

RISK FACTORS OF STREPTOCOCCUS PNEUMONIA AMONG CHILDREN IN MARDAN

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Abstract

Streptococcus pneumoniae is a leading cause of infectious pneumonia and other chronic conditions especially in children. Pneumonia causes more than one and a half million deaths annually in children. Risk factors include unvaccinated children, weakened immune system and antibiotic resistance.

OBJECTIVE:

The aim of our research is to understand the impact and prevalence of streptococcus pneumoniae among children in District Mardan in order to describe the disease occurrence and distribution.

METHODS:

The study, conducted at Mardan Medical Complex, Pakistan, from March to July 2024, sampled 464 children aged 1 to 47 months from District Mardan. Children with respiratory infection symptoms were included, while those under one month or over five years were excluded. Data were collected via Google Forms and in-person, then analyzed using SPSS version 25.

RESULTS:

The mean age of the children was 15 months, with a female-to-male ratio of 0.8. Among the 182 children, 40.5% were carriers of *Streptococcus pneumoniae*. 79 patients were positive due to non-vaccination, 62 were having weakened immune system, 33 were having antibiotic resistance and 8 patients with multiple factors.

CONCLUSION:

These results can be helpful to understand the dynamics of *Streptococcus pneumoniae* infection. Vaccinating children before 3 months of age is crucial in preventing the disease.

INTRODUCTION

Streptococcus pneumoniae remains the leading cause of infectious pneumonia in children (1) and the most common cause of lung abscesses in young children. The most common cause around the globe under the age of five years causing more than one and a half million deaths is *streptococcus*

pneumoniae (2). According to the observation of World Health Organization (WHO) pneumonia infection continues to cause most deaths among children and also among vaccine-preventable diseases (3). Pneumococcus is mostly reported from children under the age of 2 years and adults

more than 65 years, especially those with chronic conditions (for example, pulmonary disease such as atelectasis, sepsis) and those with congenital immunodeficiency, HIV infection, use of steroids (4 – 6). Pneumococcal vaccines are potent against *streptococcus pneumoniae* and had a positive impact on infants and children under five years and also an indirect effect on those not considered to get the vaccine (7, 8).

As early in 1900s antimicrobial pneumococcal infections were reported which shows resistance in experimental animal (9). After five years later acquired resistance was seen in human beings (10). For the first time in 1939 acquired sulfonamide resistance was reported (11). It was for the first time in 1965, the first clinical isolate with less potent penicillin vulnerability was delineated (12). In the period of 1980s different resistance to penicillin and trimethoprim-sulfamethoxazole spread rapidly to different countries and regions such as Australia, Spain, Holland and United States (13 – 17). Ciprofloxacin and macrolides to be used to treat lower respiratory tract infections demonstrate poor potency against *streptococcus pneumoniae* and its introduction has been associated with rapid emergence of resistance in pneumococci (18). As compared to above the fluoroquinolone also shows resistance but relatively of low level. Our study was around the following three main factors.

1. Those who missed Vaccine
2. Weak Immune System
3. Antibiotic Resistance

Methods:

The research was carried out in Mardan, Khyber Pakhtunkhwa, Pakistan, using a comparative observational correctional methodology. The study conducted at Mardan medical Complex, from June to November 2024 the sample size was

calculated to be 464 children aged 1 to 47 months from district Mardan, with 95% confidence interval and 5% confidence limit. The research did not include children with age less than 1 month and more than 5 years and those with heart or chronic respiratory diseases. Before involvement, Participants were informed of the objective of the study and requested to provide informed verbal consent. Using the non-probability convenient sampling technique, a standardized questionnaire was employed to collect data. The questionnaire used for data collection was designed, upon an extensive review of the existing literature and underwent validation by domain experts resulting in a positive Cronbach's alpha value. The Review Board and Ethics Committee of Bannu Medical College, Bannu approved the Study design. The data analysis was done with SPSS version 24.0. To analyze the variables descriptive Statistics were used such as means with standard deviation and percentages. With a significant P- Value of 0.05 to identify any significant differences.

Results:

The mean age of the children was 15 months, with a female to male ratio of 0.8. Among 464, 282 were non carriers and 182 were carriers of *streptococcus pneumoniae*. When stratified by age group, 29% of infants aged 1 to 3 Months (23/78) tested positive for the bacterial pneumonia. In 4 to 6 months aged group 51% (39/76) were carriers. Among infants aged 6 to 12 months 41% (53/128) were positive, and in 12 to 24 months age group, 41% (42/102) tested positive. For children age 24 to 36 months, 31% (12/39) were carriers, while 48% (13/27) of children older than 36 tested positive for streptococcus pneumonia. This was overall result of collected data. (Table 1.1)

Overall Results of Collected Data.

S.No	Age (Months)	No. of Children	Carriers	P-Value
1	1-3	78	23(29%)	0.02
2	4-6	76	39(51%)	0.04
3	6-12	128	53(41%)	0.05
4	12-24	102	42(41%)	0.05
5	24-36	39	12(31%)	N. S
6	>36	27	13(48%)	0.05

Total Cases = 450

Female= 203

Male= 247

Total Carrier of Pneumonia= 182(39.2%)

Female/ Male = 0.8.

When stratified according to the risk factors then the following results were obtained. Those children who missed the Vaccine was 79 out of 182, tested positive for bacterial pneumonia stratified by age given below.

Table 1.2 Non Vaccinated Patients Data.

S.No	Age (Months)	No. of Children Affected	+ve due to non-vaccination	P-Value
1	1-3	23	8(34%)	<0.05
2	4-6	39	19(48%)	0.046
3	6-12	53	24(45%)	0.038
4	12-24	42	18(42%)	0.067
5	24-36	12	5(41%)	0.045
6	>36	13	5(38%)	0.050

Those children who show resistance to antibiotics were 33 out of 182 shown below according to age stratification (Table 1.3).

Antibiotics Resistance Data.

S.No	Age (Months)	No. of Children Affected	+ve due to Antibiotics Resistance	P-Value
1	1-3	23	3(13%)	0.05
2	4-6	39	5(12%)	0.05
3	6-12	53	8(15%)	0.043
4	12-24	42	7(16%)	0.067
5	24-36	12	4(33%)	0.05
6	>36	13	6(46%)	0.05

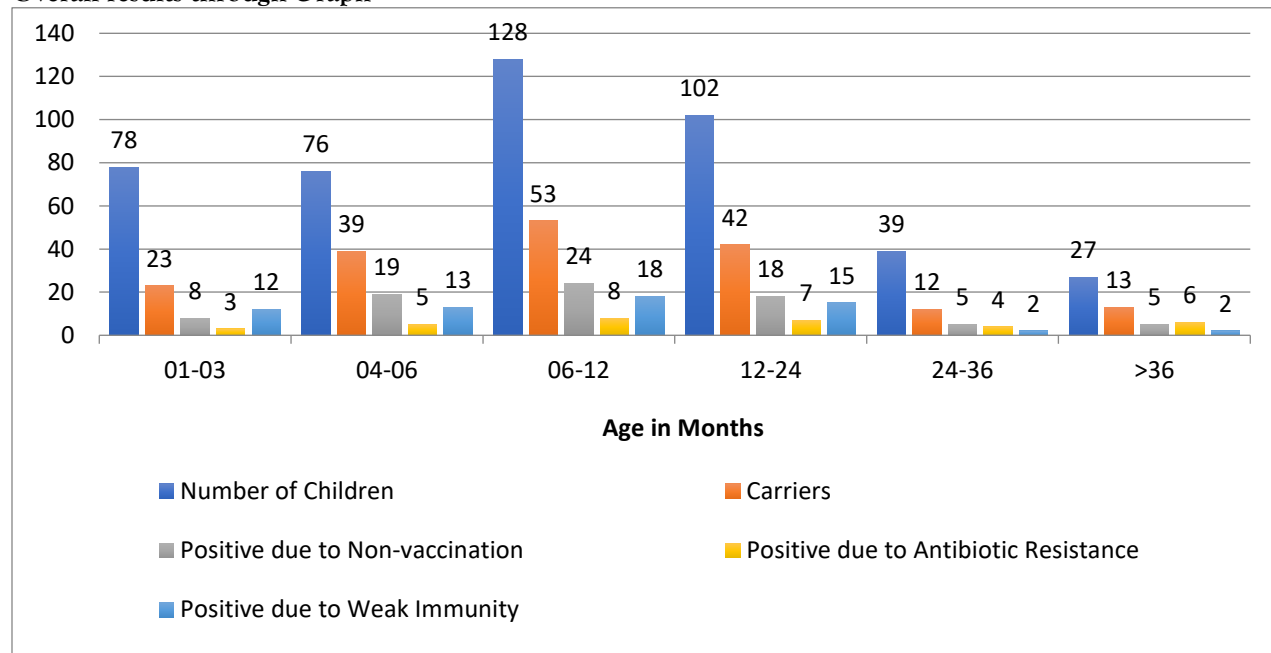
Out of 182, 62 children tested positive for Bacterial Pneumonia having weak Immune System shown below with age Stratification (Table 1.4).

Weak Immune System Data

S.No	Age (Months)	No. of Children Affected	+ve due to Weak Immune System	P-Value
1	1-3	23	12(52%)	0.046
2	4-6	39	13(33%)	0.047
3	6-12	53	18(33%)	0.05
4	12-24	42	15(35%)	0.05
5	24-36	12	2(16%)	0.032
6	>36	13	2(15%)	0.048

Out of 182, 8 Children tested positive for Bacterial Pneumonia with multiple factors i.e, malnutrition, Poor Hygiene etc.

Overall results through Graph



Discussion:

Affecting children under the age of five years in prospering and developing nations *streptococcus pneumoniae* is still a major global health issue. More than one and a half million deaths occur annually. With high morbidity and mortality rate pneumonia continues to be a threat to children's health despite advances in medical technology and awareness efforts. The purpose and objective of this study was to assess the risk factors involved in causing pneumonia among children in our locality. According to a study by Ibrahim Dan Dano, Sani Ousmane, only 39. % of participants recognized as having pneumonia of bacterial type

and that same study recognized three important risk factors for *streptococcus pneumoniae* [12]. Our study shows that 43.4% children were positive due to missed vaccination. Vaccination before the age of 3 months is very crucial for the prevention of *streptococcus pneumoniae*. WHO recommended different strands PCV vaccines. Our study shows that, those children were healthy who have done their vaccinations timely. [1,7,14]. Another group of children were positive due to antibiotics resistance. The results show that 18.1% were positive due to resistance shown to antibiotics. The developing antibiotics should be improved

with new formulas and contents to combat the infections. Penicillin antibiotics show remarkable resistance. Nowadays a group of antibiotics known as fluoroquinolones are widely used. Due to age limitation syrups are mostly used for children treatment. But these still need to be improved [8,9,10,11]. The last factor of our study is weak immune system. In our study 34% children were positive due to weak-immune system. This factor is associated with different chronic conditions and especially the health of mother. Immune system becomes weak due poor nutrition of children, low socioeconomic status of parents. Mothers need to eat health food take care of her health routinely. Initial immunity develops in children solely from mother. Children under the age of 1 year is more susceptible to pneumonia due to weak immune system [13,14,15]. The study of Robinson KA, Baughman W, shows that prevention of disease has a lot of opportunities in developing vaccine. New strands and serotypes of vaccines are still required due to the structural mutations in bacterial strands [16]. Whitney CG, Claimed a control case of *streptococcus pneumoniae* disease due to pneumococcal conjugate vaccine. As our results clearly shows that vaccination is very important for the prevention of pneumonia [17]. Despite potential biases such as cross-sectional study design, the study strength includes its well-defined objectives, statistically determined representative sample size, comprehensive statistical analysis using SPSS and a structured questionnaire evaluating the knowledge of *streptococcus pneumoniae*.

Conclusion:

These results can be helpful to understand the dynamics of *streptococcus pneumoniae* infection. The study confirms that vaccinating infants before the age of 3 months with appropriate vaccine is very helpful to prevent the spread of disease in children. This also confirms that due to resistance shown by antibiotics new class of antibiotics is necessary to develop for controlling the infection. Children should need a good and hygienic health for his immune system to fight against the infections. Future research should

focus on specified areas according to the findings of this study. In this respect, looking toward healthcare provides, cost effectiveness of screening programs and psychosocial factors regarding attitude and perception is important.

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