review Article

Dedication to a lifelong mission: Gu Fangzhou and the Chinese road to polio elimination ☆

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ABSTRACT

This paper reviews Professor Gu Fangzhou's contributions to polio control and elimination in China. Following the 1955 polio outbreak, he advocated for the live oral polio vaccine (OPV) route tailored to national conditions. To validate vaccine safety, he initiated human trials by testing the vaccine on himself and his infant son. He led the construction of the domestic OPV production base and pioneered the sugar-coated pill formulation to overcome cold chain constraints, ultimately facilitating the nationwide elimination of indigenous wild polioviruses by 1994. Furthermore, he established China's OPV production and quality control standards and trained numerous public health professionals.

1. Introduction

The year 2026 marks the centenary of the birth of Professor Gu Fangzhou (Fig. 1), a distinguished Chinese medical scientist, virologist, and medical educator. Although he passed away in 2019, his enduring legacy—aptly reflected in his given name, "Fangzhou" (meaning "ark")—will continue to safeguard the health and wellbeing of future generations.

In 1955, polio emerged as a major public health threat in China following large-scale outbreaks in Nantong, Jiangsu, which spread nationwide, causing widespread paralysis and death among children and triggering social panic.[1] Gu's lifelong work—including the strategic selection of vaccine technical routes, the development of the oral polio sugar-coated pill vaccine, and the cultivation of public health professionals—led to the establishment of a domestic polio prevention and control system tailored to China's context. This achievement represents a landmark success in infectious disease control for developing nations and provides a replicable model for global public health governance. However, existing literature has predominantly focused on isolated aspects such as sugar pill vaccine development and his personal participation in clinical trials, lacking an integrated analysis of his technical decision-making, technological innovation, and talent cultivation philosophies. This paper provides an in-depth examination of his four major contributions based on verified historical materials, concluding with an assessment of his enduring legacy for the Healthy China initiative and global health security.

2. Selecting the vaccine technical route: a strategy suited to China's context

2.1. The global vaccine debate and China's development dilemma

By the late 1950s, two distinct poliovirus vaccine technologies existed internationally, i.e., Salk's inactivated polio vaccine (IPV) and Sabin's live oral polio vaccine (OPV), each with unique advantages and limitations.[2] Although the Salk IPV, a formalin-inactivated formulation, exhibited satisfactory safety in clinical trials, its large-scale implementation entailed prohibitive costs. The requirement for 3–4 intramuscular injections at approximately 5 U.S. dollars per dose, alongside strict cold-chain requirements and trained medical staff, posed an insurmountable barrier to its adoption in China, given the country's vast rural population and the fiscal constraints of the early People's Republic of China (PRC). In contrast, Sabin's OPV elicited both mucosal and humoral immunity and facilitated herd immunity via fecal viral shedding. Although this presentation offered significant advantages, e.g., ease of administration and lower production costs, its safety profile for mass pediatric immunization remained unvalidated, thereby posing substantial risks for countries considering its adoption.

In 1959, Gu was assigned to the Soviet Union for formal training in IPV manufacturing technology. During an international virology conference in Moscow, he happened to learn that the large-scale clinical trials for OPV initiated by Sabin across Soviet research institutes. Gu subse-

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Fig. 1. Professor Gu Fangzhou (1926–2019).
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quently collected all available OPV trial data, conducting a comprehensive cost-benefit analysis based on China's demographic and economic fundamentals. Given the population of over 200 million children under the age of seven nationwide, universal IPV vaccination would have depleted national public health budgets and indefinitely delayed epidemic elimination. However, the adoption of the then-unproven OPV necessitated assuming full accountability for potential vaccine-related adverse events.

2.2. Strategic route decision-making rooted in China's national conditions

Following rigorous data analysis, Gu submitted a formal policy recommendation to the Ministry of Health, advocating for the nationwide adoption of the Sabin OPV, as detailed in his 1959 internal research report, *Current Status and Prospects of Live Attenuated Poliovirus Vaccine*. This far-sighted judgment was validated by more than three decades of national immunization surveillance data: OPV induces sustained herd immunity, as vaccine recipients may shed the virus through the intestinal tract,[3] which effectively interrupted nationwide wild poliovirus transmission—an effect that could not be achieved by the humoral immunity elicited exclusively by IPV. This strategic decision not only freed China from potential technological reliance on Western IPV supply chains but also established a foundational decision-making paradigm for China's public health governance: technical policy formulation should prioritize domestic public health needs over uncritical adherence to international practices.

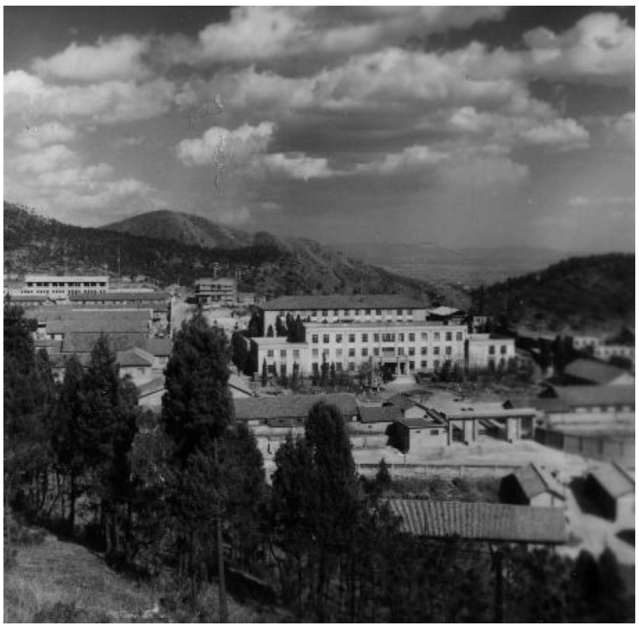

Fig. 2. A landscape of the Institute of Medical Biology, Chinese Academy of Medical Sciences in Yunnan Province in 1960s.
Licensed by: Institute of Medical Biology, Chinese Academy of Medical Sciences.

3. Venture forward amid risks: the fortitude to test the vaccine on his infant son

After the lab studies and animal experiments were completed, the critical procedure for vaccine development, a clinical trial in humans, followed. This was to prove the vaccine was safe and effective in children. Faced with ethical challenges and unknown risks, Gu made a decision that shocked the common people; he administered the first batch of the vaccine to his infant son without telling his wife. This amounted to using his son as the first child subject in the trial. Although previous animal studies and trials in adults had proven the vaccine was generally safe, he endured immense psychological pressure and kept monitoring his son's health status day and night. Inspired by Gu, his fellow lab researchers tested the vaccine on their own young children as well. When the observation period ended, all the children were safe and sound. He burst into tears and held his son tightly. Years later, Gu elucidated his fundamental ethical rationale in a retrospective interview with *Guangming Daily*, "If I lacked sufficient confidence to administer this vaccine to my own child, I had no right to request that other families assume this risk".[4] This episode represents a seminal example of scientific accountability in modern Chinese medical history.

4. Indigenous technological innovation: sugar-coated OPV as a China-specific solution to cold chain barriers

4.1. Production base construction in Kunming

In 1960, after successful trial production, Gu's team encountered two formidable challenges to a nationwide vaccine rollout: the absence of a national cold-chain infrastructure and poor acceptability of the bitter liquid oral vaccine among infants. Tasked by the national government, the team established the Institute of Medical Biology, Chinese Academy of Medical Sciences (IMBCAMS)—China's first large-scale polio vaccine production base—amid the rugged hills of Yu'an Mountain in the western suburbs of Kunming. Despite enduring harsh conditions—living in caves with limited rations—they built production facilities from scratch, laying the foundation for subsequent large-scale OPV production (Fig. 2).

Fig. 3. Production of oral polio vaccine: the sugar-coated pill rolling process. Licensed by: Institute of Medical Biology, Chinese Academy of Medical Sciences.

Although Gu acquired Sabin OPV seed strains and liquid vaccine production technology from Soviet virologists during his 1959 academic exchange, the sugar-coated pill formulation represented an entirely indigenous Chinese innovation. Starting in January 1962, Gu's team adapted traditional Chinese pill-making techniques and conducted extensive iterative formulation trials in collaboration with the Shanghai Sine Pharmaceutical Factory. Through these efforts, they optimized the ratios of milk powder, cream, and excipients, and finalized low-temperature rolling techniques that preserved viral activity at ambient temperature.[5] This independent breakthrough, achieved outside Soviet research frameworks, enhanced the vaccine stability, extended its shelf life, and improved its taste and acceptability[6] (Fig. 3).

4.2. Public health breakthroughs of polio sugar pills and national immunization achievements

By utilizing simple thermos flasks packed with ice for transportation, health and epidemic prevention workers successfully delivered the sugar-coated vaccine to hundreds of millions of households across China, ensuring the nationwide rollout was a complete success. The introduction of the sugar pill facilitated the broader immunization campaign, as this presentation was favored by both children and their guardians. The transition from injectable vaccines to an oral formulation replaced children's anxiety with anticipation. Parents likewise found the oral method more convenient and acceptable, which increased their willingness to vaccinate their children. In 1978, the sugar-coated pill formulation of OPV was incorporated into the national Expanded Programme on Immunization (EPI). The reported coverage for the first dose rose from <30% in 1975 to over 95% in 1990 in every province of mainland China. The average incidence rate of polio dropped from 3.18/100,000 (1956–1960) before the implementation of the nationwide immunization to 0.02/100,000 in 1994.[7,8] In September 1994, China recorded its last case of indigenous wild poliovirus in Hubei province.[9,10] In 2000, China was officially certified as polio-free by the Regional Commission for the Certification of Poliomyelitis Eradication within the WHO Western Pacific Region, acknowledging the successful elimination of the wild poliovirus.

The development of OPV in the sugar pill represents a symbolic achievement of China's EPI. Tailored to national conditions and grounded in scientific evidence, it combined theoretical principles with practical innovations, enabling the country to accomplish large-scale immunization in a cost-effective and time-efficient manner.

5. Dedication to public health talent cultivation and institutional capacity building

5.1. Technical standard establishment for OPV and medical talent cultivation

During his tenure from 1985 to 1992 as President of Chinese Academy of Medical Sciences (CAMS) & Peking Union Medical College (PUMC), Gu developed a comprehensive, multi-layered framework for medical education governance. Concurrently, he was instrumental in standardizing the national regulatory system for live OPV production and quality control, primarily through his landmark technical report, *Certain Experiences in Live Attenuated Poliovirus Vaccine Production and Quality Control*. The report systematically outlined monkey neurovirulence test standards, aseptic cell culture protocols, and lot release criteria, serving as the foundational document for the first national OPV manufacturing regulations issued in 1964, which were later codified into national biologic standards.[11,12] Additionally, he revitalized the eight-year elite medical education system at PUMC, mandating full-time clinical mentorship for all interns, establishing an autonomous graduate school, and expanding interdisciplinary research focused on emerging infectious disease preparedness. Despite his demanding administrative responsibilities, he maintained weekly seminars to monitor students' research progress. According to institutional archives, he frequently waited outside sterile laboratories for graduate students delayed by ongoing experiments, ensuring uninterrupted academic mentorship. Throughout his career, he supervised over 30 postgraduate students in virology and preventive medicine.

5.2. Talent cultivation philosophy and long-term public health strategic legacy

During his tenure at CAMS & PUMC, Gu consistently championed a core institutional principle: while eradicating an infectious disease may require decades of targeted vaccine research, building a robust national public health workforce demands a century-long commitment to systematic education.

Gu proposed an integrated public health human workforce framework bridging laboratory research expertise with grassroots epidemic prevention efforts. This paradigm rejects hierarchical stratification between clinical specialists and frontline rural health practitioners, emphasizing that despite their different specializations, both groups share the common mission of safeguarding national public health and jointly form the backbone of China's multi-tiered preventive medicine network.

Beyond his work on polio, Gu spearheaded national policy initiatives to incorporate the hepatitis B vaccine into routine pediatric immunization schedules. Besides, he guided research teams focused on enterovirus surveillance and established inter-provincial frameworks for public health training and professional exchange. Even into his 80 s, following the domestic elimination of polio, he continued to publish review articles on pandemic preparedness, cautioning against complacency in the development of public health expertise. Ultimately, his enduring legacy extends beyond polio elimination to the establishment of a robust domestic vaccine industry and a multi-tiered, specialized epidemic prevention workforce prepared to address emerging infectious disease outbreaks.

6. Summary

As China maintains its WHO-certified polio-free status, generations of children spared from paralytic polio stand as a profound testament to

the lifelong commitment of "People's Scientist" Gu Fangzhou. Commemorating his birth centenary in 2026 necessitates a dual tribute: honoring his tangible scientific achievement—the "sugar pill" OPV that eliminated indigenous wild poliovirus—and inheriting the core principles embedded in his lifework. This review highlights how these principles manifested in a holistic "Chinese Solution": adopting a contextually tailored OPV technical route to bypass cold-chain barriers, and establishing a medical education framework for a sustainable public health workforce. Offering a replicable model for low- and middle-income countries, Gu's integrated paradigm of evidence-based decision-making, domestic innovation, and talent cultivation remains a cornerstone of global health practice, embodying the enduring responsibility Chinese scientists uphold for human health.

Author's contributions

Wu J: Conceptualization, Writing-Original Draft; Zhao Y: Writing-Review & Editing, Data curation; Liu Y.-F: Wiing-Review & Editing, Validation. All authors read and approved the final version to be published.

Declaration of generative AI and AI-assisted technologies use

During the preparation of this work, the authors used large language models to assist with language editing, translation, and figure formatting. After using this tool/service, the authors closely reviewed and edited the content as needed and take full responsibility for the final content of the publication.

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References

1. Dong DX. Eradication of poliomyelitis in China: historical review and experience. *Foreign Med Sci*. 2004(5):261–264. Chinese.
2. Chu JY, Shu JD. The road to conquering polio: comparison, competition, and complementarity between the inactivated and live-attenuated vaccines. *Ke Xue*. 2022;74(5) 57-62+69. Chinese.
3. Sabin AB. Present position of immunization against poliomyelitis with live virus vaccines. *Br Med J*. 1959;1(5123):663–680. doi:10.1136/bmj.1.5123.663.
4. Jin ZY, Gao CF. Lifelong persistence of the "Sugar Pill Grandpa". *Guangming Dly*. 2024-07-28. Chinese.
5. Wu J, Dong DX, Li Y. Just for Chinese people's stood up—Prof. Fangzhou Gu, father of "sugar pills". *Protein Cell*. 2020;11(4):231–234. doi:10.1007/s13238-019-00669-7.
6. Halm A, Yalcouyé I, Kamissoko M, et al. Using oral polio vaccine beyond the cold chain: a feasibility study conducted during the national immunization campaign in Mali. *Vaccine*. 2010;28(19):3467–3472. doi:10.1016/j.vaccine.2010.02.066.
7. Dong DX. Immunization with oral poliovirus vaccine in China. *Prog Med Virol*. 1985;31:212–221.
8. National Health Commission of the People's Republic of China. *2021 China health statistics yearbook*. Beijing: Peking Union Medical College Press; 2021. Chinese.
9. Centers for Disease Control and Prevention (CDC)Importation of wild poliovirus into Qinghai Province, China, 1999. *MMWR Morb Mortal Wkly Rep*. 2000;49(6):113–114.
10. Hao LX. Fighting polio—Witnesses' accounts: "we will finally eradicate poliomyelitis". *Health News*. 2021-04-29. Chinese.
11. Wu M. Regulations for the manufacture and control of live poliovirus vaccine: international experience and China's path. *Chin Med Sci J*. 2023;38(4):315–320. doi:10.24920/004284.
12. Wu M. The history of the development of Chinese regulations for live poliovirus vaccine. *Med Philos*. 2023;44(17):12–16. Chinese.