

DOI: 10.53555/ks.v12i4.2811

Ethno-Graphical Factors Behind Polio Vaccine Hesitancy in Pakistan: An Analytical Perspective

Mazhar Nisar¹, Shahzad Ali Khan², Tariq Mehmood Ali³, Muhammad Nadeem Asghar^{4*}

^{1,2,3}Health Services Academy, Quaid-i-Azam University, Islamabad, Pakistan ²Email: shahzad@hsa.edu.pk

^{4*}Department of Medical Biology, University of Québec at Trois-Rivieres, Trois-Rivieres, QC G9A 5H7, Canada

***Corresponding Author:** Muhammad Nadeem Asghar

*Email: muhammad.nadeem.asghar2@uqtr.ca

Abstract: United in its stand, global community is still at war against paralytic poliomyelitis. Even though the concomitant efforts have reduced to global percentage of polio virus by 99%, countries such as Pakistan and Afghanistan are still facing it as major public health concern. The recent surge in the number of cases in the region is alarming. In Pakistan, it is particularly linked to refusal of vaccine by the parents belonging to various ethnicities in high-risk areas. Keeping in view, it was proposed to critically investigate the ethnic and cultural differences shaping reluctance towards vaccination and hence propose a way forward. Therefore, a cross sectional analytical study was conducted by interviewing health care workers at vaccination centers in high-risk regions across Pakistan. The results present striking similarities in hesitancy towards vaccines across various ethnic groups. Among the refusal reasons presented, misconception regarding nature of the vaccine turned out to be the dominant factor. While no significant correlation could be established between vaccine refusal and ethnicity, yet Pashtuns appeared most reluctant towards vaccine followed by Baloch and Sindhi. This study highlighted the importance of awareness campaigns particularly to address the misconceptions about vaccine, among under privileged communities who despite technological boom have limited access to valid information.

Keywords: polio, ethnicity, misconception, vaccine, Pakistan

1. Introduction

Despite being an arduous task, conjoined efforts of stake holders and funding under international agencies has led to polio eradication from most of the world. The Global Polio Eradication initiative by the World Health Organization (WHO) reduced the global burden by up to 99.9% WHO. However, it is largely faced as a global challenge due to its continuous spread in countries like Pakistan and Afghanistan [1]. No matter faced with multitude of constraints, Pakistan has been at the forefront in the fight against polio as evident by the declining trail reported from the country. Notwithstanding, only one case in 2021 to 20 cases as of now, implies that endemic for polio can follow an upward trend if not addressed properly [2]. According to WHO, the recent outbreak of polio virus cVDPV2 in the country, ended up paralyzing eight children in 2021 [3]. The outbreak primarily steeped the areas reported to have low immunization coverage and/or inherent absence of immunity [4].

The major reason for this upward trend was vaccine refusal in the different parts of Pakistan [5]. This indicates failure in planning and implementation of policies by the government which additionally manifest as false markings and bribery for vaccine refusal [6][7] [8]. Extensive studies conducted in various high risk areas highlighted religious, social and political factors as being instrumental in vaccine refusal [9][10][11][5]. Reports suggest that miss-conception, demographic location and social threats force the parents and caretakers to resist the polio virus vaccine [12]. War torn areas, in particular, are exploited by the religious clerics whereby vaccine is projected as a western product made out of pig which is considered prohibited in Islam [13] [15] [16]. Another miss-conception is that vaccine could render male population sterile thus adding fuel to the fire [17] [18].

In an era where technological innovations have impacted social awareness of the communities, such perceptions not only appear ironical but largely advocate the need to address the root cause. Since Pakistan is home to diverse ethnicities across a vibrant landscape, it is highly desirable to investigate the general perception about the vaccine and vaccination campaigns among the under-privileged communities in particular. Henceforth, this comprehensive study was designed to investigate the ethnographic and behavioral factors responsible for polio-vaccine refusal across high risk areas in Pakistan. In a country which presented marked decline in polio cases over the decades, a surge in the disease burden needs to be investigated. Therefore, the study presented herein was conducted to identify the specific reasons shaping the vaccine refusal culture in Pakistan.

2. Materials and Methods

Study Design: This cross-sectional analytical study was conducted all across the three provinces of Pakistan i-e, Khyber Pakhtunkhwa (KPK), Balochistan and Sindh, over a span of two years 2019-2020.

Setting: To analyze the ethnic roots and associated reasons of the vaccine refusal behavior, data was initially collected from National Emergency Operation Centre (NEOC), situated in Islamabad. The Union Councils UCs presenting vaccine refusals,

during National Immunization days polio vaccination campaigns were marked. Following, team of investigators, under the principal investigator, interviewed trained health workers at the district health offices and vaccination centers in all the marked UCs.

Survey Design and Pilot Study: The survey comprised of an interview session of the healthcare workers with the investigators following, filling out a pre-designed questionnaire manually by the participant. The maximum time allotted to each participant was 30 minutes. A standardized questionnaire, consisting of three sections, was designed after extensive review of all the reasons presented for vaccine refusal [19][20][6][18]. Section I covered general information about the enrolled health care worker such as District of health care facility, no of vaccination campaigns joined, immunization year, total refusals. Section II consists of seven questions corresponding to demographic characteristics of the population such as gender, age of the parents/guardian, number of children < 5 years age, education and socio-economic status. Section III looked at the reasons behind vaccine refusals against a total of eight questions such as “religious reasons, misconception, safety reasons, demand refusal, repeated campaigns, sickness and others”. A pilot study conducted among healthcare workers in twin cities Rawalpindi and Islamabad helped in initial validation of the entire survey design to ensure its applicability, suitability and consistency. The responses acquired were not incorporated in final analysis but helped overcome confusions in leading questions and generate a finalized form of the questionnaire. For ease of participants, questionnaire was translated into English, Urdu language.

Data Analysis: After in-depth analysis of the recorded interviews and filled questionnaires, all the data was recorded and analyzed in SPSS 20.22 (IBM Inc., Chicago, IL, USA). Statistical analyses were recorded as percentage and presented by correlating no and reasons of refusals by different ethnic group in each province.

Ethical Approval: Ethical approval of the study was obtained from Institutional Review Board, National Institute of Health, Islamabad, prior to the survey. Participation in the survey was voluntary however informed consent of each participant was obtained prior to the interviews and confidentiality of the participant was strictly maintained.

3. Results

This study is based on refusals encountered during National Immunization Day NID polio vaccination campaigns conducted during the year 2019 and 2020. There were altogether six vaccination campaigns from January 2019 till December 2020 across Pakistan. Initial data collected from NEOC revealed that refusal rate is high in under-privileged areas of three provinces Sindh, KPK and Balochistan. Therefore, final study focused these three provinces. The results for vaccination refusal were tabulated gender wise; province wise and refusal reason for each province were analyzed individually.

There were a total of three NID Polio Eradication campaigns conducted during the year 2020 (Table 1). During the first campaign, conducted in February 2020, a total of 40,315,882 children were targeted, out of which there were 187,578 refusals 0.5%. Subsequent campaigns conducted during September and November present a net decline in number of refusals, recorded as 0.4% and 0.3% respectively. Comparing the trends, the greatest number of refusals was recorded for the province Sindh where the refusal percentage outnumbers all other provinces, in all three of the campaigns conducted during this year. For the campaigns conducted during year 2019, maximum refusals were received in KPK followed by Baluchistan.

Table 1: Province wise data for vaccination targets and refusals during NIDs polio vaccination campaigns January 2020- November 2019

NID Campaigns	Province	Total coverage	Still Refusals	Still Refusals % out of target
February 2020	Islamabad	363411	240	0.1
	Gilgit Baltistan	241590	20	0.0
	AJK	683657	100	0.0
	Balochistan	2441981	6736	0.3
	KPK	6619209	62508	0.9
	Sindh	9387261	117969	1.3
	Punjab	20578773	5	0.0
	Total	40,315,882	187,578	0.5
September 2020	Islamabad	330823	274	0.1
	Gilgit Baltistan	252246	0	0.0
	AJK	664436	142	0.0
	Balochistan	2408164	18094	0.8
	KPK	6640285	46030	0.7
	Sindh	8916705	104087	1.2

	Punjab	19589137	43	0.0
	Total	38,801,796	168,670	0.4
November 2020	Islamabad	335682	413	0.1
	Gilgit Baltistan	246436	5	0.0
	AJK	664618	154	0.0
	Balochistan	2423316	14171	0.6
	KPK	6748529	39770	0.6
	Sindh	9124612	77421	0.8
	Punjab	19876575	1	0.0
	Total	39419768	131935	0.3

In depth analysis of data revealed that hesitancy towards vaccination is not gender specific. While in Sindh, female population present higher refusal; 51% in 2019 and 53% in 2020; the trend is otherwise in other two provinces (Figure 1).

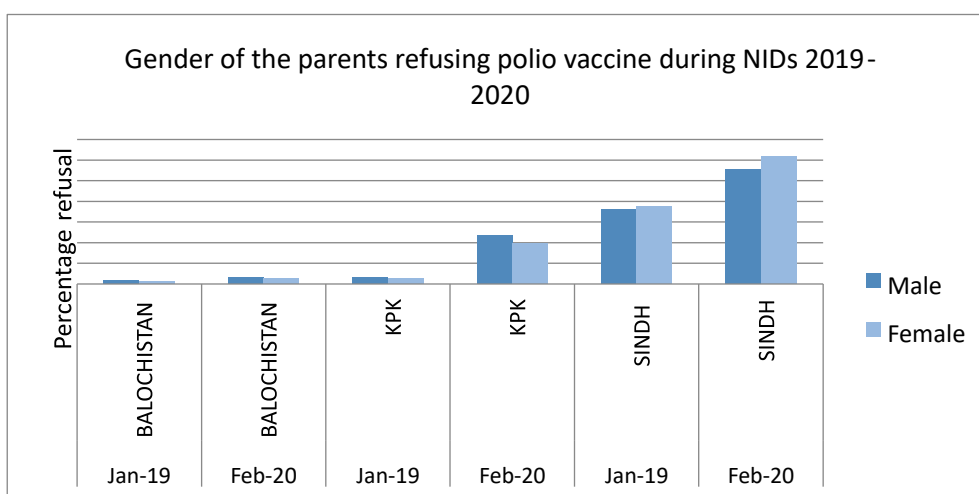


Figure 1. Gender of the parents refusing polio vaccine during national immunization days NIDs polio vaccination campaigns from January 2019-November 2020

Similarly, there is no prominent correlation between ethnicity/race and vaccine refusals. Each province presents maximum refusals by the dominant race/ethnic group in the respective province. This trend is consistent in all the campaigns conducted from January 2019 till November 2020. As shown in the figure (2a, 2b, 2c) maximum refusals in Balochistan were noted for the Baloch, Sindhi in Sindh and Pashtun in KPK. The trend

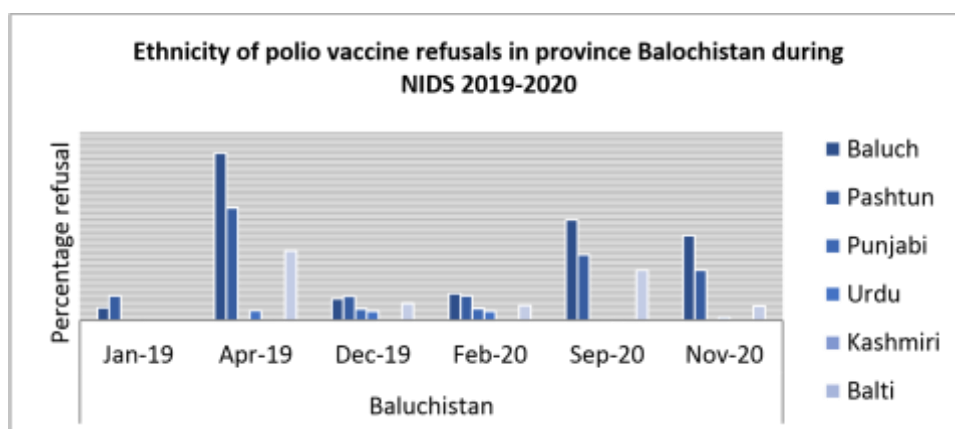


Figure 2a. Ethnicity of polio vaccine refusals in Balochistan during NIDs 2019-2020

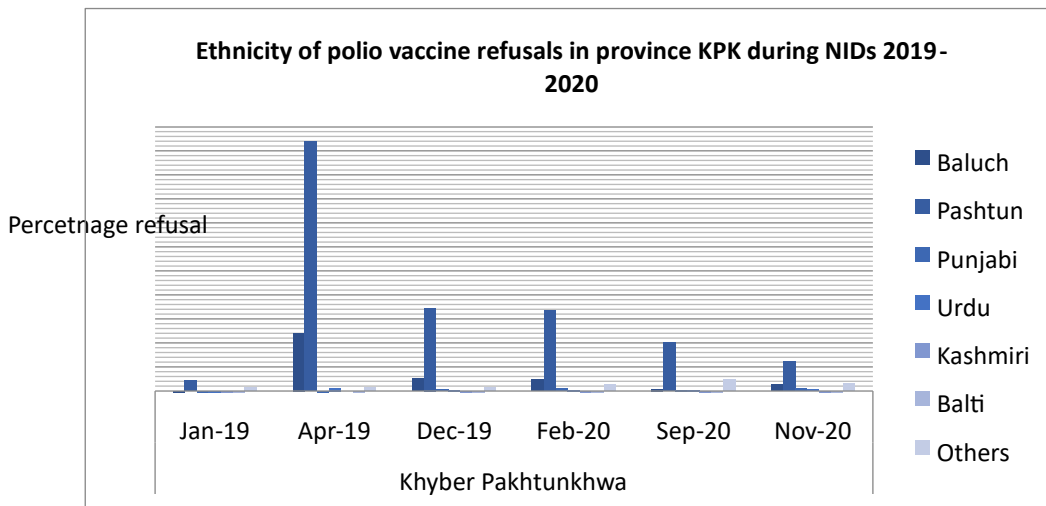


Figure 2b. Ethnicity of polio vaccine refusals in KPK during NIDs 2019-2020

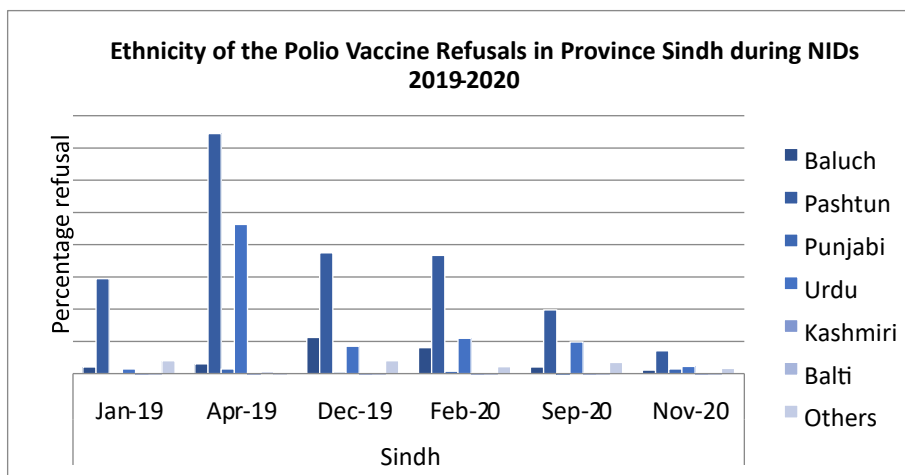


Figure 2c. Ethnicity of polio vaccine refusals in Sindh during NIDs 2019-2020

Analyzing the responses received for refusals, misconception regarding vaccine and vaccination campaigns appeared as the most dominant refusal reason in all three of the provinces (Figure 3). It was followed by religious reasons where by general public seemed misguided about the nature or the origin of the vaccine. Sickness following vaccination is another notable factor. There are altogether no safety concerns. Some factors such as repeated campaigns, direct refusals and vaccine demand related issues did show province specific trend specifically prominent in Balochistan, Sindh and KPK respectively.

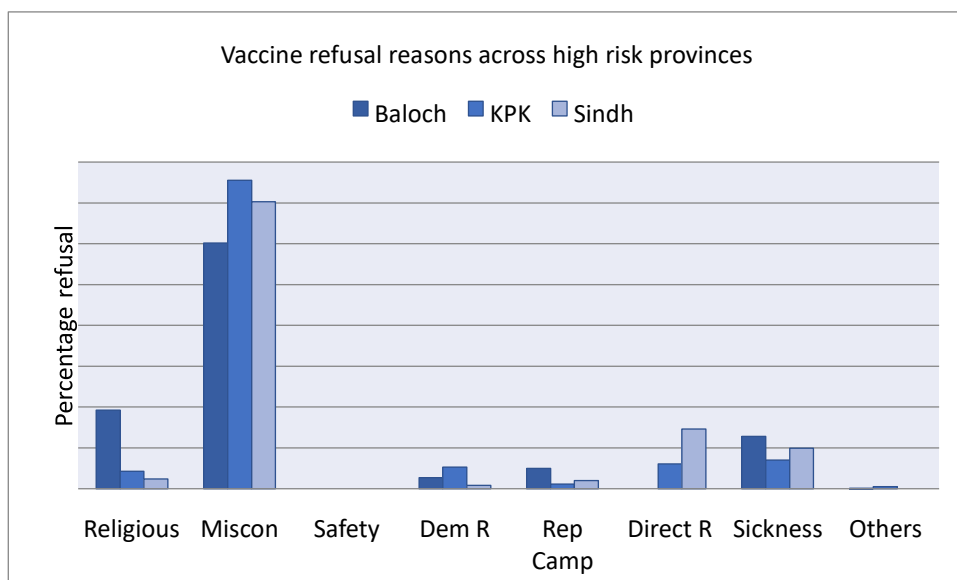


Figure 3. Vaccine refusal reasons across high risk underprivileged areas of Balochistan, KPK and Sindh

4. Discussion

Despite being at the forefront in the fight against polio eradication, Pakistan is still counted among countries where this acute paralytic disease is endemic. Not only this is a major healthcare challenge for the country itself, geographic location of the country and cross border mobility can render it pandemic if sufficient measures are not taken in time. The recent hike in the number of polio cases in Pakistan has prompted national and international stake holders to revisit the policies and planning regarding polio eradication. Vaccination with oral polio vaccine OPV is considered gold standard in establishing immunity against the diseases [5]. Therefore “door to door” vaccination campaigns are routinely organized via trained health care workers (HCW), whereby each vaccinated child is marked <https://www.endpolio.com.pk/polioin-pakistan>. Healthcare workers are at the frontline and reported to have positive attitude towards polio vaccination [21]. Nevertheless, the vaccination campaigns have faced resistance in some part of the country, particularly in under privileged communities of KPK, Balochistan and Sindh. Studies report that false markings, bribery and refusal of the general public towards vaccination as major factors responsible for increasing number of polio cases [22] [23] [24].

The common myths against vaccination instigated the authors to conduct an in-depth analysis of the factors responsible for shaping hesitation among the general public against polio vaccine. Therefore, the data was organized based on information received from frontline HCW in areas reported to present high number of refusals. The study summarized the reasons for refusals as trio of misconception, religious pretense and sickness. Among the common misconceptions, the fear of infertility, particularly among the male gender was most common, as reported earlier by other studies [25] [9] [26]. Similarly, the propaganda by religious clerics deems vaccine “western agenda” which aims to wipe out Muslim population by rendering them infertile [27]. The “war torn “areas of tribal region in KPK (ex FATA) have been exploited by militants and extremists who further pressurized parents and caretakers to stop immunization of their children[26] [25] [28]. It is this hostility and misconception among masses that developed hostility and led to fatal attacks at the polio vaccination teams [29] [30].

The trend towards acceptance or refusal of vaccine among various ethnic groups, in all three of the provinces, was strikingly similar. Studies report higher reluctance among Pashtuns in accepting the vaccine [31] which is in line with our findings. Although most of the refusals in each province are reported by the dominant ethnic group, being major population, the refusal percentage in Pashtun ethnic group in province other than KPK is noticeable. This is because most of the Pashtun belong to the regions inflicted by war against terror and consider the West responsible for their sufferings [28] [32].

The other most hesitant ethnic group is the Baloch population living in all three of the provinces studied. Balochistan is a province known for its natural resources and under developed regions both at the same time. Amidst poor infrastructure and resource allocation particularly in education and health care system, there are socioeconomic insecurities and lack of awareness among the masses [33] [34]. Resultantly, the people cannot forsake their heirs to become infertile [20] [35].

Additionally, it is revealed that socio-economic stability and status of education of the parents and caretakers has a direct bearing on refusal or acceptance of the vaccine. Some parents believe that one time vaccination is enough and successive vaccination can lead to sickness. This belief is strengthened by incidents whereby vaccinated children developed abdominal pain, vomiting and diarrhea following vaccination [36] [37].

It is worth mentioning that this study targeted exact number of community refusals from the NEOC, Islamabad, followed by detailed data acquisition from the health care workers. Since descriptive or qualitative method of data collection was avoided, the approach adds to the validity of the data whereby each refusal was verified. While the international community is focusing recently launched Global Polio Surveillance Action Plan (GPSAP) 2022-2024 ,to eradicate wild polio virus WPV as well as circulating vaccine derived poliovirus cVDPV, improved measures are highly encouraged to address the persistent gaps in surveillance and chronic vulnerability to virus transmission [38]. Therefore, assessments to conduct health-seeking behaviors among vulnerable communities are encouraged for real time monitoring and capacity building.

Given the fact that misconception is the prime cause of refusal in Pakistan, campaigns need to be designed to educate and convince the masses by involving indigenous dignitaries and notable figures through print, electronic and social media. No matter communication officers and mobilization teams are making efforts, so far the message has not been effectively communicated and need revised action plan.

5. Conclusions

A comprehensive account of the various ethnographic variables included in the study highlighted that misconception about the vaccine is the major reason for vaccine refusal irrespective of the province or the ethnic group. Though Pashtuns appear most hesitant, the major reasons for hesitancy among them are equally shared with Baloch or Sindhi community. These findings advocate the need to revise the policies as well as strategies to counter the false narrative about vaccine, particularly in high risk areas.

Author Contributions: Conceptualization M.N; S.A.K; M.N.A, methodology M.N; T.M, data analysis M.N; T.M; M.N.A, writing—original draft preparation M.N; M.N.A, writing—review and editing, M.N; S.A.K; M.N.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board IERB, Health Service Academy on 16th March 2018 vide IERB approval number 7-82/2017-IERB-5.

Informed Consent Statement: Informed consent was obtained from all the participants involved in the study.

Acknowledgments: The authors are grateful to all the officials at National Emergency Operation Centre [NEOC], Islamabad and District health officers for their cooperation in the study.

Conflicts of Interest: Authors declare no conflict of interest.

References

1. Rana MS, Asghar RJ, Usman M, Ikram A, Salman M, Umair M, et al. The resurgence of wild poliovirus in Pakistan and Afghanistan: A new setback for polio eradication. *J Infect* [Internet].
2. 2022 Sep 1 [cited 2023 Aug 12];85[3]:334–63. Available from: <http://www.journalofinfection.com/article/S0163445322003498/fulltext>
3. Jawed S, Islam MB, Butt MH, Ullah I. Re-Emergence of Polio in Pakistan: Another Public Health Failure? *Disaster Med Public Health Prep* [Internet]. 2023 Sep 29 [cited 2023 Aug 12];17[8]:e262. Available from: <https://www.cambridge.org/core/journals/disaster-medicine-and-public-health-preparedness/article/reemergence-of-polio-in-pakistan-another-public-healthfailure/CD4CB9AE463DFD4A7E7F15B2060A7978Program> PPE. Polio cases in Pakistan. 2019.
4. World Health Organization. No Title [Internet]. <https://www.emro.who.int/polio-eradication/priority-countries/pakistan.html#:~:text=Eight%20children%20were%20paralysed%20by,an%20inherent%20absence%20of%20immunity.> Available from: <https://www.emro.who.int/polioeradication/priority-countries/pakistan.html#:~:text=Eight children were paralysed by,an inherent absence of immunity>. Accessed August 12, 20203.
5. Soofi SB, Vadsaria K, Mannan S, Habib MA, Tabassum F, Hussain I, et al. Factors Associated with Vaccine Refusal [Polio and Routine Immunization] in High-Risk Areas of Pakistan: A Matched Case-Control Study. *Vaccines* 2023, Vol 11, Page 947 [Internet]. 2023 May 5 [cited 2023 Aug 12];11[5]:947. Available from: <https://www.mdpi.com/2076-393X/11/5/947/htm>
6. 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. *Vaccines* 2023, Vol 11, Page 1206 [Internet]. 2023 Jul 5 [cited 2023 Aug 12];11[7]:1206. Available from: <https://www.mdpi.com/2076-393X/11/7/1206/htm>
7. Basharat S, Shaikh BT. Polio immunization in Pakistan: ethical issues and challenges. *Public Heal Rev.* 2017;38[1]:1–6.
8. Shah M, Khan M, Shakeel S, Mahmood F, Sher Z, Sarwar M, et al. Resistance of polio to its eradication in Pakistan. *Virol J.* 2011; 8:457–457.
9. Zahra T. Poliomyelitis in Pakistan: Evolving challenges and way forward. *J Fatima Jinnah Med Univ.* 2022;16[2]:51–2.
10. Shabbir H, Saeed S, Farhan M, Abbas K, Rehman ME ur, Gul F, et al. Poliomyelitis in Pakistan: Challenges to polio eradication and future prospects. *Ann Med Surg.* 2022 Aug 1; 80:104274.
11. Junaidi I. Polio refusal cases among well-educated people baffle officials. *Dawn News*; 2017.
12. 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. *Glob Heal.* 2016;12:63.
13. Asghar RJ. Why is polio still here? A perspective from Pakistan. *Lancet Glob Heal* [Internet].
14. 2020 Feb 1 [cited 2023 Aug 12];8[2]:e177–8. Available from: <http://www.thelancet.com/article/S2214109X19305248/fulltext>
15. Andrade GE, Hussain A. Polio in Pakistan: Political, Sociological, and Epidemiological Factors.
16. Ahmad SO, Bux AS, Yousuf F. Polio in Pakistan's North Waziristan. *Lancet Glob Heal.* 2015 Jan 1;3[1]:15e.
17. Shah M, Khan M, Shakeel S, Mahmood F, Sher Z, Sarwar M, et al. Resistance of polio to its eradication in Pakistan. *Virol J.* 2011;8.
18. Khan T, Qazi J. Hurdles to the global antipolio campaign in Pakistan: an outline of the current status and future prospects to achieve a polio free world. *J Epidemiol Community Heal* [Internet]. 2013 Aug 1 [cited 2023 Aug 12];67[8]:696–702. Available from: <https://jech.bmj.com/content/67/8/696>
19. Awan UA, Malik MW, Khattak AA, Ahmed H, Khan MI, Qureshi H, et al. Emerging polio hotspots in Pakistan: Challenges and the way forward. *J Infect* [Internet]. 2021 Oct 1 [cited 2023 Aug 12];83[4]:496–522. Available from: <http://www.journalofinfection.com/article/S0163445321003613/fulltext>
20. Ahmad SO, Yousuf F, Bux AS, Abu-Zaid A. Pakistan: the final frontier for global polio eradication. *J Epidemiol Community Heal* [Internet]. 2016 Feb 1 [cited 2023 Aug 12];70[2]:109–10. Available from: <https://jech.bmj.com/content/70/2/109>
21. Khattak FA, Rehman K, Shahzad M, Arif N, Ullah N, Kibria Z, et al. Prevalence of Parental refusal rate and its associated factors in routine immunization by using WHO Vaccine Hesitancy tool: A Cross sectional study at district Bannu, KP, Pakistan. *Int J Infect Dis.* 2021 Mar 1;104:117– 24.
22. Nazir MH, Ahmad M, Umer M, Azeem S. Change in trend of poliovirus strain affecting Pakistan. *Ann Med Surg* [Internet]. 2022 Sep 1 [cited 2023 Aug 12];81. Available from: https://journals.lww.com/annals-of-medicine-and-surgery/Fulltext/2022/09000/Change_in_trend_of_poliovirus_strain_affecting.73.aspx
23. Malik S, Waheed Y. Tracking down the recent surge of polio virus in endemic and outbreak countries. *J Med Virol* [Internet]. 2023 Jan 1 [cited 2023 Aug 12];95[1]:e28265. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1002/jmv.28265>

28. Ghafoor S, Sheikh N. Eradication and Current Status of Poliomyelitis in Pakistan: Ground Realities. *J Immunol Res.* 2016;2016.
29. Ataullahjan A, Ahsan H, Soofi S, Habib MA, Bhutta ZA. Eradicating polio in Pakistan: a systematic review of programs and policies. <https://doi.org/10.1080/14760584.2021.1915139> [Internet]. 2021 [cited 2023 Aug 12];20[6]:661–78. Available from: <https://www.tandfonline.com/doi/abs/10.1080/14760584.2021.1915139>
30. Mushtaq A, Mehmood S, Rehman MAU, Younas A, Rehman MSU, Malik MF, et al. Polio in Pakistan: Social constraints and travel implications. *Travel Med Infect Dis.* 2015 Sep 1;13[5]:360–6.
31. Shakeel SI, Brown M, Sethi S, MacKey TK. Achieving the end game: Employing “vaccine diplomacy” to eradicate polio in Pakistan. *BMC Public Health* [Internet]. 2019 Jan 17 [cited 2023 Aug 12];19[1]:1–8. Available from: <https://link.springer.com/articles/10.1186/s12889-019-6393-1>
32. Rahimi F, Talebi Bezmin Abadi A. Poliomyelitis outbreaks caused by circulation of the vaccinated-derived poliovirus. *Int J Surg.* 2022 Sep 1;105.
33. Abimbola S, Malik AU, Mansoor GF. The Final Push for Polio Eradication: Addressing the Challenge of Violence in Afghanistan, Pakistan, and Nigeria. *PLOS Med* [Internet]. 2013 [cited Aug 12];10[10]:e1001529. Available from: <https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1001529>
34. Riaz H, Rehman A. Polio vaccination workers gunned down in Pakistan. *Lancet Infect Dis.* 2013;13[2]:120.
35. Gunmen kill policeman escorting polio vaccine worker in Pakistan | News | Al Jazeera [Internet]. [cited 2023 Aug 12]. Available from: <https://www.aljazeera.com/news/2022/10/25/gunmen-kill-policeman-escorting-polio-vaccineworker-pakistan>
36. Waheed Y. Polio eradication challenges in Pakistan. *Clin Microbiol Infect* [Internet]. 2018 Jan 1 [cited 2023 Aug 12];24[1]:6–7. Available from: <http://www.clinicalmicrobiologyandinfection.com/article/S1198743X17305189/fulltext>
37. Rahim S, Ahmad Z, Abdul-Ghafar J. The polio vaccination story of Pakistan. *Vaccine.* 2022 Jan 24;40[3]:397–402.
38. Molodecky NA, Usman A, Javaid A, Wahdan A, Parker EPK, Ahmed JA, et al. Quantifying movement patterns and vaccination status of high risk mobile populations in Pakistan and Afghanistan to inform poliovirus risk and vaccination strategy. *Vaccine.* 2021 Apr 8;39[15]:2124–32.
39. Shahid S, Ahmed S, Qazi MF, Ali R, Ali SA, Zaidi AKM, et al. Differential coverage for vaccines in the expanded program on immunization [EPI] among children in rural Pakistan. *Vaccine.* Apr 17;41[16]:2680–9.
40. Khan MT, Zaheer S, Shafique K. Maternal education, empowerment, economic status and child polio vaccination uptake in Pakistan: a population based cross sectional study. *BMJ Open* [Internet]. 2017 Mar 1 [cited 2023 Aug 12];7[3]:e013853. Available from: <https://bmjopen.bmj.com/content/7/3/e013853>
41. Riaz A, Husain S, Yousafzai MT, Nisar I, Shaheen F, Mahesar W, et al. Reasons for nonvaccination and incomplete vaccinations among children in Pakistan. *Vaccine.* 2018 Aug 23;36[35]:5288–93.
42. O’Reilly KM, Durry E, Ul Islam O, Quddus A, Abid N, Mir TP, et al. The effect of mass immunisation campaigns and new oral poliovirus vaccines on the incidence of poliomyelitis in Pakistan and Afghanistan, 2001–11: a retrospective analysis. *Lancet* [Internet]. 2012 Aug 8 [cited 2023 Aug 12];380[9840]:491. Available from: [/pubmed/articles/PMC3418593/](https://pubmed.ncbi.nlm.nih.gov/22418593/)
43. WHO. No Title [Internet]. 2022. Available from: <https://apps.who.int/iris/bitstream/handle/10665/354479/9789240047310eng.pdf?sequence=1&isAllowed=y> Accessed August 12, 2023