Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 26s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Assessing the Prevalance of Immunization Status, Complications and Outcomes in Children with MMR (MMR,mumps,Rubella):A cross sectional study

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Cite this paper as: Sonia khan , Nadia Jabeen,Jaweria soomro ,Shanker Lal , Aakash, Neelam, Yumna Wajid, Simrat Mohan ,Khan Muhammad,Bheru lal , Misha Fatima, (2025) Assessing the Prevalance of Immunization Status, Complications and Outcomes in Children with MMR (MMR,mumps,Rubella):A cross sectional study. *Journal of Neonatal Surgery*, 14 (26s), 1271-1277.

ABSTRACT

Background: The MMR vaccine is a combination vaccine that protects against measles, mumps and rubella. Mumps is a viral disease caused by the mumps virus, belonging to the family Paramyxoviridae and is characterized by swelling of the parotid glands and can lead to complications such as orchitis and meningitis. Measles is another infectious viral exanthema, caused by Morbilivirus belonging to the family Paramyxoviridae. The MMR vaccine is a combination vaccine that protects against two highly contagious and potentially serious viral diseases.

Objective: To assess the immunization Status, complications and outcome in Children with MMR.

Methodology: This cross sectional study was conducted at Dow university hospital. The study duration was of 1 year from January 2024 to December 2024. A total of 200 patients of either sex from the ages of 3 months to 13 years who presented with measles, mumps, rubella or with its complications were included. Detailed history and physical examination was done and findings entered in a proforma that had been prepared after thorough research of literature. Immunization status of the patients was checked by examining the National Expanded Program on Immunization (EPI) card where available or parental enquiry if EPI card was not available. All the relevant investigations like complete blood count, serum electrolytes and X-ray chest were carried out besides history and clinical examination. Cerebrospinal fluid examination was done where needed.
Results: A total of 200 patients were admitted during the study period with measles, mumps, rubella or its complications. Male were 170 (85.3%) of and females accounted for 30 (14.7%). The vaccination status of the patients revealed that 113 (56.76%) had received complete vaccination against MMR, while 47 (23.24%) were unvaccinated and 40 (20%) were partially vaccinated. The most common complication was pneumonia affecting 90 (45%) patients, followed by gastroenteritis in 42 (22%) ,bleeding problems 8 (4%) and rarely orchitis 4 (2%) in patients. Notably, 56 (28%) patients had no complications...

Keywords: *Immunization ,Outcome, Mumps, Measles, Rubella ,MMR*

1. INTRODUCTION

The MMR vaccine is a crucial tool in preventing measles, mumps and rubella, three highly infectious viral diseases that can cause significant morbidity and mortality in children. Despite its importance, vaccination coverage and immunization status vary globally and outbreaks still occur[1]. Assessing the prevalence of immunization status, complications and outcomes in children with MMR is essential to understanding the effectiveness of vaccination programs and identifying areas for improvement.The measles is an extremely infectious viral exanthema, caused by Morbilivirus belonging to the family Paramyxoviridae. Prior to the introduction of the MMR vaccine, the disease caused millions of fatalities annually around the globe. In 2008, an estimated 164000 deaths were attributed to disease[2,3]. The MMR vaccine has significantly reduced morbidity and mortality associated with this highly contagious disease. However, there remain significant obstacles to measles,mumps ,rubella (MMR) control and eventual elimination .An infection with MMR can result in a variety of complications, including diarrhea, otitis media, pneumonia, CNS infections ,bleeding problems, blindness, hearing losses and rarely orchitis. MMR related morbidity and death is worse in poor nations due to malnutrition, huge populations, inaccessibility to health care, and lack of vaccination. The CNS is affected during active infection and after the illness has become inactive. Primary encephalitis, subacute sclerosing panencephalitis and acute post infectious encephalomyelitis are the CNS sequel[4-7]. The incidence of measles confirmed infections in Pakistan increased from 24.6 per million cases between 2000 and 2009 to 80.4 per million between 2010 and 2018. Approximately 30-40% of measles and mumps patients experience certain complications. Many organs in the body is defected by measles, mumps and rubella due to damage to mucosal membranes and transitory and profound immunosuppression. This may persist for months, causing complications and may prove fatal[8]. Nonimmunization, overcrowding, malnutrition, immunological deficiency, vitamin A deficiency, infection at a young age, lack of healthcare facilities, severe consequences of various complications in the body. These complications can affect multiple systems in the body including the respiratory, gastrointestinal, nervous and reproductive systems. Measles can cause pneumonia, gastroenteritis, and encephalitis, which can be severe and even life-threatening[9]. Mumps can lead to orchitis, meningitis, and deafness, while rubella can cause arthritis, encephalitis and bleeding problems.

Vaccination against measles, mumps, rubella is an effective way to prevent these complications and protect public health[10]. Although measles, mumps ,rebella (MMR) is ubiquitous in Pakistan. During 2000-2016 ,MMR vaccine prevented an estimated 20.4 million deaths from occurring. Global MMR deaths have decreased by 84% from an estimated 550100 in the year 2000 to 89780 in 2016.The MMR vaccine has been in use for over 50 years. It is safe effective and inexpensive[11]. It is equally effective in the single or combined form. Two doses of vaccine are recommended to ensure immunity and prevent outbreaks as about 15% of vaccinated children fail to develop immunity from the first dose. In 2016 about 85% of the worlds' children received one dose of the MMR vaccine by their first birthday through routine health services as compared to 72% in the year 2004.

Pakistan has one of the highest burdens of measles, mumps, rubella(MMR) and its related deaths in the world. MMR is endemic to Pakistan, with periodic epidemics occurring every two to three years[12-13]. The proportion of incompletely immunized children in Pakistan varies from 37-58% and this has recently resulted in outbreaks of measles, mumps, rubella(MMR).

Immunization status plays a crucial role in determining the risk of contracting these diseases and experiencing related complications. Studies have shown that individuals who are unvaccinated or partially vaccinated are more likely to develop measles, mumps, rubella, and are at a higher risk of experiencing complications.

Outcomes of MMR vaccination are generally excellent, with the vaccine being highly effective in preventing measles, mumps, rubella. Vaccinated individuals are significantly less likely to develop these diseases and experience related complications. In addition, vaccination helps to prevent the spread of these diseases in the community, protecting vulnerable individuals who may be unable to receive the vaccine[14]. Immunization status is a critical factor in determining the risk of complications and outcomes. Individuals who are fully vaccinated with two doses of the MMR vaccine are highly protected against measles, mumps, rubella, and are at a significantly lower risk of experiencing complications. In contrast, individuals who are unvaccinated or partially vaccinated are at a higher risk of developing these diseases and experiencing related complications[15-17]. Overall, the MMR vaccine is a safe and effective way to protect against measles, mumps, and rubella, and vaccination is an essential tool in preventing complications and promoting public health.

This study was carried out with the objective of evaluating the vaccination status of children with measles, mumps, rubella(MMR). Furthermore, the aim was also to determine the frequency of occurrence of MMR and its complications in the children. As MMR and its complications, still present as a fatal illness even among vaccinated children in our country and epidemics of the disease have been frequently occurring especially over the past few years therefore, keeping in view the magnitude of the problem this study was conducted

2. METHODOLOGY

This cross sectional study was conducted at Dow university Hospital. A comprehensive study was conducted on a total of 200 patients, comprising both males and females, aged between 3 months and 12 years, who presented with measles, mumps,

rubella or its complications.The patients were thoroughly evaluated through detailed history-taking and physical examination, and the findings were documented in a proforma that had been meticulously prepared after an extensive review of existing literature. measles, mumps, rubella(MMR) was diagnosed in children presenting with characteristic signs and symptoms, including cough, coryza, conjunctivitis, high fever and an erythematous maculopapular rash, as virtually every patient becomes clinically apparent. Mumps was diagnosed in children presenting with swelling of the parotid glands, often accompanied by fever, headache, and fatigue. Pneumonia, a common complication of measles was diagnosed using the Integrated Management of Childhood Illness (IMCI) criteria, which include an increased respiratory rate or infiltrates on chest X-ray. Other complications, such as orchitis and meningitis were also monitored in children with mumps. Bleeding problems and Central nervous system problems was considered involved if there was lethargy, unconsciousness, fits and neurological deficit with rubella infection. Other problems of MMR like diarrhea, stomatitis, eye complications, febrile fits and otitis media were also notified in case sheets. Informed consent was obtained from parents or caregivers of all eligible patients prior to data collection and confidentiality of all patients was ensured by a coding system. Detailed history and physical examination was done and findings entered in a proforma that had been prepared after thorough research of literature. Immunization status of the patients was checked by examining the National Expanded Program on Immunization (EPI) card where available or parental enquiry if EPI card was not available. This included checking the vaccination history for MMR and mumps, which are typically prevented through the administration of the MMR (measles, mumps, rubella) vaccine.

The collected data, encompassing age, sex, immunization status, nutritional status, complications, and outcome, were entered into an MS Excel sheet and subsequently analyzed using SPSS version 22 for Windows. The analysis aimed to provide insights into the clinical presentation, management, and outcome of measles, mumps, rubella in the study population, as well as the impact of immunization status on the disease course.

3. STATISTICAL ANALYSIS

Data regarding age, sex, immunization status, nutritional status, complications and outcome was entered on MS Excel sheet and analyzed by using SPSS version 22 for windows. The results were expressed as frequencies and percentages for qualitative data and mean and standard deviation for quantitative data

4. RESULTS

A total of 200 patients were added in the study period with measles, mumps, rubella (MMR) and its associated complications. The patient population consisted of males 170 (85.3%) and females accounted for 30 (14.7%).

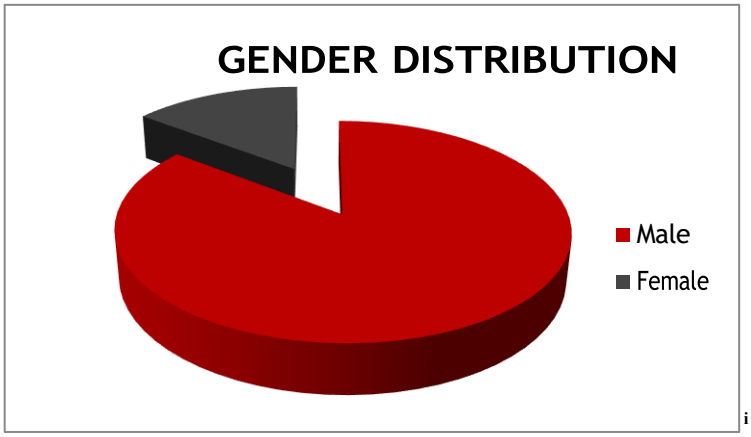

Figure 1: Gender wise distribution of patients

The age distribution of the patients revealed that the majority, 86 (43%), were between 1-3 years old, followed by 40 (20%) patients between 7-11 months, 26 (13%) patients between 4-6 years, 20 (10%) patients between 3-6 months, 14 (7%) patients between 7-9 years, and 14 (7%) patients between 10-13 years.

Table 1 showed the age wise distribution of patients

Vaccination status	Frequency	Percentage
3-6 months	20	10%
7-11 months	40	20%
4-6 years	26	13%
7-9 years	14	7%
10-13 years	14	7%

The vaccination status of the patients revealed that 113 (56.76%) had received complete vaccination against MMR, while 47 (23.24%) were unvaccinated and 40 (20%) were partially vaccinated.

Table 2 showed the Vaccination status of the patients

Vaccination status	Frequency	Percentage
Complete vaccination	113	56.76%
Unvaccinated	47	23.24%
Partial vaccinated	40	20%

The most common complication was pneumonia, affecting 90 (45%) patients, followed by gastroenteritis in 42 (22%), bleeding problems 8(4%), bronchiolitis 4 (2%) and rarely orchitis 8 (5%) in patients. Notably, 50 (29%) patients had no complications.

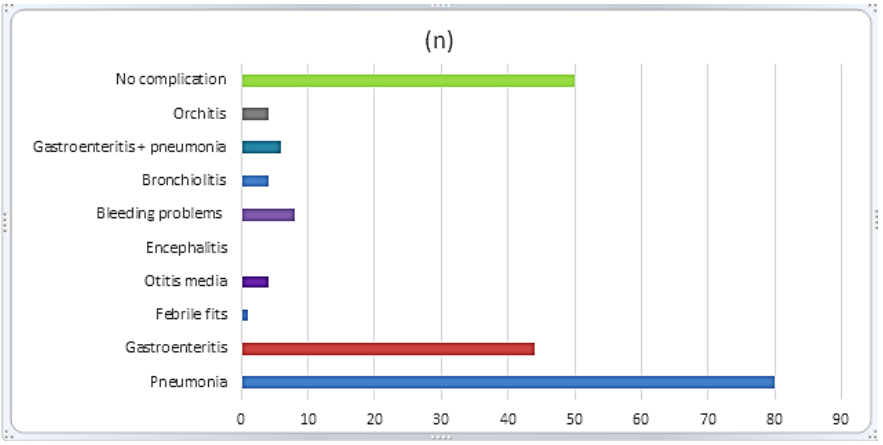

Figure 2 showed the complications of Measles, Mumps ,Rubella

In terms of outcome, the mortality rate was 2.35% (5 patients out of 200), with pneumonia being the leading cause of death. The majority of patients, 181 (95%), had a favorable outcome and were discharged from the hospital within a week, indicating effective management and treatment of MMR and its complications.

5. DISCUSSION

Measles, mumps, and rubella (MMR) epidemics continue to occur in Pakistan, resulting in significant morbidity and mortality. According to the World Health Organization (WHO), in 2013, MMR caused nearly 0.14 million deaths worldwide[18]. Pakistan has been experiencing an increasing number of MMR outbreaks since 2012, which can be attributed to several factors, including improper vaccine storage, low vaccination coverage, malnutrition, inadequate health infrastructure and failure to administer a second dose of the MMR vaccine[19,20].

The present study's demographic analysis revealed that the majority of patients were between 1-3 years old (43.24%), followed by those between 7-11 months (20%), 4-6 years (13%), 3-6 months (10%), 7-9 years (7%), and 10-13 years (7%). These findings are consistent with previous studies conducted in Karachi and other parts of Pakistan, which reported a high incidence of MMR in children under 3 years old[21]. Similar studies conducted in Iran, Nigeria and other countries have also reported a high incidence of measles, mumps, rubella (MMR) in children under 5 years old. This age group is more susceptible to MMR due to the endemic nature of the virus in developing countries and the fact that maternal antibodies provide protection only up to the first 3 months of life[22,23]. The first dose of the MMR vaccine is typically administered at 9 months, leaving infants vulnerable to infection between 3-9 months of age.

A study from the Netherlands found that maternal antibodies against measles, mumps, rubella MMR provide immunity to infants only until 3.5-5.5 months after birth, highlighting the need for earlier vaccination or alternative strategies to protect this age group[24-27]. The high incidence of MMR in children under 5 years old emphasizes the importance of improving vaccination coverage, ensuring proper vaccine storage, and strengthening health infrastructure to prevent and control MMR outbreaks.

The male preponderance of measles, mumps, rubella (MMR) cases in the study can be attributed to societal factors, where male children often receive preferential treatment and medical attention is sought earlier for them[28]. Additionally, female children tend to have a stronger immune system, making males more susceptible to infections.

The World Health Organization (WHO) recommends vaccination measles, mumps, rubella MMR vaccine and achieving vaccination coverage of 95% or higher with both doses. Despite the availability of free vaccination through the Expanded Program on Immunization (EPI), many children in Pakistan remain unvaccinated or partially vaccinated. The study found that 56.76% of patients had received complete vaccination against MMR, while 23.24% were unvaccinated and 20% were partially vaccinated. This is consistent with other local studies, which have reported low vaccination coverage and highlighted the need for mass media campaigns to raise awareness about the importance of vaccination.

The occurrence of measles, mumps, rebella in completely immunized children suggests vaccine failure, possibly due to improper vaccine storage or cold chain maintenance issues. Studies have reported high vaccine failure rates and inadequate sero conversion, emphasizing the need for improved immunization practices. Interestingly, the study found that 80% of measles, mumps, rubella (MMR)cases admitted to a private hospital were vaccinated with two doses, while only 20% of cases admitted to a public-sector hospital were completely vaccinated. This highlights the significant contribution of the private sector to immunization service delivery in Pakistan and underscores the need to strengthen public-sector health infrastructure, particularly the EPI program.

The study found that the many patients developed rashes between 1-4 days of illness, while 17.94% developed rashes between 5-12 days. The most common complications of measles, mumps, rubella (MMR) were pneumonia (45%), followed by gastroenteritis (21.18%), bleeding problems 8(4%), bronchiolitis 4 (2%) and rarely orchitis 8 (5%) in patients. Additionally, some patients experienced complications such as encephalitis (a complication of measles and rubella) .These findings are consistent with other studies, although some have reported higher rates of encephalitis and mortality[29]. Mumps complications included orchitis, meningitis, and deafness, while rubella complications included arthritis and bleeding problems.

The study's findings highlight the need for improved vaccination coverage and strategies to prevent MMR epidemics. Further multicenter studies with MMR antibody status are needed to better understand the disease and vaccine effectiveness. To control and eliminate measles, mumps, and rubella (MMR), catch-up immunization campaigns should be launched targeting children aged 8 months to 12 years. Given the frequency of MMR cases in infants under 6 months, administering the first dose of MMM vaccine earlier than 9 months of age may be recommended.Public awareness campaigns should emphasize the importance of receiving two doses of MMR vaccine, aiming to achieve vaccination coverage of over 95%. Strong political commitment and strengthened surveillance are crucial to reporting suspected cases and maintaining elimination efforts.

Stricter enforcement of immunization status assessment at school entry is necessary. Further research is needed to identify factors contributing to vaccine failure and develop more immunogenic and heat-stable next-generation vaccines.By prioritizing these strategies, Pakistan can reduce MMR incidence and work towards eliminating these diseases.

6. CONCLUSION

The study revealed that a substantial number of children are hospitalized with measles, mumps, rubella (MMR) in Pakistan. Notably, many patients developed the disease despite receiving two doses of the vaccine, highlighting concerns about vaccine effectiveness. Furthermore, a significant proportion of patients were either unvaccinated or partially vaccinated, underscoring the need for improved vaccination coverage. These findings emphasize the importance of strengthening vaccination efforts, improving vaccine delivery, and addressing potential issues with vaccine efficacy to reduce the burden of MMR in Pakistan

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