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A Review about Measles Cases in Children

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مقال حول حالات الحصبة في الاطفال

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ABSTREACT

Measles is a major public health problem and a serious airborne disease for humans, caused by an RNA virus that belongs to the family Paramyxoviridae; it can affect anyone but is most common in children.The most commonly clinical symptoms were fever, coryza, skin rash, cough, conjunctivitis, and while lymphadenopathy was the least reported.

Problem Statement despite the availability of an effective vaccine, low vaccination coverage remains a major barrier to measles elimination, measles vaccination has been influential in all parts of the globe to save almost 59 million deaths between 2000 and 2024. In 2024 alone, the reported number of deaths was almost 95,000, most of them being under five years old with no vaccination or less vaccination. In one study occur in 2026 in Anbar governorate, a total cases was 1663 in 2023-2024 with a male-to-female ratio of 1.2:1. Among of the cases, 259 (15.6%) were unvaccinated, 944 (56.8%) had received a single dose of the measles vaccine, and 460 (27.6%) had received two or more doses.

The aim of the study is to determine the prevalence of measles and its association with vaccination status among children.

Conclusion the measles outbreak is still a great threat to the world, causing larger cases of morbidity and even mortality.

Recommendation To prevent measles the Iraqi Republic, especially the Ministry of Health, should provide a standardized method to eliminate the outbreaks of measles including a rapid way of distribution of measles vaccines to all regions including distal and rural areas, to facilitates immunization of larger number of children.

Keywords: Measles, Vaccination, Treatment, Prevention

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INTRODUCTION

Measles is a viral disease that is highly contagious and results because of RNA virus which is under the family of Paramyxoviridae, which is the measles virus. The virus spreads easily by the air since it is mostly achieved through respiratory droplets as an infected person sneezes, coughs or even breathes out the virus. After penetration into the body, the virus first infects the respiratory tract and then spreads to other organs in the body. It is important to note that the virus can be passed on by infected people to others in or around about four days prior to the emergence of the typical rash, thus it is complex to contain the virus at an early stage. A measles case is very infectious and thus can lead to as many as 18 secondary infections [1].Measles incubation normally takes 10-14 days, but can take a range of 7-23 days after exposure the measles virus [2].The disease is typified by a myriad of clinical manifestations which include fever ($38.3C^0$), cough which is persistent, malaise, coryza (runny nose), conjunctivitis and generalized maculopapular rash. The rash typically occurs 7 to 18 days following exposure and it is characterized by the upper part of the neck and face before extending downwards to trunk, hands and feet in a span of three days or so. Measles may cause serious complications especially to children below five years of age and people with weak immunity. The most frequent complications are pneumonia, encephalitis, and diarrhea that can appear in up to 30% of sick people, and it depends on age, nutrition status and underlying health conditions [3].With vitamin A deficiency or immunocompromising conditions, e.g. HIV infection, of the malnourished children, the risk of severe disease and mortality is increasing significantly. Majority of deaths involving measles are as a result of complications and not the actual viral infection, which usually takes place two to three weeks after the rash. Moreover, the infection of measles during pregnancy is extremely dangerous, with the possibility of early birth and birthweight reduction in children increasing. The most effective and safe way of preventing the infection of measles and restricting its transmission in society is through vaccination. Measles vaccine also activates the immune system to develop protective immunity against the virus and this helps to reduce the incidence and spread of the disease [1].The following review seeks to discuss the transmission process of the measles virus as well as how it causes pathophysiological effects to the human body. It is also aimed at investigating clinical implications of measles, especially in children, its complications and the preventive measures, especially the importance of vaccination in controlling the disease and its associated burden [4].

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Definition

Measles is an infectious viral disease that is caused by a single stranded RNA virus known as the Paramyxoviridae. The disease has a broad spectrum of clinical manifestations, which is indicative of a systemic viral infection of different body systems [5].In clinic, measles manifests itself as a complex of prodromal symptoms and typical characteristics. Depending on the type of disease, the first stages are usually characterized by high temperature, up to 39-40 ^{o} C, general malaise, lack of appetite (anorexia), and exhaustion. Respiratory symptoms are also eminent such as; coryza (nasal discharge), rhinitis, persistent cough, pharyngitis and tracheitis. Moreover, conjunctivitis is a frequent observation and it usually leads to reddish watery eyes and photophobia [6]-[7].These initial symptoms represent the early replication of the virus in the respiratory system and its further distribution across the body making the disease systemic.

Vaccination and History

Measles vaccine is a live attenuated viral vaccine which is characterized by the ability to cause long term immunity against measles virus. The World Health Organization (WHO) suggests that two dosages are the best way to attain maximum protection against the disease. At the moment, measles elimination targets have been set in all six WHO regions where surveillance systems are vital in monitoring and attaining them[3].Before the introduction of measles vaccine in 1963 and the introduction of mass immunization campaigns, measles epidemics were common after every two to three years and caused the death of an estimated 2.6 million all over the world [1].

The outbreak of vaccination programs decreased the prevalence and death rates of measles impressively. As an example, Finland was the first European state to eradicate measles in 1993 after a two-dose campaign was introduced in 1982 and by 1991 the state had a vaccination coverage rate of around 96%. Measles vaccination was put on national immunization in France in 1983; that is, it was not initially a school entry requirement. With an increase of vaccination coverage, reported cases were reduced to Half, for 400,000 cases in 1987 to 44,000 cases in 1993, and thereafter to 10,000 cases in 2000. Even with this development, the latter coverage hit a plateau at approximately 80 percent, and local differences further propagated the virus. As a result, the combined measles-mumps-rubella (MMR) vaccine was developed in 1996, and the vaccination became compulsory in 2018 because of the re-emergence of outbreaks, partially caused by the misinformation about the vaccine safety [8].Immunization has been regarded as one of the greatest

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pillars of preventive medicine because it lowers the disease burden in addition to lowering the healthcare expenses and socioeconomic development [3]. In 1974, WHO embarked on the worldwide agenda of immunizations against measles and countries like Pakistan started immunizations against measles a few months later in 1978 with national immunization programs being launched in the effort to contain and ultimately eradicate measles and other vaccine preventable diseases [5].Measles vaccination has been influential in all parts of the globe saving almost 59 million deaths between 2000 and 2024. Nevertheless, even with a safe and affordable vaccine, measles is still a major health issue facing the population. In 2024 alone, the reported number of lives was almost 95,000, most of them being under five years old with no vaccination or less vaccination. The world coverage of the first dose of measles vaccination was 84 percent in 2024, slightly lower than the 86 percent in 2019 [1]. In one study that occurred in 2026 in Anbar governorate, a total cases were 1663 in 2023-2024 with a male-to-female ratio of 1.2:1. Among of the cases, 460 (27.6%) had received two or more doses, 944 (56.8%) had received single dose of the measles vaccine ,and 259 (15.6%) were unvaccinated[6].

Vaccine coverage of over 93-95 percent is also required to achieve herd immunity and break the cycle of transmission to eliminate measles [9].Vaccination of all the vulnerable people and childhood immunization are hence highly advised [10].The existing measles vaccines have live attenuated strains, which can replicate in the host body, causing the humoral and cellular immune response [11]-[12].One dose of measles vaccine given at or above the age of 12 years gives about 93-95 percent protection and two doses offer almost full protection up to about 90 percent efficacy [9]-[10].Nevertheless, the vaccine reduces its efficacy to about 85 percent when it is administered at the age of 9 months because it reacts with maternal antibodies [12].Pneumonia and measles vaccines are in monovalent preparations or more often, in combination vaccines like measles-mumps-rubella (MMR) or measles-mumps-rubella-varicella (MMRV)[13].

Epidemiological research also stresses the significance of vaccination. Meta-analysis proved that vaccination prevents the risk of measles infection in about 70 percent. Vaccination Studies in Sindh among the regions showed that 59.1 percent of the confirmed cases happened in those who had not been vaccinated, 29.6 percent in those who had one dose, and only 10.3 percent in those who were fully vaccinated [14].The same results were also recorded in Karachi, Faisalabad and Jhang where most of the cases were among the unvaccinated populations (1517). The greatest risk factor

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of measles outbreaks has been reported to be low vaccination coverage among children aged 12 years and below (9,10) [15] -[16]. All these observations are worldwide. Multi-country studies have demonstrated that measles immunization is linked to a decrease in other infections which is a 15-30 percent decrease in acute respiratory infections and 12- 22 percent decrease in diarrheal diseases in such countries as India and Pakistan [18]. In the rural Senegal, vaccine efficacy went as high as 90% [12] and in Somalia, only 9.7 per cent of hospitalized measles infected children had one dose of the vaccine, which is the impact of poor coverage [18]. In one study in 2011 in Kirkuk city findings revealed that (49.3%) of measles cases were more than fifteenth years of age, (57.9%) of them were male and (42.1%) of cases were female,. and according to vaccination status, (47.4%) of measles cases were vaccinated[8].

In 2012, the World Health Assembly passed the Global Vaccine Action Plan, to have measles eradicated in five out of the six WHO regions by the year 2020 [19].The percentage of children in the world who had their first dose of the measles-containing vaccine (MCV1) rose by 72 to 84 percent between 2000 and 2010 with a high of 86 percent in 2019. Nevertheless, in one study from Nasiriyah government the coverage reduced to 84% in 2020 because of the interference of the COVID-19 pandemic [20]-[21].The estimated number the measles cases in the world in 2023, as calculated by WHO, is 10.3 million ,this is a twenty percent higher number than that of 2022 [22]. As a consequence, the reported cases of measles have increased in number, reaching 11595 on March 12, 2024 and Iraq is considered the 5th country among the top 10 countries in the world, as indicated in Table 1 [23].

Table 1. Top ten countries with measles outbreaks in the world.

Rank	Country	Cases Number
1	Kazakhstan	21740
2	Azerbaijan	13720
3	Yemen	13676
4	India	13220
5	Iraq	11595
6	Ethiopia	9042
7	Kyrgyzstan	7601
8	Russian Federation	7594
9	Pakistan	5812
10	Indonesia	5648

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Clinical and laboratory diagnosis

Measles diagnosis is mostly done based on the characteristic signs and symptoms. The appearance of Koplik's spots, or small white spots on the buccal mucosa, is viewed as a pathognomonic feature and a strong indication in favor of the diagnosis. Moreover, the common sequence followed by rash, beginning with the face and head and then extending to the trunk followed by the extremities, is another clinical indication of measles infection [24].Nevertheless, it is important to be laboratory proven, especially in those areas where elimination of measles is the target or in the time of an outbreak in order to make a correct diagnosis and surveillance. In order to diagnose measles, several laboratory procedures are performed:

Observation of measles specific IgM antibodies.

The presence of measles-specific IgM serum-based antibodies, with an approved or certified laboratory procedure, is regarded as a standard diagnostic technique. They should be interpreted with caution though when a patient has a recent measles-containing vaccination within 8 days to 6 weeks before samples are taken, particularly without any known measurements of measles transmission or travel history of the patient, as these can give false-positive results[12].

Seroconversion or a large increase in antibody titer.

Seroconversion or a fourfold or greater rise in serum measles-specific IgG antibody titers is also diagnostic. This involves combination serum tests, the second (convalescent) test being taken at least 10 days after the first (acute) test was taken. As with IgM testing, recent vaccination should be taken into consideration in result interpretation[22].

Identification of the measles virus genome.

PCR and other molecular methods can be used to identify the genome of wild-type measles virus in suitable clinical samples. This method is not commonly used in diagnosis although it can be useful for epidemiological and research purposes because it has low sensitivity compared with serological assays[25].

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Virus Isolation

Infection can also be confirmed by isolation of wild-type measles virus in clinical samples. This technique is however not commonly done in a standard diagnostics practice due to its technicality and is a less sensitive method compared to serological techniques[26].

Elimination setting classification of cases.

The end classification of measles cases in a nation working towards the eradication of measles or managing an outbreak is generally achieved by utilizing standardized epidemiological algorithms that take both clinical, laboratory, and exposure data into account to guarantee correct confirmation and reporting of cases [25].

Treatment

No antiviral treatment of measles exists, and, as a result, treatment is mainly based on supportive treatment, working to relieve the symptoms, bring more comfort to patients, and avoid possible complications. Hydration is a vital need and the patients are advised to take adequate fluids to replace the losses through fever, diarrhea or vomiting. When it comes to dehydration, proper fluid replacement therapy must be used. It is also important to maintain a balanced and nutritious diet that would help to support immune functioning, as well as facilitate recovery [26].Further, it may require a medical intervention due to secondary bacterial infections as they are common complications of measles. Antibiotics can also be prescribed by physicians to treat other related illnesses including pneumonia, otitis media (ear infections), and eye infections as would be indicated by the physician.

Vitamin A supplementation is an important part of the treatment of measles. It is suggested that every child and adult with measles be treated with 2 doses of vitamin A with a time gap of 24 hours. The given intervention is especially valuable, as commonly the measles infection results in the deficiency of vitamin A, even in people who have sufficient nutritional conditions. The supplementation with vitamin A was proved to diminish the severity of the disease, prevent such complications as eye damage and blindness, as well as measles-related mortality rates significantly [26].

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Altogether, supportive care, with the help of proper nutritional and medical treatments, is an important factor to enhance the outcomes and minimize the complications that can be caused by measles infection [13].

Prevention of measles

The best measure of preventing measles is community-wide vaccination. Measles is a disease which should be vaccinated in all children. The vaccine is safe, effective and cheap. To immunize children, the vaccine must be administered twice, at least [27].In countries with high measles incidence, the initial dose is administered at the age of 9 months, whereas in other countries, it is administered at the age of 1215 months. Later in childhood a second dose is administered, typically at 1518 months. Measles can be administered as a single vaccine or sometimes together with mumps, rubella and/or varicella. Mass immunization and constant measures to vaccinate against measles in the countries where number of cases is high are essential in reducing the number of deaths caused by measles in the world [21]. Measles vaccine is nearly 60 years old and costs less than US$ 1 per child. The measles vaccine is also administered in times of emergency to prevent the spread of outbreaks. Refugees represent the population at high risk of being affected by measles and must be vaccinated as promptly as possible. Adding the small expense of vaccines will enable you to share costs of delivery and administration and, most importantly, have a bonus protection against the most prevalent vaccine preventable infection, rubella, which can infect babies in the womb. In 2024, the latest estimates made by WHO and UNICEF estimate that around 30 million infants under 18 months of age were still not covered by measles immunization [1].Routine immunization against measles is advised in developed countries such as the US and Canada, with the first and second vaccines received at the ages of 12 and 4 to 6 months, respectively [1].The vaccine containing measles is not recommended prior to the age of 12 months due to the less preferred immune response during that age [22,30]. The World Health Organization suggests that the initial and second doses of a measles-containing vaccine be administered at 9 months and 15 to 18 months of age, respectively[27]-[28].in the countries with high rates of measles infection [29].Measles-containing vaccine should be given to those at increased risk of catching measles (including children aged 6-11 months) who have received one dose of a measles-containing vaccine before the age of 12 months: two additional doses should be administered.

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DISCUSSION

Serological evidence has shown that the immunity against measles and rubella in children is very varied even before the development of vaccination campaigns. It was noted that before vaccinations during supplementary immunization activities (SIA), 86 percent and 90 percent of children were seropositive to measles and rubella, respectively. Although the baseline immunity levels were relatively high, there was a considerable amount of difference depending on the previous vaccination status. A high vulnerability was witnessed in children who did not receive any dose of measles-rubella (MR) vaccine because only 36% of children who were not vaccinated were seropositive. On the other hand, approximately 9 percent of the sample population of children who had been administered two regular doses of MR were seronegative implying that primary or secondary vaccine failure had taken place. These results highlight the fact that full vaccination coverage, vaccination effectiveness, and adequate immunization procedures are the key factors needed to attain effective population immunity [31].

Demographically, younger children, especially those below the age of five years are the largest number of the affected cases with older children taking a smaller percentage. This trend indicates the greater susceptibility of younger age groups under the condition of the lack of vaccination or underdeveloped immune conditions. Vaccination coverage is still poor in most of the world [6]. The estimated coverage of children older than one year per 2024 is 76 percent of those who have received both doses of the measles vaccine, and 84 percent of those who have received at least one dose [32].These numbers are indeed huge, but they still do not reach the mark that must be covered to obtain herd immunity which is believed to exist at 93-95 per cent. The measles vaccine is highly advised in two doses to provide long-term immunity and prevent the outbreak of the disease because a one-dose vaccine injection is not always effective in stimulating immune responses in people [33]. Measles remains a major health issue even though there is a safe and cost-effective vaccine that can help prevent this disease. Globally, in 2024, an estimated 95,000 deaths were reported because of measles, most of them being in children under the age of five years. Nevertheless, the immunization programs have demonstrated an immense effect with the estimated number of 59 million deaths prevented due to the action of global vaccination through WHO, Measles and Rubella Partnership, and other international organizations between 2000 and 2024 [1]- [34].

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However, the effectiveness of the vaccines may be affected by a number of factors. Primary vaccine failure can be acquired because of poor immune response after vaccination, whereas secondary vaccine failure can be achieved by the time-dependent waning of immunity. Also, a poor storage and handling of vaccines, especially failure in the cold chain system, may decrease the vaccine potency, and affect its efficacy [35].This notwithstanding, the number of deaths caused by measles has decreased dramatically around the world with 780,000 deaths recorded in 2000 and 95,000 in 2024 [1]- [2].

Notably, the measles vaccine is known to last long because two doses are deemed to be effective at sustaining the antibody level at or above protective levels even though the levels may decrease over time [36].The protective effect of vaccination is further supported by evidence of epidemiological studies. An example that can be offered is a study carried out in California where cases of measles were reported to be linked with secondary vaccine failure, but those who had been vaccinated with two or more doses of the vaccine had their diseases manifested mildly. Such patients were less hospitalized and their symptoms were less severe in terms of cough, conjunctivitis, coryza, and fever as compared to unvaccinated people [37].

All in all, these results emphasize the necessity have a high level of vaccination, adequate vaccine administration and storage, and effective immunization measures. To curb the burden of diseases, prevent outbreaks and end global measles elimination targets, there is need to strengthen these measures.

CONCLUSION

Measles is a major public health problem and serious airborne disease for humans, it can affect anyone but is most common in children . Low vaccination coverage remains a major barrier to measles elimination. This study determine the prevalence of measles and its association with vaccination status

RECOMMENDATIONS

National immunization programs should be strengthened, and the MMR vaccine must be included and maintained within the routine childhood vaccination schedule and healthcare workers , teachers at schools and nurseries should have regular workshops or educational programs regarding measles and communicable diseases among children’s should receive adequate training in the early recognition and diagnosis of suspected measles cases. Laboratory confirmation should be encouraged to ensure accurate diagnosis and timely reporting to public health authorities. Strict isolation measures should be applied for infected children during the infectious period, particularly in schools and daycare centers.

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Conflict of interests.

There are non-conflicts of interest.

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الخلاصة

الحصبة مشكلة صحية عامة رئيسية ومرض خطير ينتقل عبر الهواء، ويسببه فيروس RNA ينتمي إلى عائلة الفيروسات المخاطية، ويمكن أن يصيب أي شخص ولكنه أكثر شيوعًا بين الأطفال. أكثر الأعراض السريرية شيوعًا هي الحمى، والزكام، والطفح الجلدي، والسعال، والتهاب الملتحمة، بينما كان تضخم الغدد الليمفاوية أقل الأعراض شيوعًا. على الرغم من توفر لقاح فعال، لا تزال نسبة التغطية المنخفضة بالتطعيم عائقًا رئيسيًا أمام القضاء على الحصبة. كان لتطعيم الحصبة أثر بالغ في جميع أنحاء العالم، حيث ساهم في إنقاذ ما يقرب من 59 مليون شخص بين عامي 2000 و2024. في عام 2024 وحده، بلغ عدد الوفيات المبلغ عنها حوالي 95,000 حالة، معظمهم من الأطفال دون سن الخامسة الذين لم يتلقوا التطعيم أو تلقوا جرعات غير كافية. في دراسة أجريت عام 2026 في محافظة الأنبار، بلغ إجمالي الحالات 1663 حالة في الفترة 2023–2024، بنسبة ذكور إلى إناث 1.2:1. من بين الحالات، كان 259 حالة (15.6%) غير مُلقّحة، و944 حالة (56.8%) قد تلقت جرعة واحدة من لقاح الحصبة، و460 حالة (27.6%) قد تلقت جرعتين أو أكثر. هدفت الدراسة إلى تحديد مدى انتشار الحصبة وعلاقته بحالة التطعيم بين الأطفال. خلصت الدراسة إلى أن تفشي الحصبة لا يزال يشكل تهديدًا كبيرًا للعالم، متسببًا في ارتفاع معدلات الإصابة والوفيات. توصي الدراسة بضرورة أن توفر الجمهورية العراقية، وخاصة وزارة الصحة، آلية موحدة للقضاء على تفشي الحصبة، بما في ذلك طريقة سريعة لتوزيع لقاحات الحصبة على جميع المناطق، بما فيها المناطق النائية والريفية، لتسهيل تحصين أكبر عدد ممكن من الأطفال، وذلك للوقاية من الحصبة.