Journal of Advances in Microbiology Research

E-ISSN: 2709-944X
P-ISSN: 2709-9431
JRM 2026; 7(1): 27-31

www.microbiojournal.com
Received: 17-11-2025
Accepted: 21-12-2025

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Study on measles virus, causes, impact, diagnosis and effectiveness of vaccination in limiting spread of disease in Babylon, Iraq

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DOI: https://www.doi.org/10.22271/micro.2026.v7.i1a.302

Abstract

Background: Measles still a challenge for the health of the Iraqi community and globally, especially in areas with low vaccination coverage and weak health systems. The aim of this current study is to develop effective interventions in the field of vaccination and public health protection.

Objective: The present study amid to evaluate the effectiveness of vaccination programs and identifying gaps in coverage within population groups in Babylon Governorate

Methods: From 1st February, 2023 to 30th March, 2024, a total of (2527) suspected measles cases was reported. These cases were confirmed based on symptoms and laboratory tests. Personal information, especially vaccination status was given. Statistical analyses of data were performed using SPSS software and chi-square tests.

Results: The data of present study explain that the vaccinated group appears low rate of infection with measles (1.513) compared with un vaccinated group (62.41). The results showed no significant variation between male and female with uptake of vaccine and the vaccination rate was somewhat similar

Conclusion: The results confirm the effectiveness of vaccination in limiting the spread of easles and highlight the importance of enhancing coverage of the second dose of the vaccine to control of the measles disease.

Keywords: Measles virus, vaccine, red measles, MMR

Introduction

Measles is caused by the measles virus, which is a single-stranded, enveloped RNA virus with negative polarity, belonging to the Morbillivirus genus within the *Paramyxoviridae* family. It can remain infectious for up to two hours in the air or on contaminated surfaces. A person infected with measles can be a source of infection for approximately ninety percentage of healthy individuals who come into close contact with them, such as family members, who are likely to become infected. Humans are the only natural hosts for this virus, and research has not indicated known animal reservoirs; it is believed that mountain gorillas are susceptible to the disease [1]. There are many risk factors for measles virus infection, the most important of which include immunodeficiency diseases such as AIDS, or immunosuppression following organ transplantation or stem cell transplants, or treatment with alkylating agents or corticosteroids, regardless of vaccination. Measles is considered one of the most severe contagious viral diseases, and it can be transmitted from one person to another through sneezing, coughing, and commonly via direct contact with the infected person .A child infected with measles is a source of infection for others and is contagious about five days before the appearance of symptoms such as a rash and for another five days after the appearance of the clinical symptoms of the measles virus. The child should be prevented from going to school or having direct contact with family members until they recover or for a week after the rash appears. The incubation period lasts from ten to fifteen days. the only natural host for this virus is human [2].

Measles, a viral infection that usually causes high fever with characteristic rash on the body, is highly contagious, thus vaccination is the major way to prevent it. Usually, symptoms show up after 2-3 weeks from getting the infection [3]. The most severe symptoms last for about 7-10 days. Firstly, sudden high fever with coughing and chesty rattling and inflamed eyes are the symptoms. About two days later, something that then takes the form of tiny white spots named Koplik's spots appears in mouth of the child, out of which a bright red rash grows on the child's face and then spreads all over the body. Usually, other symptoms like diarrhea occur with measles infection in eight percentage of cases, seven percentage of cases occurs as middle ear infection, and six percentage of patients appear as pneumonia, which is caused by the immunosuppressive activity of the virus. Also, paroxysmal events may include seizures, blindness, or brain inflammations which are extremely rare. Measles also has different names, for example morbilli, rubeola, red measles and English measles. Possible manifestations of Coxsackievirus infections are very similar to those caused by Rubella and Roseola, which are caused by other pathogenic agents. Measles is known for herd immunity which spreads through coughs/sneezes of the infected that is, to mention, a direct contact with their nasal and oral mucus. It is true that the infected person who does not have immunity has a high possibility of infecting almost all non-immune people they me meet [4]. On the other hand, the level of attention we exercise is very important through handwashing, among various other measures to decrease the spread of the disease. Antibiotic prophylaxis is required in cases of transferable ear or pneumonia. Further, giving vitamin A to the progenies is suggested. The percentage of cases fell below 0.1% from 1986 to 1994, but it ascended to 12% in the ill-sustained patients. Measles is measured the important killer among children that have not grasped the age of five years old [5, 6].

Measles signs usually manifest 10-14 days after contact, often presenting as a four-day fever convoyed by a head cold, sneezing, fever, and red eyes along with a rash called maculopapular. The fever, which can reach up to 40°C lasts about a week. One diagnostic mark is Koplik's spots, small white spots inside the mouth, which appear momentarily and can help in early detection before contagiousness. The typical rash typically begins behind the ears and spreads to the head, neck, and body 2-4 days after initial symptoms, lasting up to 8 days. The rash variations color from red to dark brown before declining. Vaccinated individuals with incomplete immunity may experience modified measles, characterized by a longer incubation period and milder symptoms, including a sparse and brief rash [7, 8].

The clinical diagnosis of measles usually begins with appears of symptoms like as elevation of body temperature and malaise about ten days after infection with this virus. After that, cough, runny nose, and conjunctivitis develop, and the situation worsens over the next four days. The presence of Koplik spots, which are tiny white spots appear on the inner lining of the cheek, is also a distinctive feature of the disease. However, similar conditions can cause similar symptoms, such as dengue fever, Kawasaki disease and parvovirus. Thus, laboratory confirmation is very important to accurately diagnose measles and to differentiate it from other diseases that have similar clinical symptoms [9, 10].

Measles is usually diagnosed in the laboratory by confirming the presence of measles immunoglobulin (IgM) antibodies or by collecting throat, nasal, or urine samples from the suspected person for detection of measles virus RNA by using reverse transcriptase polymerase chain reaction (RT-PCR) assay. This method of diagnosis is beneficial when the IgM antibody results are inconclusive. For individuals from whom blood collection cannot be performed, saliva is collected to test for measles-specific IgA. However, this method has limitations [11].

Saliva contains various fluids and proteins, which may hinder sample collection and measles Abs detection. Moreover, saliva generally contains eight hundred times fewer Abs than Abs in blood samples, this fact making salivary testing more challenging. Positive contact with individuals known to have measles can also contribute to the diagnosis. This clinical evidence, combined with laboratory test results, strengthens the certainty of a measles detection. laboratory diagnosis of measles virus can be achieved through many ways, including IgM antibody testing and RT-PCR assays, challenges exist, particularly with saliva-based testing due to its lower Abs concentration and potential sample contamination. Positive contact history can help in confirming the diagnosis [12, 13].

Methodology

A cross-sectional study was conducted in Al-Hillah Governorate, Iraq, From January to December 2024. A total of 2527 individuals suspected of having measles. Blood samples were collected from all participants and then the serum was separated and use for detection of IgM antibodies by using of Enzyme-linked immunosorbent assay (ELISA) technique which done according to manufacturer's instruction. In addition, the throat swabs were randomly taken from a subset of positive cases for laboratory analysis. The vaccination status of each individual within study group was documented to enable comparisons between vaccinated and unvaccinated groups.

Statistical analysis: To compare and observe the significant differences between the study results, a chi-square statistical analysis was conducted, and the results showed statistically significant differences between the study groups' results.

Results

The results in table (1) appears the comparison between number of vaccinated and unvaccinated population.

The role of the vaccine among the population explained in Figure (1).

Table 1: Distribution of population that vaccinated and unvaccinated

Population groups	1	2	3	4	5
Total population	540	340	623	465	559
Vaccinated	475	294	616	437	556
unvaccinated	65	46	7	28	3

Significant differences in rate between vaccinated and unvaccinated population group p-value <0.0

The results in table (2) appears the comparison between vaccinated and unvaccinated population and rate of infection, unvaccinated individuals showed significantly higher infection rate compared to vaccinated group

Table 2: Comparison between vaccinated and unvaccinated population with rate of infection

Groups of population	Total number	Vaccinated	Infected no.	Infected %	Unvaccinated	Infected No.	Infected No.%
1	540	475	12	2.50	64	43	67.18
2	340	294	8	2.721	45	31	68.8
3	623	616	5	0.811	8	0	0.0
4	465	437	8	2.72	29	9	31.03
5	559	556	3	0.539	31	10	32.25
Total	2527	2378	36	1.513	149	93	62.416

Significant differences in rate of infection between vaccinated and unvaccinated population group p-value <0.0

The results in table (3) indicated that the rate of vaccination uptake between tow sexes are nearly equal, the rate of individual who reserved first dose of vaccine was 43.8% within males and 56.2 within females, while the second dose uptake reach 48.3% in males and reach 51.7% in females. Statistical analyses of data appear no significant changes between two sexes (p-value > 0.05).

Table 3: Distribution of vaccinated uptake among males and females

No. of dose	Males No.	Females No.	Total	Males%	Females%
First dose	988	1266	2254	43.8	56.2
Second dose	60	64	124	48.3	51.7
unvaccinated	70	79	149	48	52.0

No significant difference between two sexes. P-value> 0.05

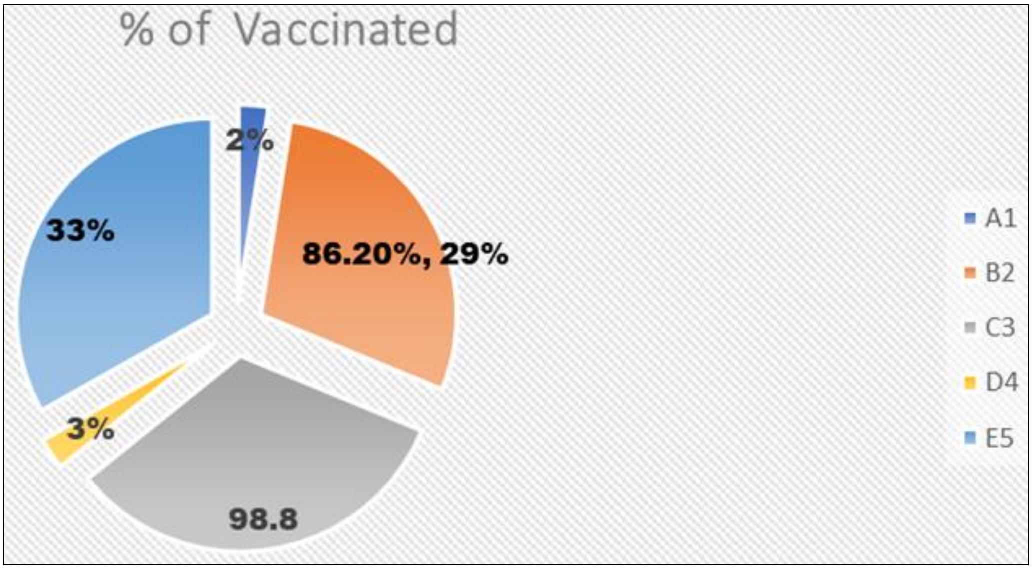

Fig 1: Explained the role of the vaccine among the study population

Discussion

The comparison of measles virus spread between vaccinated and unvaccinated populations revealed notable trends in current study. The results in present study appears the comparison between vaccinated and unvaccinated population and rate of infection, unvaccinated individuals showed significantly higher infection rate compared to vaccinated group.

A study was conducted in 2023 [14], and another study was conducted in 2024 [15], in addition to the study carried by Xia in 2023 [16] were agreement with data of present study

The population that remained unvaccinated exhibited a higher rate of measles virus dissemination compared to population who were vaccinated. Public healthcare centers in Iraqi cities provide basic free services to all individuals. Therefore, all citizens can easily access vaccines through the Iraqi National Immunization Program. The standard immunization schedule to achieve herd immunity includes a single dose of the measles vaccine at nine months of age and two doses of the MMR vaccine, usually given at two years of age. Additionally, the Iraqi Ministry of Health, in cooperation with the World Health Organization, conducts extensive vaccination campaigns for children [8].

The goal of vaccination campaigns is to immunize as many children as possible, reduce the incidence of measles, and consequently lower the risk of death from it. Likewise, such campaigns are considered part of Iraq's commitment with the World Health Organization to reduce the spread of measles.

Despite the efforts made and the continuous pursuit by all countries in cooperation with the World Health Organization to prevent the spread of measles, outbreaks have still occurred in different countries, both developed and developing [8]. One of the most important factors contributing to the spread of measles in Iraq is the low rate of vaccination coverage. There are various reasons attributed to the failure to achieve full vaccination coverage, including fear of vaccination, lack of regular check-ups for children, living in rural areas, the mother's age and her awareness of the seriousness of diseases, lack of awareness among mothers, and losing or forgetting children's vaccination cards [10].

Mothers forgetting the vaccination card, sometimes the unavailability of vaccines, crowding, mothers' lack of awareness about the importance of vaccination, insufficient proper cooperation between child health care providers and primary care physicians, mothers forgetting, which accounts for 30% of the factors contributing to not receiving a dose or receiving only one dose of the vaccine and not completing the second dose, social problems, child health disorder [10]. Incorrect methods of importing the vaccine are another factor that may reduce vaccination coverage rates [5]. There are also reasons related to changing residence or migration of people from neighboring countries to Iraq such as Lebanon and Syria, which may serve as a source for the spread of measles in Iraq. Additionally, the reasons may be related to the viral agent, as the genetic diversity of the measles virus plays an important role in the high infection rates of the disease [11].

The data in table (3) appears to rate of vaccination uptake between tow sexes are somewhat similar, the rate of individual who reserved first dose of vaccine was 43.8% among males and 56.2 among females, while the second dose uptake reach to 48.3% in males and reach to 51.7% in females. Statistical analyses of data appear no significant differences between the two sexes at (p-value > 0.05).

A similar study was conducted in Iraq [22], and its results clarified the distribution of measles cases by gender, showing that males generally had higher case numbers than females in the younger age groups. The results indicated that the numbers of cases were approximately similar between males and females. However, females recorded slightly higher rates than males. This pattern suggests the existence of gender-based differences in the incidence of measles across genders.

The current study highlights the importance of developing carefully designed, targeted strategies to enhance vaccine acceptance, especially among segments of the population that do not recognize the importance of vaccination, and working to reduce the gaps between males and females in vaccination rates. Health initiatives at public vaccination centers can improve overall vaccination coverage, thereby reducing the spread of measles and other viral diseases that threaten individual health and safety and spread easily among people, thus protecting the community and reducing the burden of these diseases and their impacts on society.

Conclusion

Measles is one of the most contagious diseases. It is one of the infectious diseases that can be prevented through vaccination. Despite the extensive efforts and major measures taken by all countries and the World Health Organization, measles outbreaks remain a significant threat worldwide, leading to increased cases of illness and higher mortality rates. Therefore, a unified approach must be provided to eliminate measles outbreaks by increasing the vaccination coverage rate among children.

The current study emphasizes the need to find specially prepared and carefully designed strategies to promote vaccine acceptance, especially among underrepresented groups. By reducing gender disparities in vaccination rates, public health initiatives can improve overall vaccination coverage, thereby reducing the risk of measles and other serious viral diseases that spread easily among people, protecting the health and safety of the community.

Conflict of Interest

Not available.

Financial Support

Not available.

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How to Cite This Article
Al-Khafaji MSA, Al-Masoudi HK. Study on measles virus, causes, impact, diagnosis and effectiveness of vaccination in limiting spread of disease in Babylon, Iraq. Journal of Advances in Microbiology Research. 2026;7(1):27-31.