# FACTORS RELATED TO PREVALENCE OF POLIO IN VARIOUS LOCALITY OF KHYBER PAKHTUNKHWA

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**ABSTRACT**

To investigate the factors related to prevalence of Polio along with association among factors in various locality of Khyber Pakhtunkhawa, the data was collected by total 322 patients of Polio consisting of 242 male patients with a percentage of 75.2 and 80 female patients with a percentage of 24.8. In this 184 patients observed in favor of Polio Immunization with a percentage of 57.1 whereas about 42.9 percentage of the patients observed in not favor of immunization, indicating no significance difference in patient's opinion gender wise. Moreover, the odds ratio indicating that male are in favor of Polio immunization as compare female patients by more than 1.374 times. The study concluded no difference in the previous experience of Polio in family gender wise whereas male patients have more exposure to Polio in family as compare female patients by more than 1.023 times. The results indicated that there is a difference in the Polio vaccination to child gender wise and observed that male patients have more exposure toward polio vaccination as compare female patients by more than 1.397 times. The study concluded that information regarding the causing of Polio by Virus depends upon the education level of the parents. The study showed cross table of various facility to patients like proper flesh system, washing of hands and availability of foods and water in the case and control group of patients. The study showed that 55 patients in the control group has fear of infertility by Polio vaccine while 45 patients have no as such fear in control group whereas 184 patients in the case group has fear of infertility while 38 patients have no such fear in control group. The study concluded a difference in the fear of infertility caused by Polio vaccination and observed that patients with vaccination have more exposure toward infertility as compare patients no vaccination by more than 1.499 times. The study concluded that perception regarding the effective of immunization in preventing against Polio does not depends upon education level of parents and the value of odds ratio obtained as 0.520 as yes to no by information point of view of parents regarding the immunization as preventing way.

Keywords: Polio, Pakistan, Khyber Pakhtunkhwa, Eradication, Gender

## INTRODUCTION

Polio remains a significant health challenge in Pakistan, particularly among children under five due to insufficient vaccination coverage. In 2010, Pakistan reported 144 cases, surpassing Nigeria, India, and Afghanistan. Symptoms include fever, fatigue, headache, vomiting, neck stiffness, and limb pain. Although preventable through immunization, polio has no cure and continues to affect under-vaccinated populations. The poliovirus is transmitted from person to person and is most prevalent in children[1].

Despite efforts by the Pakistani government, including immunization campaigns and establishing vaccination centers, polio persists, especially among non-immunized children and migrant families. Security concerns and population movement exacerbate the issue. High-risk areas include FATA, KPK, Balochistan, Karachi, and parts of Punjab and Sindh. These regions often lack consistent immunization due to security challenges and socio-economic barriers. Globally, the fight against polio has seen significant progress, spearheaded by initiatives

like the Global Polio Eradication Initiative (GPEI) launched in 1988[2]. While many countries have eliminated polio, Pakistan and Afghanistan remain endemic, with failure to meet eradication goals due to weak immunization strategies. Sociocultural factors, conspiracy theories, and inadequate healthcare infrastructure further hinder progress. For example, some conspiracy theories in Pakistan link vaccination programs to alleged geopolitical agendas, undermining public trust.

Polio's history dates back centuries, with notable outbreaks in the U.S. in the early 1900s. Vaccines developed in the mid-20th century drastically reduced cases worldwide. Today, most countries are polio-free, thanks to widespread vaccination programs. However, in Pakistan, challenges persist due to poor sanitation, lack of resources, and societal resistance. The present study aims to examine the characteristics of polio-affected households, including demographic, economic, and social factors, and to identify barriers to eradication[3]. By understanding these challenges, targeted solutions can be developed to minimize the impact of poliovirus and strengthen eradication efforts.

## Literature Review
This chapter reviews prior studies on polio eradication, including both local and international perspectives.

Zimmermann[4]. highlighted the persistent challenges in eradicating polio globally despite significant investments. Their study evaluated the economic implications of polio eradication compared to permanent control measures. Mehndiratta et al. explained that poliomyelitis, caused by the poliovirus, leads to varying symptoms, from mild illness to severe paralysis. Andrade and Hussain focused on the sociological and political barriers to eradication in Pakistan, Afghanistan, and Nigeria, emphasizing the role of conspiracy theories and limited education. Closser et al. found that community collaboration and improved health services could address vaccination gaps, especially in Karachi, where internally displaced persons resisted immunization.

Mayer [5] suggested that re-immunizing adults could aid eradication efforts. Toole discussed the progress of the Global Polio Eradication Initiative (GPEI), which, by 2015, reduced cases significantly but faced setbacks in Pakistan and Afghanistan. Cochi et al. highlighted the success of GPEI over 25 years, documenting lessons that can guide future health campaigns. Bahl et al. studied India's polio eradication, declaring South-East Asia polio-free by 2014. They emphasized the importance of emergency responses to prevent re-emergence. Tebbensa et al. supported the economic rationale for global eradication despite rising costs, while Aylward and Tangermann emphasized strategic innovations that reduced global cases by 99% by 2000.

Onyeka [6] analyzed immunization coverage in Nigeria, emphasizing the risk of imported cases in commercial regions like Anambra State. Kabir and Afzal identified barriers to eradication in Pakistan, including poor planning, economic conditions, and inadequate health facilities. Rehman et al. noted that polio continues to thrive in Pakistan due to weak health infrastructure and misinformation campaigns. Nadeem warned that global travel poses risks for reintroducing the virus even in polio-free regions. Khan linked parental education levels to vaccination outcomes, suggesting that more educated households ensure better immunization.

Abubakar et al[7]. traced global progress in eradication, noting a 99% reduction in cases since 1988. However, coverage gaps persist, particularly in regions with low maternal education levels and rural areas. Targeted immunization campaigns in these areas are essential for achieving complete eradication.

## Aims and Objectives
The study has the following objectives:
1. To describe the factors associated with the prevalence of Polio.
2. To explore the living conditions of the high-risk Polio groups in the study area.

## Material and Methods
This section outlines the methodology and materials utilized throughout the study, including the study population, sampling design, sample size estimation, data collection methods, and statistical techniques applied during the analysis. Each aspect is described in detail below.

**Population of Interest**

The study focuses on the population of Khyber Pakhtunkhwa (KP) to achieve the research objectives. A case-control approach is employed, dividing the population into two groups:

- **Case Group**: Families affected by polio.
- **Control Group**: Families not affected by the disease.

**Sampling Strategy**

Given that the study universe is KP, a multistage probability sampling method is adopted.

1. In the first phase, polio-affected cities within KP are randomly selected.
2. In the second phase, families impacted by polio are randomly chosen from the identified cities.

**Sample Size**

A proportion-based formula is used to estimate the sample size, as the study variable is categorical (presence or absence of polio). The formula incorporates a 95% confidence interval ($Z = 1.96$), a margin of error ($e = 0.05$), and the prevalence rate of polio ($P = 0.70$) derived from DHIMS-2018.

The calculated sample size is n $= 322$

Thus, 322 polio-affected families will be included. Additionally, a control group comprising 100 families will be studied to identify significant risk factors for polio.

**Data Analysis**

The data will be analyzed using **Statistical Package for Social Sciences (SPSS), version 27**. Both descriptive and inferential statistics will be applied:

- **Descriptive Statistics**: Data presentation through frequency distributions, graphs, and charts.
- **Various test of statistical inferential like** Chi-square and odds ratio performed to examine associations and to assess the strength of associations respectively.

Empirical Analysis

This section includes the descriptive analysis of the factors associated with the prevalence of Polio. This includes bivariate analysis along with the association between the variables and strength of association using odds ratio.

The data table describes the frequency table of the gender of the patients included in the study. The table depicts that a total 322 patients of Polio included in the study consisting of 242 male patients with a percentage of 75.2 and 80 female patients with a percentage of 24.8.

**Frequency table of Patient's Gender**

|  | Frequency | Percent |
|---|---|---|
| Male | 242 | 75.2 |
| Female | 80 | 24.8 |
| Total | 322 | 100.0 |

The following Sector diagram presents the graphical presentation of gender distribution of the patients. The sector diagram defines that most of the patients observed in KP was male and the prevalence of the Polio looks more spread in the male as compare to female patients.
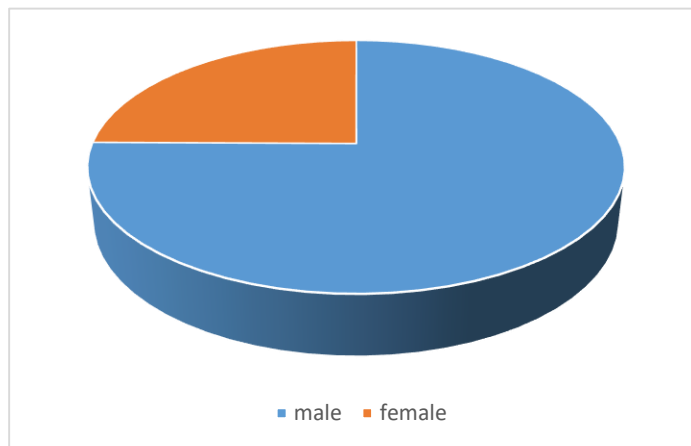
To investigate the opinion of the patients regarding the in favor of immunization of Polio, the respondents were asked and the results observed in the following table

**Frequency table of Polio Immunization**

|       | Frequency | Percent |
|-------|-----------|---------|
| Yes   | 184       | 57.1    |
| No    | 138       | 42.9    |
| Total | 322       | 100.0   |

The results indicates that out of 184 patients recorded their opinion in favor of Polio Immunization with a percentage of 57.1 whereas about 42.9 percentage of the patients observed with the opinion of no, as they were not in favor of immunization. To study the significance of patients opinion in the gender groups, the following cross table along with the chi-square statistics and p-value observed.

**Frequency table of Gender verses Polio Immunization**

|        |        | Polio Immunization | | | | | |
|--------|--------|-----|-----|-------|--------------------------|---------|---------------------------|
|        |        | Yes | No  | Total | Chi-Square Statistics    | P-Value | Odds Ratio Male/Female    |
| Gender | Male   | 143 | 99  | 242   | 1.509                    | 0.219   | 1.374                     |
|        | Female | 41  | 39  | 80    |                          |         |                           |
| Total  |        | 184 | 138 | 322   |                          |         |                           |

The above cross table the gender wise distribution of the patient's Opinion regarding Polio Immunization. To investigate difference in the patient's opinion between male and female patients, the value of the Chi-square statistics observed as 1.509 with the P-value as 0.209. As the p-value of chi-square is more than 0.05, there hypothesis of insignificance difference in the opinion across gender group is failed to rejected and concluded that there is no difference in the opinion regarding immunization gender wise. Moreover to determine exposure of male patients in compare to female patients, odds ratio computed and observed that male are in favor of Polio immunization as compare female patients by more than 1.374 times.

The patients were asked about the past experience of the Polio in their family, the following table observed as

**Past experience with Polio patients**

|  | Frequency | Percent |
|---|---|---|
| Yes | 118 | 36.6 |
| No | 204 | 63.4 |
| Total | 322 | 100.0 |

The results indicates that a total of 118 patients observed with previous experience of Polio in family with a percentage of 36.6 whereas about 63.4 percentage of the patients i.e., 204 observed with no previous experience of Polio in family. To study the significance of difference of previous family history of Polio in the gender groups, the chi-square test performed and the following cross table along with the chi-square statistics and p-value observed.

**Frequency table of Gender with Previous family  history with Polio**

| | | Previous Family History of Polio | | | Chi-Square Statistics | P-value | Odds Ratio Male/Female |
|---|---|---|---|---|---|---|---|
| | | Yes | No | Total | | | |
| Gender | Male | 89 | 153 | 242 | 0.007 | 0.903 | 1.023 |
| | Female | 29 | 51 | 80 | | | |
| Total | | 118 | 204 | 322 | | | |

The above cross table is the gender wise distribution of the patient's previous experience of Polio in family. To investigate difference in the patient's previous experience of Polio in family between male and female patients, the value of the Chi-square statistics observed as 0.007 with the P-value as 0.903. As the p-value of chi-square is more than 0.05, there hypothesis of insignificance difference in the previous experience of Polio in family across gender group is failed to rejected and concluded that there is no difference in the previous experience of Polio in family gender wise. Moreover to determine exposure of previous experience of Polio in male patients as compare to female patients, odds ratio computed and observed that male patients have more exposure to Polio in family as compare female patients by more than 1.023 times.

The patients were asked about the vaccination of Polio to their children and the following record observed as

**Frequency Table of vaccination.**

|  | Frequency | Percent |
|---|---|---|
| Yes | 223 | 69.3 |
| No | 99 | 30.7 |
| Total | 322 | 100.0 |

The results indicated that a total of 223 patients vaccinated their child with a percentage of 69.3 whereas about 30.7 percentage of the patients i.e., 99 observed with no vaccination of Polio to their child. To study the significance of difference of vaccination of Polio to their child in the gender groups, the chi-square test performed and the following cross table along with the chi-square statistics and p-value observed.
The following cross table is the gender wise distribution of vaccination of parents to their child. To investigate difference in the vaccination of Polio to child between male and female patients, the value of the Chi-square statistics observed as 2.515 with the P-value as 0.022. As the p-value of chi-square is less than 0.05, there hypothesis of insignificance difference in vaccination of Polio to their child across gender

group is rejected and concluded that there is a difference in the Polio vaccination to child gender wise. Moreover to determine exposure toward the Polio vaccination between male patients and female patients, odds ratio computed and observed that male patients have more exposure toward polio vaccination as compare female patients by more than 1.397 times.

**Frequency table of Gender verses vaccinated**

| | | Child vaccinated. | | | Chi-Square Statistics | P-Value | Odds Ratio Male/Female |
|---|---|---|---|---|---|---|---|
| | | Yes | No | Total | | | |
| Gender | Male | 172 | 70 | 242 | 2.515 | 0.022 | 1.397 |
| | Female | 51 | 29 | 80 | | | |
| Total | | 223 | 99 | 322 | | | |

To investigate the information about the causing by Virus depends on education level of patient's parents, the following cross table constructed. The information about causing of Polio by Virus being categorized into three categories and education level as literate and illiterate. To study the association between mentioned factors, Chi-Square test of association is performed and following table observed.

**Cross table of information regarding Polio causes with  Education**

| | | Education | | | Chi-Square Statistics | P-value |
|---|---|---|---|---|---|---|
| | | Literate | Illiterate | Total | | |
| Polio is caused by Virus | Dont Know | 51 | 135 | 186 | 11.807 | 0.003 |
| | Yes | 45 | 49 | 94 | | |
| | No | 13 | 29 | 42 | | |
| Total | | 109 | 213 | 322 | | |

The table depicts that the value of chi-square statistic observed as 11.807 with the p-value as 0.003. As the p-value is less than 5 % level of significance therefore the null hypothesis of the no association is rejected and concluded that information regarding the causing of Polio by Virus depends upon the education level of the parents.

To investigate the frequency of the various factors like facility of flesh system at home, proper washing of hands and unhygienic availability of foods in case and control groups, the following cross frequency table is computed.

**Cross Table of various factors with Case/Control group**

| | | Case / Control | | |
|---|---|---|---|---|
| | | Control | Case | Total |
| proper flesh system | Yes | 55 | 20 | 75 |
| | No | 45 | 202 | 247 |
| Washing of hands | Yes | 46 | 14 | 60 |
| | No | 54 | 208 | 262 |
| Availability of Food and Water | Yes | 30 | 150 | 180 |
| | No | 70 | 72 | 142 |

The above table defines that cross table of various facility to patients like proper flesh system, washing of hands and availability of foods and water in the case and control group of patients. The table depicts that

55 patients in the control group has proper flesh system while 45 patients have no as such facility at home whereas 20 patients in the case group has proper flesh system facility while 202 patients have no proper flesh system at home. Also, 46 patients in the control group has proper facility of washing hands while 54 patients have no as such facility at home whereas 14 patients in the case group has proper washing of hands facility while 208 patients have no proper washing of hands facility at home. Similarly, 30 patients in the control group has availability of foods and water at home while 70 patients have no as such facility at home in control group whereas 150 patients in the case group has proper availability of foods and water facility while 72 patients have no proper water and food facility in control at home.

To investigate the perception of patient's parents regarding fear of infertility by Polio vaccine with the status of patient, the following cross frequency table observed

**Cross table group wise of fear of infertility by Polio vaccines**

|  |  | Case / Control | | |
|---|---|---|---|---|
|  |  | Control | Case | Total |
| fear of infertility by Polio vaccines? | Yes | 55 | 184 | 239 |
|  | No | 45 | 38 | 83 |
| Total |  | 100 | 222 | 322 |

The table defines that 55 patients in the control group has fear of infertility by Polio vaccine while 45 patients have no as such fear in control group whereas 184 patients in the case group has fear of infertility while 38 patients have no such fear in control group.

The following cross table is the cross table of parent's fear regarding fertility by Polio vaccine and vaccination status of the patients. To investigate difference in the vaccination of Polio to child between patients having fertility fear, the Chi-square test of association is performed.

The table defines the value of the Chi-square statistics observed as 3.390 with the P-value as 0.013. As the p-value of chi-square is less than 0.05, there hypothesis of insignificance difference in fear of infertility by vaccination of Polio is rejected and concluded that there is a difference in the fear of infertility caused by Polio vaccination. Moreover to determine exposure of patients parents having fear of infertility by Polio vaccination as compare to parents having no fear, odds ratio computed and observed that patients with vaccination have more exposure toward infertility as compare patients no vaccination by more than 1.499 times.

**Cross tabulation of fear of infertility by Polio vaccines**

|  |  | Child should be vaccinated. | | | Chi-Square statistics | P-value | Odds Ration Yes/No |
|---|---|---|---|---|---|---|---|
|  |  | Yes | No | Total |  |  |  |
| Fear of infertility by Polio vaccines. | Yes | 171 | 68 | 239 | 3.390 | 0.013 | 1.499 |
|  | No | 52 | 31 | 83 |  |  |  |
| Total |  | 223 | 99 | 322 |  |  |  |

To investigate the association between education level of patient's parents and supposing of immunization as best way to prevent from Polio in child, the following cross table constructed and chi-square test of association is performed. Also the odds ratio is computed. The table depicts that the value of chi-square statistic observed as 7.706 with the p-value as 0.006. As the p-value is less than 5 % level of significance therefore the null hypothesis of the no association is rejected and concluded that perception regarding the effective of immunization in preventing against Polio does not depends upon education level of parents and the value of odds ratio obtained as 0.520 as yes to no by information point of view of parents regarding the immunization as preventing way.

**Cross tabulation of Immunization as preventing Polio and Education**

| | | Education | | | Chi-Square Statistics | P-value | Odds Ratio Yes/no |
|---|---|---|---|---|---|---|---|
| | | Literate | Illiterate | Total | | | |
| Immunization is effective way of preventing Polio | Yes | 50 | 132 | 182 | 7.706 | 0.006 | 0.520 |
| | No | 59 | 81 | 140 | | | |
| Total | | 109 | 213 | 322 | | | |

## Conclusion

The data was collected by total 322 patients of Polio consisting of 242 male patients with a percentage of 75.2 and 80 female patients with a percentage of 24.8. In this 184 patients observed in favor of Polio Immunization with a percentage of 57.1 whereas about 42.9 percentage of the patients observed in not favor of immunization, indicating no significance difference in patient's opinion gender wise. Moreover the odds ratio indicating that male are in favor of Polio immunization as compare female patients by more than 1.374 times.

The study indicated that a total of 118 patients observed with previous experience of Polio in family with a percentage of 36.6 whereas about 63.4 percentage of the patients i.e., 204 observed with no previous experience of Polio in family. To investigate difference in the patient's previous experience of Polio in family between male and female patients, the value of the Chi-square statistics observed as 0.007 with the P-value as 0.903. The study concluded that there is no difference in the previous experience of Polio in family gender wise. Moreover odds ratio showed that male patients have more exposure to Polio in family as compare female patients by more than 1.023 times.

The results indicated that a total of 223 patients vaccinated their child with a percentage of 69.3 whereas about 30.7 percentage of the patients i.e., 99 observed with no vaccination of Polio to their child. To

investigate difference in the vaccination of Polio to child between male and female patients, the value of the Chi-square statistics observed as 2.515 with the P-value as 0.022. It is concluded that there is a difference in the Polio vaccination to child gender wise and observed that male patients have more exposure toward polio vaccination as compare female patients by more than 1.397 times. The study concluded that information regarding the causing of Polio by Virus depends upon the education level of the parents. The study showed cross table of various facility to patients like proper flesh system, washing of hands and availability of foods and water in the case and control group of patients. The study showed that 55 patients in the control group has fear of infertility by Polio vaccine while 45 patients have no as such fear in control group whereas 184 patients in the case group has fear of infertility while 38 patients have no such fear in control group. The study concluded that there is a difference in the fear of infertility caused by Polio vaccination also odds ratio computed and observed that patients with vaccination have more exposure toward infertility as compare patients no vaccination by more than 1.499 times. To investigate the association between education level of patient's parents and supposing of immunization as best way to prevent from Polio in child, the study depicted that the value of chi-square statistic observed as 7.706 with the p-value as 0.006. The study concluded that perception regarding the

effective of immunization in preventing against Polio does not depends upon education level of parents and the value of odds ratio obtained as 0.520 as yes to no by information point of view of parents regarding the immunization as preventing way.

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