

Childhood MMR Vaccination and the Incidence Rate of Measles Infection

AHMED EJAZ¹, AHMED AMMAD², UMAR ARIF³, SALEHA ISLAM⁴, RABIA ISLAM⁵, ABDULLAH ISLAM⁶

¹Medical Officer, Emergency Department, The Indus Hospital, Lahore.

²Medical officer, Orthopedic Surgery, The Indus Hospital QF&NST Campus

³Demonstrator, Pathology department, Rashid Latif Medical College, Lahore

⁴PGR Medicine, Shahida Islam teaching hospital, Bahawalpur

⁵Assistant Professor, Maternal and Child Health, Institute of Public Health Lahore

⁶Final year student, United Medical and Dental College, Karachi

Corresponding author: Rabia Islam, Email: rabiaislam1@gmail.com

ABSTRACT

Objective: The efficacy of the measles, mumps, and rubella (MMR) immunization in children against subsequent measles diagnoses was the focus of this research.

Method: After the ethical approval from institution review board, this cross-sectional study was conducted at Indus hospital Lahore. In this study, MMR vaccination data was collected from all the government vaccination centers from 1st January 2019 till 1st January 2023. Individuals' month and year of enrollment, gender, date of birth, and county level domicile were all included in the comprehensive eligibility data. Each person's diagnostic status was recorded in great detail in their claims file. Those who received just one dose of the MMR vaccination were included as part of the vaccinated group, whereas those who did not get any kind of vaccine containing measles were excluded from the research. Participants who had previously received more than one dose of MMR or any other measles-containing vaccine were not included in this analysis.

Results: There were a total of 2000 people in the MMR-vaccinated cohort, accounting for 1543 person-years of data, and a total of 5000 people in the unvaccinated cohort, accounting for 3423 person-years of data. The male-to-female ratio in the MMR-vaccinated group was 0.97, while it was 1.13 in the unvaccinated group. 7% children in the MMR vaccinated group were diagnosed with measles, while 25% children in the unvaccinated group was diagnosed with measles.

Conclusion: The prevalence of measles infections in children has been drastically decreased due to widespread MMR immunization.

Keywords: MMR, measles, childhood, immunization

INTRODUCTION

Measles has recently broken out in many regions of Pakistan, prompting new concerns about the country's vaccine strategy. In 2012, there were supposedly 14,000 instances of measles, and 210 people died as a result (1). Currently, there is an outbreak of measles in Pakistan, but accurate demographic data, such as the ages of patients afflicted, are unavailable owing to a lack of adequate monitoring infrastructure. We can't have an honest conversation about the present crisis and the answers because of this. Pakistan is one of just three nations where polio is still prevalent, therefore its vaccine effort is already highly topical (2). Measles is a highly infectious illness that was widespread across the globe until the vaccination was developed to prevent it. Vaccination against measles via the World Health Organization's vaccination programme has drastically reduced the frequency of outbreaks (3). (WHO). According to World Health Organization data, a staggering 84 percent of all children have been vaccinated against measles (4). The measles vaccination in Pakistan is given in two doses, the first at 9 months of age and the second at the age of 2 years (5). Corruption, parental refusal, an influx of unvaccinated refugees, an ongoing war in the Northern areas, political insurgency, security issues, a lack of awareness among health-care professionals about the vaccination schedule, inadequate training in vaccine administration, and the failure of the vaccine itself have all been blamed for the immunization program's inability to stem measles outbreaks in Pakistan. Though efforts are being made to address each of these reasons separately, there has been little evidence of an overarching strategy to assess and address the vaccine's failure. It is evident that parental vaccination refusal and insufficient dissemination of the immunization programme are key factors in the spread of measles outbreaks. There is, however, some data suggesting that the vaccination failure rate in Pakistan may be greater than desirable. In Karachi, the biggest city in Pakistan affected by the measles outbreak, researchers found that the primary vaccination campaign covered almost 90% of children between the ages of 1 and 5, but the secondary drive covered just 3% (6). The global average is 84%, therefore this is significantly over that (40). The research went on to indicate that just 12% of the youngsters had gotten both doses of the measles vaccination, while 78% had received only one. Only

55% of the kids tested positive for measles-immunity-indicating antibodies. This demonstrates that only around half of vaccinated children are resistant to measles, despite the fact that 90% of children are receiving the vaccine. Antibodies against measles were found in 58% of children who received only one dose of the vaccination, and 64% of those who had both doses. Though parental recollection was employed in this research to determine vaccination status, it should be noted that this is not as unreliable as it may at first seem. Parents' recollections of their children's immunization histories have been demonstrated to be a valid indicator in studies of this kind (7). Other studies have also shown alarmingly high rates of measles vaccine failure. The vaccination success rate in the Lasbela area of Pakistan was determined to be above 50% in recent research (8). Despite the fact that this research showed that unvaccinated children had double the risk of catching measles compared to vaccinated children, the vaccine failure rate is quite high. Vaccine failure may occur at any point, from during production to after it has been given to a patient. Vaccine effectiveness may be diminished if inexperienced staff administer it incorrectly. However, further research is required to verify this. The timing of the measles vaccination might potentially be an issue. Whether deciding when to administer a vaccination, doctors consider the age at which the kid is most vulnerable to the illness, how long the child will be protected by the mother's antibodies, and how long the mother's antibodies will last in the child. Measles immunity from maternal antibodies has been demonstrated to last for just 2.61 months after delivery (9). A kid is entirely vulnerable to catching measles for a few months after the first dose of measles vaccination is provided, around 9 months of age. This retrospective, longitudinal cohort research set out to determine whether or not the pediatric MMR vaccine was beneficial in lowering the number of measles infections among Pakistani children.

METHODOLOGY

After the ethical approval from institution review board, this correctional study was conducted at Indus hospital Lahore. In this study, MMR vaccination data was collected from all the government vaccination centers from 1st January 2020 till 1st January 2023. Individuals' month and year of enrollment, gender,

date of birth, and county level domicile were all included in the comprehensive eligibility data. Each person's diagnostic status was recorded in great detail in their claims file. Those who received just one dose of the MMR vaccination were included as part of the vaccinated group, whereas those who did not get any kind of vaccine containing measles were excluded from the research. Participants who had previously received more than one dose of MMR or any other measles-containing vaccine were not included in this analysis. For persons who have been given the measles, mumps, and rubella vaccination, the date of service for the first claim in chronological order with a process code identifying MMR vaccine was taken to be the date of vaccine administration. It was found that there were a total of 2000 people in the MMR-vaccinated cohort and 5000 people in the comparison group who had not been immunized. Measles, measles with additional indicated problems, measles keratoconjunctivitis, measles with undetermined complication, and measles without mention of complication were all looked at. There was no indication of whether or not measles cases had been verified by a laboratory. A person was deemed to have measles if they were diagnosed with any of the conditions associated with the disease throughout the research period, and they were not diagnosed with measles if they were not diagnosed with any of these conditions. The presumed date of measles infection beginning was the date of service for the first claim in chronological order with a measles diagnostic among those having a measles diagnosis. The final MMR vaccinated cohort only consists of individuals who have not been diagnosed with measles or who have been diagnosed more than 30 days after receiving the vaccine. SPSS version 26 was used to analyze the data.

RESULTS

The sample population's demographic information is shown in Table 1. There were a total of 2000 people in the MMR-vaccinated cohort, accounting for 1543 person-years of data, and a total of 5000 people in the unvaccinated cohort, accounting for 3423 person-years of data. The male-to-female ratio in the MMR-vaccinated group was 0.97, while it was 1.13 in the unvaccinated group. Furthermore, the average ages of the vaccinated and unvaccinated groups were the same. Characteristics of the 1359 research participants with confirmed measles diagnoses are shown in Table 2. Females outnumbered males by a margin of 1.17 to 1, although this ratio was same in both vaccinated and unvaccinated groups. When comparing measles cases between vaccinated and unvaccinated individuals, the vaccinated cohort (1998) had a somewhat earlier mean birth year than in unvaccinated cohort (1998). The vast majority of measles cases (94%) were mild.

Table 1: Demographic characteristics of the persons examined in this study

Parameters	MMR vaccinated cohort (n=2000)	Unvaccinated cohort (n=5000)
Person-year	1543	3423
Gender		
Male	989 (49%)	2656 (53%)
Female	1011 (51%)	2344 (47%)
Date of Birth	1997±4.3	1997±3.4
Number Diagnosed with Measles	134	1245

Table 2: Demographic summary of the persons diagnosed with measles examined in this study

Parameters	All Persons Diagnosed with Measles (n=1379)	Vaccinated Persons Diagnosed with Measles (n=134)	Unvaccinated Persons with Diagnosed Measles (n=1245)
Gender			
Male	635 (46%)	62 (46%)	573 (46%)
Female	744 (54%)	72 (54%)	672 (54%)
Date of Birth	1998±2.3	1997±1.6	1998±3.2
Age of measles	1.72±3.2	1.23±1.7	1.66±4.2

diagnosis			
Year of measles diagnosis	1999±1.7	1998±1.3	1999±3.1
Measles Diagnosis-Associated Complications			
No Complication	1300 (94%)	130 (97%)	1170 (94%)
Complication specified	70 (5%)	4 (3%)	66 (5%)
unknown complication status	9 (0.6%)	0	9 (0.7%)

DISCUSSION

Important and persuasive new epidemiological quantitative data addressing the vaccine efficacy of the kids MMR vaccine regularly given in the United States are provided by the findings of this retrospective longitudinal cohort research using prospectively obtained healthcare data. Furthermore, the efficacy of childhood MMR vaccination was still present after controlling for factors including gender and birth year. The Cochrane Collaboration has released a comprehensive evaluation of the MMR vaccine's efficacy, which includes a comparison of the current study's findings with those of other studies (10). All three cohort studies analyzed by the Cochrane Collaboration found that giving children the MMR vaccination was very efficient at avoiding measles cases in clinical settings (11-13). Moreover, the Cochrane Collaboration research similarly reported vaccination efficacy = 97% for MMR vaccine provided in US immunization programmed (12). This study's findings that the MMR vaccine given to children greatly reduces the incidence rate of measles for several years after immunization are consistent with biological reality. For instance, in 1971 it was reported that 96% of infants vaccinated with MMR vaccine (who had no preexisting measles antibodies) developed such antibodies (13). Researchers found that > 90% of kids who were given a single dose of the MMR vaccination at 15 months old and then tested for measles immunity again at 6-7 years old still had detectable antibodies (14). Measles antibodies may remain for more than a decade after MMR immunization, according to other investigations in other populations [15, 16]. Persistent antibodies were detected in > 90% of individuals in long-term longitudinal cohort studies of measles vaccination recipients (17, 18). Benefiting from prospectively created eligibility and claims data as part of the regular healthcare delivered to individuals in Pakistan was a major strength of this research. Thus, the data used in the analysis were not part of the same set used in the present research. Most likely, the doctors who reported MMR vaccination administrations and measles diagnoses didn't make the connection between the two when they submitted their reports. There was one possible flaw in this research due to the fact that there was a lack of data on people's actual residences over the several years of this study. It was considered that the cohorts of vaccinated and unvaccinated individuals had similar risks of exposure to wild type measles virus. Exposure to the wild type measles virus may vary in frequency from one year to the next, and from one region to the next. There has to be more research done on this possible phenomenon.

CONCLUSION

Routine childhood MMR vaccination in the United States considerably lowered the incidence rate of identified measles cases, as shown by this retrospective cohort research using prospectively gathered healthcare data from the IHRD. Overall, the current study's findings lend credence to the idea that regular MMR vaccination is an effective public health intervention for lowering the number of cases of measles that are identified each year. The duration and strength of the MMR vaccine's protective effects should be tracked in future trials.

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