Readers Insight
Publisher of open access books and journals
PJMLS OPEN ACCESS
Print ISSN: 2707-4471. Online ISSN: 2707-448X

Review Article	Pak-Euro Journal of Medical and Life Sciences
DOI: 10.31580/fg0fbm40	Copyright © All rights are reserved by Corresponding Author
Vol. 8 No. 3, 2025: pp. 715-722	
www.readersinsight.net/pjmls	**Revised:** September 15, 2025 **Accepted:** September 22, 2025
Submission: June 16, 2025	**Published Online:** September 30, 2025

PROGRESS AND CHALLENGES IN POLIO VACCINATION IN PAKISTAN: A REVIEW ON EFFORTS, OUTCOMES AND FUTURE DIRECTIONS

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Abstract

Poliomyelitis, caused by Poliovirus (a member of the Picornaviridae family), causes permanent paralysis in children under five. Although after many efforts, Pakistan is one of the two remaining endemic countries where Wild Poliovirus Type 1 continues to circulate. According to the Pakistan National Surveillance report, 74 cases were reported in 2024. This review explores the progress and barriers facing the polio eradication initiative of the country. We examine the main challenges that continue to obstruct the complete eradication including vaccine hesitancy, the difficulty in reaching the mobile populations and security threats to vaccinators. This article also reviews the historical milestones achieved, the recent immunization strategies and emerging technological and strategic innovations that are important to eradicate polio from all over the world.

Keywords: *AFP, bOPV, Challenges, IPV, NID, OPV, Polio eradication, SNID*

INTRODUCTION

Apart from Afghanistan and Nigeria, Pakistan also has a serious polio epidemic, which mainly affects children under the age of five. The spatial nature of the disease was recognized in the 1980s, which was the first discoverer for the 1994 nationwide polio vaccination campaign, but religious and cultural approaches, Western medicine mistrust and political stresses have contributed to the broader vaccine hesitation. Recent data from WHO (2024) show that Pakistan recorded 74 polio cases in 2024 and 29 till September 2025 compared to 306 in 2014, showing a major drop but not complete elimination (1, 2).

IMPORTANCE OF VACCINATION

Polio vaccination is a major public health initiative that has nearly eradicated the disease in the country. This is a serious disease that can cause permanent paralysis and death in children. Vaccination campaigns have erased the disease up to 99% worldwide since 1988, in which global polio eradication initiative was initiated. The virus is returning and re -appearing in areas that have been erased, especially in a country like Pakistan, where sanitary measures are not as effective as they should be (1). It is important to maintain a high vaccination rate for national and international efforts to eliminate the virus. In addition, the vaccine initiative often offers a way to provide other important health services, such as regular vaccination and vitamin A complementary, strengthening of health system and improving children's overall health in low-resources contexts (3, 4).

REVIEW'S OBJECTIVES

Research Gap and Objectives: Several earlier studies have discussed Pakistan's eradication efforts, most of them rely on outdated data before 2020 (5). This review aims to compile and analyze recent progress, identify the barriers and propose strategies for future action. The main objectives are:

- Summarize the progress of vaccination campaigns in Pakistan (6)
- Highlight the main challenges and factors affecting vaccine acceptance (7).

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- Discuss the role of surveillance, environmental monitoring and technology in polio control (8)
- Suggest future directions for complete eradication (9).

HISTORICAL CONTEXT

The polio vaccination program of Pakistan is regularly growing with the help of international cooperation, Social and political support and public health initiatives. To control this virus in 1970s, very limited steps were taken but the Expended program of Immunization (EPI) increased the vaccination coverage in 1978. The Global Polio Eradication Initiative (GPEI) found in 1988 which focused on high polio rates and cases in Pakistan (10). The government of Pakistan organized the National Immunization Day (NID) and Sub National Immunization Day (SNID) in 1994 to vaccinate every child. The OPV was introduced in 2015 but to reduce the risk of spreading of the virus, an inactivated polio vaccine was introduced in late 2015 (11). The highest number of polio cases were recorded in 2014 in Pakistan throughout the world which lead to a national emergency (12). The major outcomes, from the launch of EPI to the introduction of IPV and NEAP, are summarized in Table I (13, 14).

Table I. Historical milestones of polio vaccination in Pakistan

Sr. #	Year	Event / Initiative	Outcomes	Citations
1	1978	EPI	Routine vaccination introduced nationally	WHO, n.d. (15)
2	1994	NID & SNID	Mass campaigns for children under 5	Reichler et al., 1997 (16)
3	2014	NEAP	Focus on high-risk districts after case surge	Government of Pakistan, 2014 (17)
4	2015	Introduction of IPV in routine schedule	Added injectable vaccine to OPV campaigns	WHO, 2015 (11)
5	2016	Switch from trivalent OPV to bivalent OPV	Reduced risk of type-2 vaccine-derived virus	GPEI, 2016 (18)
6	2019-2024	Annual NEAP updates and SIAs	Ongoing reduction of cases, but outbreaks persist	Government of Pakistan, 2020–2024 (9, 19)

MILESTONES ACHIEVED IN DISEASE ERADICATION

Pakistan has made key achievements against polio, the cases in the country is significantly decreasing showing the success of dedicated vaccination efforts and improvements in public health infrastructure. The number of cases decreased in 2012 compared to the past high incidence. The National Emergency Action Plan (NEAP) was launched in 2014 in response to the resurgence of polio cases, which focuses on high-risk areas and the observation of strengthened accountability systems. NEAP is revised annually to address emerging issues and it is a key component of the Country's Emergency Operations Plans (EOPs) (20).

In 2015, IPV was introduced into routine immunization programs. By providing immunity without the risk of Vaccine-Reported Poliovirus associated with OPV, Pakistan has adopted a novel approach used in vaccination, such as construction of vaccination centers through transport systems at the border in hard to reach areas, deployment of vaccination workers in women led communities (21). Pakistan's Acute Flasid Paralysis (AFP) monitoring system is important in tracking the spread of the disease and adjusting vaccination strategies. International organizations like WHO, UNICEF and Bill and Melinda Gates Foundation have played an important role in maintaining speed in the country and overcoming the obstacles (22).

KEY HISTORICAL CHALLENGES

Polio eradication plan is the country's one of the key priority with facing many challenges and conflicts. It applies mainly in Khyber Pakhtunkhwa province and Federally Administered Tribal Areas (FATA) which are the main refusals to vaccination. Logistical challenges in these hard to reach areas are also important and when combines with inadequate roads and poor infrastructure it delay or prevent access to help in some areas (23). The nomadic lifestyle in these areas makes it more difficult to ensure that children get the required amounts of vaccines. Political instability and issues of governance also block the polio eradication efforts. The false cultural and religious beliefs are also the major barriers to polio vaccination.

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The success of polio eradication efforts has also been disturbed by poor management of vaccination teams and the lack of training and responsibility (24, 25).

CURRENT VACCINATION STRATEGIES

OVERVIEW OF VACCINATION CAMPAIGNS

The foundation stone of Pakistan's polio eradication campaign is NID and SNID. In NID, thousands of vaccination teams distribute in different areas all over the country and vaccinate the children with oral polio vaccine. SNIDs targets high risk locations such as Sindh, Balochistan, and KPK (26). Supplementary Immunization Activities (SIAs) are also important in polio eradication efforts, which are carried out in form of campaigns in response to the detection of the disease or later outbreaks. In 2024, more than 45 million children were targeted in SIAs, with over 250,000 vaccinators participated from all over the country. Policies such as mobile vaccination teams, permanent vaccination sites in transit centers and community participation have become essential for the most at risk and hard to reach children (14, 27).

TYPES OF VACCINES USED

Polio eradication effort in Pakistan depends on the use of vaccines such as the OPV and IPV. OPV is a live attenuated vaccine that is given orally and provide protection to communities by decreasing the spread of the virus in the environment. It has a great importance in campaigns due to its easy use and the ability to vaccinate a large population in limited time (28). IPV, an injectable vaccine, was launched in 2015 as part of the Global Polio Endgame Strategy. It stimulates immunity in the bloodstream and prevents all three types of virus without the risk of the disease from the vaccine (29). The effectiveness of the vaccination program has increased with a combination of OPV and IPV, which helps maximize immunity in children (30).

TARGET POPULATIONS AND THEIR COVERAGE

Eradication of this disease totally depends on vaccinating the right target, including children under 5 years, a high-risk group and the areas where the virus existence is detected. The current goal of the immunization program, NID and SNID, is to provide strong protection for these, i.e urban slums and rural areas. These areas show resistance to vaccination programs, and some special strategies are applied to make sure that children are not left for vaccine in these areas. Internally Displaced Persons (IDPs), Refugees, Seasonal Workers, as well as homeless people and other immigrants are the special targets for vaccination campaigns because of their different lifestyles (31, 32).

PROGRESS AND ACHIEVEMENTS

REDUCTION IN POLIO CASES

Significant progress has been observed in reduction of the number of cases in the country; GPEI was launched in 1988, after those cases were increased quickly in the early 1990s, but the number of cases was decreased with the execution of vaccination campaigns and a complete surveillance system. In the mid-2000s, the number of annual cases were decreased from 600 to less than 100 the help of BOPV (Fig. 1) (33). The achievements achieved were mainly due to the broad immunization campaigns completed in the country. Polio cases reduced NIDs and SNIDs, with almost 0 infections in the areas where a large number of cases were reported before. In combination of these, many projects have been started for the growth of vaccination rates, to promote people's participation and safety protocols for the protection of vaccination teams (34, 35).

SUCCESS STORIES AND CASE STUDIES

Karachi, one of the largest cities of Pakistan was found that the number of polio cases dropped gradually as the campaign focused on immunization and was successful by expanding work to the community (31). Pakistan's tribal areas including KPK and FATA have proved to be particularly challenging due to logical challenges and security concerns, but it has achieved excellent success in various fields (31, 36).

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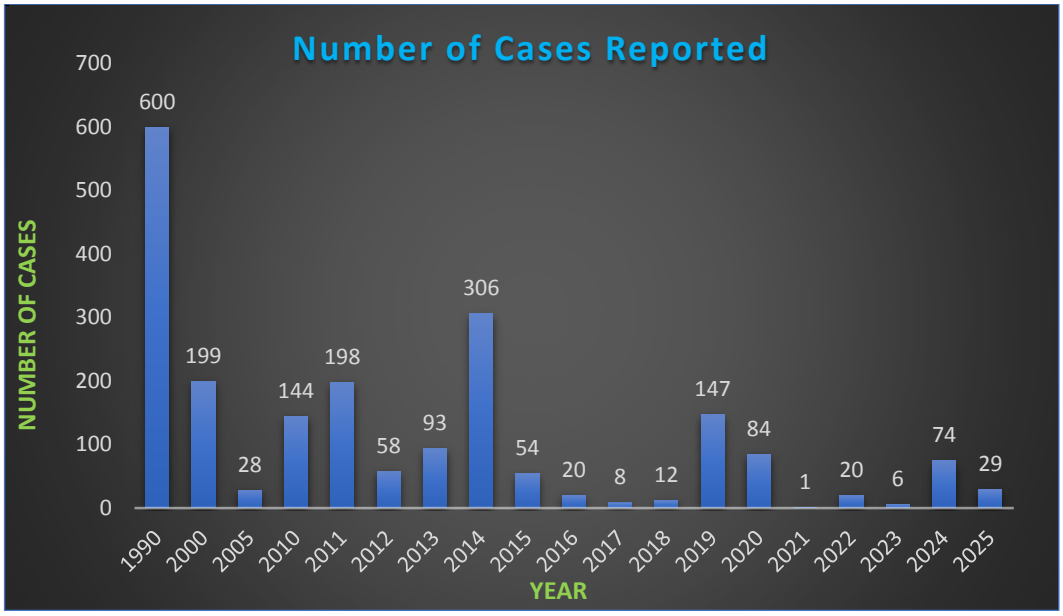

Fig. 1. Graphical representation of the trends in polio cases in the country from the year 1990 to 2025 (33).

CONTRIBUTIONS FROM INTERNATIONAL ORGANIZATIONS

Polio eradication efforts in the country have been greatly assisted by international organizations such as the WHO, United Nations Children's Fund (UNICEF), Bill & Melinda Gates Foundation, etc. NIDs and SNIDs were a great step by these organizations to ensure the success of immunization campaigns. (14). UNICEF has played a key role in efforts by arranging the procurement and supply of vaccines, logistics support, Community participation and support to the Polio vaccination campaign. Investing in the research & development to elimination of polio is important to solve problems like Vaccine Derived Poliovirus (VDPV). The Gates Foundation helps coordinate efforts and cooperation between international agencies, states and NGOs, promotes cooperation and coordinate national and local initiatives to eliminate this disease. Rotary International is also a key partner in the global polio eradication initiative through funding, support, Service, Volunteering and public awareness campaigns (22, 30).

CHALLENGES AND BARRIERS

GEOGRAPHIC AND DEMOGRAPHIC CHALLENGES

Pakistan faces a high number of challenges, including geographic and demographic which obstruct the complete eradication of this disease. Geographical challenges include remote and high risk areas such as FATA, KPK, Balochistan and internal Sindh, showing logical problems for vaccination programs (37). These areas suffer from continuous polio infections and incredible vaccine coverage. There are also differences between urban and rural areas, with high vaccination rates due to better resources and infrastructure in highly populated areas such as Karachi and Lahore (38). Polio eradication is a bit difficult due to security reasons in some areas. The country's high rate in population growth, especially in urban areas cause difficulties to vaccinate each child (39).

VACCINE HESITANCY AND PUBLIC PERCEPTION

Vaccination hesitancy is another problem in Pakistan. It is due to misinformation, religious and cultural beliefs and misleading, not trusting the health care system and many more. The factors which contribute includes misinformation about the efficacy and safety of polio vaccination. Some populations may be more resistant to vaccination because they believe that it conflicts with religious codes (13). There is almost zero trust in the health care system, as some people are unsure about the goals and legitimacy of vaccination programs because of past experiences or negative views of health care. Public opinion of polio vaccination is also a factor in vaccine acceptance. Parents hesitate to vaccinate their children in areas where polio is known as a distant or slight threat (39).

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OPERATIONAL CHALLENGES

Polio vaccination efforts in Pakistan face many operational challenges that affects the effectiveness, accessibility and efficiency of the vaccines. These problems include maintaining the cold chain due to load shedding in rural and remote areas. These issues also affects the performance in the disease eradication programs (40). Due to the mountainous terrain dry regions and the country's underdeveloped areas make it difficult for immunization teams to reach every part of the population. Even with progress, eradication efforts face many issues ranging from access issues to misinformation and operational gaps. A summary of the key challenges is presented in Table II (40).

Table II. Main challenges to polio eradication in Pakistan

Sr.#	Category	Main Issues
1	Geographic	Remote terrain, nomadic groups, poor roads
2	Security	Attacks on vaccinators, limited access in conflict zones
3	Misinformation	Rumors on safety, cultural and religious resistance
4	Cold chain	Power cuts, weak storage in rural areas
5	Program gaps	Missed children, microplan errors, weak data systems
6	Population movement	Refugees, IDPs, migrant workers in cities

STRATEGIES TO ADDRESS LOGISTICAL AND OPERATIONAL ISSUES

Maintaining the cold chain, improving the supply chain organization and the use of advanced solutions for remote areas are important to improve vaccine efficacy. A strong supply chain management system with perfect plans and good collaboration between suppliers and distributors can reduce the problems in supply chain. Modification in vaccination plans to local logistics and geographic conditions can increase the vaccine coverage in some areas (40). Establishment of cooperation among stakeholders, Vaccination team training and funding capacity building for enterprises. Impact analysis is important for determining the success of a polio vaccination campaign and to know the broader results (41).

PUBLIC HEALTH OUTCOMES

Reduction in polio cases in Pakistan is a huge public health benefit. This is because the number of polio cases are reduced in recent decades. This decrease shows the effectiveness of vaccination in controlling and almost eliminating the disease. Increased vaccination has increased the immunity of the children. Protect those who are not vaccinated and reduce the possibility of outbreak of the disease (42). Vaccination is important to achieve high level of elimination of coverage and prevent the spread of polio. Pakistan's health system has also been strengthened through polio vaccination efforts. This includes developing cold chain facilities, surveillance systems and other infrastructure to improve health care delivery and preparedness for other health crises (43).

Quality of life and social impact are improved for people and communities. This is because the frequency of polio has decreased and vaccination campaigns have increased the quality of life and social participation, as many vaccination campaigns have contributed to overall economic growth. As a healthier population becomes more productive (44). Community participation is important for a successful campaign for life and to support economic expansion. This is because it strengthens trust and removes barriers to vaccination. A robust surveillance system is needed to monitor and evaluate vaccination campaigns (44).

FUTURE DIRECTIONS

Vaccination campaigns should be focused on careful planning, logistics support and safe/easy access to remote and unsafe areas. Community participation can be extended by cooperation with local groups, appointing public health officials in the community and using socially sensitive communication techniques (21). Active contribution of community members can help to report concerns and increase vaccination rates. Surveillance systems should be strong to ensure accurate and timely detection of polio cases. Improvements include real time data handling, a good data collection system, and reliable confirmation of vaccination coverage (Finger marking with high quality markers). Good surveillance can helps in initial detection and response to outbreaks (23).

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INNOVATIONS IN VACCINATION AND SURVEILLANCE

Progress in vaccine technology, including new development and distribution techniques, has the ability to improve polio vaccination campaigns. The study of more effective inactive polio vaccine and new distribution methods offers more accessible and effective vaccination options. Digital technology and data analysis can improve vaccination and monitoring programs (36). Remote vaccine can facilitate access to hard areas such as mobile vaccination units or drones for delivery and ensure successful vaccination for all targeted groups. Policy and governance can play an important role in supporting polio elimination efforts. It is necessary to integrate policy framework, increase good governance and coordination among stakeholders, and support international cooperation for a successful vaccination program. Policy framework should prefer consistent funding, accurate targeting and implementation of the accountability system (43). Improving legal framework helps ensure efficient allocation of resources and creates a favorable environment for vaccination programs. Good governance and effective coordination between stakeholders, including corporate and non-corporate sectors, NGOs and international organizations, can increase the efficiency of polio eradication programs (43).

CONCLUSION

Polio eradication in Pakistan has shown important successes and face continuous challenges. While the country has made major progress in reducing the number of polio cases through broad vaccination campaigns and international cooperation. Vaccine disrupts efforts such as hesitation, logistics problems and safety concerns. To make this country a completely polio-free country, it is important to address these challenges by following many advanced techniques with the help of community engagement and learning about the disease. Advancements in the manufacturing of vaccines and their supply can also play a very important role in completing this goal. Improvement in the surveillance and report system is also recommended as vaccinators are using the old paper-based report system, which should be digitalized. Drone based vaccine transportation system and enhancement of cold chain and supply chain by using new techniques can be a turning point.

Authors' contribution:

All authors equally contributed to this review article in curation of data, literature search and manuscript writing.

References:

1. WHO. Polio eradication: Endemic countries. World Health Organization 2020.
2. Abimbola S, Malik AU, Mansoor GF. The final push for polio eradication: addressing the challenge of violence in Afghanistan, Pakistan, and Nigeria. PLoS medicine. 2013;10(10):e1001529.
3. Badizadegan K, Kalkowska D, Thompson K. Polio by the Numbers – A Global Perspective. The Journal of Infectious Diseases. 2022;226.
4. Sutter RW, Pallansch MA, Sawyer LA, Cochi SL, Hadler SC. Defining surrogate serologic tests with respect to predicting protective vaccine efficacy: poliovirus vaccination. Annals of the New York Academy of Sciences. 1995;754:289-99.
5. Mbaeyi C, Ul Haq A, Safdar RM, Khan Z, Corkum M, Henderson E, et al. Progress Toward Poliomyelitis Eradication - Pakistan, January 2023-June 2024. MMWR Morbidity and mortality weekly report. 2024;73(36):788-92.
6. Mbaeyi C BS, Safdar RM, et al. Progress Toward Poliomyelitis Eradication — Pakistan,. MMWR Morbidity and mortality weekly report. 2023;Rep 2023;72:880–885.
7. Sillab FA, Moghri J, Najar AV, Marvi A, Sana A, Naghipour M, et al. Breaking barriers: a qualitative study on polio vaccine hesitancy in Herat Province, Afghanistan. BMC Public Health. 2025;25(1):2820.
8. Rajput LS, Noor S, Khan MM, Sajjad M, Farooq S, Ullah A. Public Health Surveillance of Pediatric Polio in Pakistan: A Cohort Study. Cureus. 2024;16(7):e65356.
9. Initiative GPE. Polio Eradication Strategy 2022–2026: Delivering on a Promise. World Health Organization; UNICEF; GPEI. 2022.

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10. GPEI. Pakistan Becomes the Second Polio-Endemic Country to Introduce IPV. Global Polio Eradication Initiative 2015.
11. EMRO W. Pakistan introduces IPV in routine immunization. 2015.
12. UNICEF. Innovations Against Polio in Pakistan. Unicef. 2015.
13. Hussain SF, Boyle P, Patel P, Sullivan R. Eradicating polio in Pakistan: an analysis of the challenges and solutions to this security and health issue. Globalization and Health. 2016;12(1):63.
14. UNICEF. Coverage Survey in Slums/Underserved Areas of 10 Largest Cities of Pakistan. 2020.
15. WHO. Expanded Programme on Immunization Pakistan. N.A.
16. Reichler MR, Aslanian R, Lodhi ZH, Latif I, Khan MA, Chaudhry R, et al. Evaluation of Oral Poliovirus Vaccine Delivery during the 1994 National Immunization Days in Pakistan. The Journal of Infectious Diseases. 1997;175(Supplement_1):S205-S9.
17. Pakistan Go. NEAP for Polio Eradication 2014.
18. (GPEI). GPEI. Global switch from tOPV to bOPV completed. 2016.
19. Pakistan. Go. NEAP for Polio Eradication 2020–2024.
20. NEAP. National Emergency Action Plan 2014. For Polio Eradication. Government of Islamic Republic of Pakistan. 2014.
21. Bandyopadhyay AS, Macklin GR. Final frontiers of the polio eradication endgame. Current opinion in infectious diseases. 2020;33(5):404-10.
22. Foundation BMG. Polio Eradication in Pakistan: The Challenges and the Road Ahead. 2020.
23. Sultan MA, Closser S, Majidulla A, Ahmed S, Naz F, Nayyab S, et al. How to eradicate polio in Pakistan: Insights from community health workers. PLOS Global Public Health. 2023;3(8):e0002289.
24. Mbaeyi C. Polio vaccination activities in conflict-affected areas. Human Vaccines & Immunotherapeutics. 2023;19(2):2237390.
25. Khan MU, Ahmad A, Aqeel T, Akbar N, Salman S, Idress J. A Cross-Sectional Survey of Healthcare Workers on the Knowledge and Attitudes towards Polio Vaccination in Pakistan. PLOS ONE. 2015;10(11):e0142485.
26. Initiative GPE. Pakistan: National Emergency Action Plan for Polio Eradication 2019.
27. Initiative GPE. Pakistan: National Emergency Action Plan for Polio Eradication 2021.
28. World Health O. Polio vaccines: WHO position paper, March 2016-recommendations. Vaccine. 2017;35(9):1197-9.
29. WHO. Introduction of Inactivated Poliovirus Vaccine (IPV) in Routine Immunization. . World Health Organization. 2015.
30. WHO. Bivalent Oral Poliovirus Vaccine: Impact on Polio Incidence in Pakistan. . World Health Organization. 2016.
31. Hossain I, Masood T, Sultan A, Safdar RM, Setayesh H, Shimp L, et al. Rethinking Strategies to Address Inequity in Immunization Services towards Achieving Universal Immunization Coverage (UIC) in Karachi, Pakistan. 2021.
32. Ingle E, Shrestha P, Seth A, Lalika M, Azie J, Patel R. Interventions to Vaccinate Zero-Dose Children: A Narrative Review and Synthesis2023.
33. Programe PPe. District wise polio cases yearly 2025 [Available from: https://www.endpolio.com.pk/polioin-pakistan/district-wise-polio-cases.
34. Alexander JP, Jr, Zubair M, Khan M, Abid N, Durry E. Progress and Peril: Poliomyelitis Eradication Efforts in Pakistan, 1994–2013. The Journal of Infectious Diseases. 2014;210(suppl_1):S152-S61.
35. Wahid B, Kumari B, Saifullah KM, Idrees M. The History and Current Killings of Polio Vaccinators in Pakistan: A Need for Targeted Surveillance Strategy. Asia-Pacific journal of public health. 2023;35(2-3):183-8.
36. WHO. Pakistan and Afghanistan: the final wild poliovirus bastion. World Health Organization. 2019.
37. Basharat S, Shaikh BT. Polio immunization in Pakistan: ethical issues and challenges. Public Health Reviews. 2017;38(1):6.
38. Hussain SF, Boyle P, Patel P, Sullivan R. Eradicating polio in Pakistan: an analysis of the challenges and solutions to this security and health issue. Global Health. 2016;12(1):63.
39. Waheed Y. Polio eradication challenges in Pakistan. Clinical Microbiology and Infection. 2018;24(1):6-7.
40. Shabbir H, Saeed S, Farhan M, Abbas K, Rehman MEu, Gul F, et al. Poliomyelitis in Pakistan: Challenges to polio eradication and future prospects. Annals of Medicine and Surgery. 2022;80:104274.
41. Abid N, Islam OU, Bosan A, Iqbal T, Darwish A, Bile KM. Pakistan's fight against poliomyelitis: introducing innovative strategies to address challenges and attain the goal of eradication. Eastern

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Mediterranean health journal = La revue de sante de la Mediterranee orientale = al-Majallah al-sihhiyah li-sharq al-mutawassit. 2010;16 Suppl:S5-14.

42. Habib MA, Tabassum F, Hussain I, Khan TJ, Syed N, Shaheen F, et al. Exploring Knowledge and Perceptions of Polio Disease and Its Immunization in Polio High-Risk Areas of Pakistan. 2023;11(7):1206.
43. Ataullahjan A, Ahsan H, Soofi S, Habib MA, Bhutta ZA. Eradicating polio in Pakistan: a systematic review of programs and policies. Expert Review of Vaccines. 2021;20(6):661-78.
44. Ahmad T, Baig M, Khan M. Polio eradication in Pakistan: Hope against hope or are we near eradication? Journal of virus eradication. 2024;10(1):100371.

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