ORIGINAL ARTICLE

An Epidemiological Study of Measles Trend from 2019-2023 in Iraq

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Abstract

Background: As a highly contagious systemic viral infection, measles has a significant fatality rate, mostly from subsequent infections. This study assesses patient-specific demographic and environmental profiles while calculating mortality rates over a five-year follow-up period.

Methods: This is a retrospective, descriptive study analyzing epidemiological data on measles from January 1, 2019, to December 31, 2023. T The duration of data collection continued for the period from 2024/October/17th to 2025/February/28th. The data of the whole Iraq was collected from Iraqi Ministry of Health\Department of Public Health\Communicable Disease Control Center, from the section of epidemiological surveillance.

Results: This study included 3,873 laboratory-confirmed measles cases out of over 20,000 suspected cases. Their mean age was 6.4 ± 8.4 years (ranging from 2 days to 79 years). The most affected age group was 1–4 years old (42. 5%). Males affected 52.34% of the cases, while females accounted for 47.66%. 77.35% of the patients were unvaccinated, 10.02% were vaccinated, and 12.63% had unknown vaccination status. The incidence rate in 2023 reached 32.3 per 100,000 populations, the highest during the study period. The highest number of cases was reported in Baghdad–Karkh (15. 32%).

Conclusion: Measles incidence peaked in 2023, while the lowest rates were observed in 2021. Geographically, Baghdad reported the highest prevalence, whereas Sulaymaniyah recorded the lowest. Regarding diagnostic methods, more than 50% of cases were diagnosed clinically, while Epilink-based diagnosis was the least frequent. Ultimately, misinformation and vaccine hesitancy remain significant obstacles to measles eradication. This suggests a major outbreak in 2023, possibly due to declining vaccination rates or inadequate public health responses.

Please cite this article as: Mousa AA, AL-Sarray AA, Chiad IA, Radhy AH. An Epidemiological Study of Measles Trend from 2019-2023 in Iraq. J Health Sci Surveillance Sys. 2026;14(3):246-252. doi: 10.30476/jhsss.2025.107723.2085.

Keywords: Measles Trend, Epidemiological Incidence, Infections, Iraq

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Received: 22 April 2026
Revised: 23 May 2026
Accepted: 28 June 2026

Introduction

Measles, a highly contagious systemic viral infection, has a significant fatality rate, mostly from subsequent infections.[1,2] Measles is still a serious problem in countries with low vaccination rates and weak healthcare systems, even though it has been mainly contained in areas with robust immunization programs.[3] Measles has historically been a major cause of morbidity and mortality, especially for children in low- and middle-income nations. However, measles outbreaks have returned in recent years, particularly in areas where vaccination rates are dropping.[4] Measles is still a serious public health concern in Iraq, where recurrent outbreaks are worsened

by inconsistent vaccination rates and difficulties with the country's healthcare system. Clinically, measles develops in a prodromal phase including fever, cough, conjunctivitis, and coryza before culminating in a characteristic rash. Pneumonia, encephalitis, diarrhea, and otitis media are among the complications that can arise, especially in undernourished youngsters and those with compromised immune systems.[5] The mainstay of measles protection is measles vaccination, which is usually given as a component of the measles-mumps-rubella (MMR) vaccine series. The danger of measles transmission is increased in overcrowded areas like war zones and refugee camps.[6] Before development of a characteristic rash, measles clinically develops through a prodromal phase marked by fever, cough, coryza, and conjunctivitis. The World Health Organization (WHO) advises nations to get a minimum of 95% vaccination coverage to eradicate measles. Different doses of the vaccine should be administered equally in the hopes of creating herd immunity and halting the spread of the virus.[7] The live-attenuated vaccine, created in the 1960s, can prevent infection with the extremely contagious Measles Virus (MeV). In 2022; there were over 136,000 measles-related fatalities worldwide, mostly in children under five who were either unvaccinated or just partially vaccinated. Furthermore, the measles vaccination coverage rate in 2008 was the lowest since 2022, with only roughly 83% of children globally receiving a single shot by their first birthday through routine health services.[8] Due to sociopolitical unrest and continuous hostilities that have interfered with regular immunization programs and healthcare services, vaccination coverage in Iraq has been uneven. To reduce measles and lower the nation's disease burden, these issues must be resolved.[9]

Research Gap

Despite the significant resurgence of measles in Iraq, particularly in 2023, there is a lack of comprehensive studies focusing on the demographic and environmental factors influencing the outbreak. Previous research has primarily addressed vaccination coverage and its impact on measles incidence; however, there is limited insight into the specific characteristics of affected populations and the geographical distribution of cases. Furthermore, the interplay between socio-political factors and public health responses in mitigating measles outbreaks remains underexplored. This gap highlights the need for a thorough investigation into the underlying causes and trends of measles in Iraq over the recent years.

Methods

This is an epidemiological retrospective descriptive cross-sectional study carried out in Iraq; we included information on Measles from 2019/January/1st to 2023/December/31st. Data collection continued from 2024/October/17th to 2025/February /28th. The data for the whole Iraq were collected from Iraqi Ministry of Health\Department of Public Health\Communicable Disease Control Center, from section of epidemiological surveillance located in Baghdad Governorate and obtains information from health departments in the Iraqi governorates, with 3873 confirmed Measles patients.

Objective of the Study

The primary aim of this study was to identify the demographic and environmental factors associated with measles cases in Iraq from 2019 to 2023. Additionally, the research seeks to estimate the mortality rate and incidence trends over the specified period, with a focus on understanding the implications of vaccination rates and public health responses on the outbreak.

Statistical Analysis

The collected data were coded, entered, presented, and analyzed through computer using the available database software program statistical package of IBM SPSS-29 (IBM Statistical Packages for Social Sciences-version 29, Chicago, IL, USA). Simple metrics such as frequency, percentage, mean, standard deviation, and range (minimum-maximum values) were used to display the data. The Pearson Chi-square test with Yate's adjustment or Fisher Exact test, if appropriate, was used to assess the significance of differences in various percentages (qualitative data). When the P value was equal to or less than 0.05, statistical significance was taken into consideration.[10, 11]

Sample Size

All eligible patients filled out the consent form and completed the research tool in a written format. The sample size was calculated using the following formula:

$$n = \frac{Z^2_{1-\alpha/2}\sigma^2}{d^2}$$

Where n is the sample size, α is the first type, Z is the table-based normal distribution index that is considered at 5% type-one error (P<0.05), σ represents the small variable variance, and d shows the accuracy of quantitative variable estimation.

Results

The study included 3,873 laboratory-confirmed measles cases out of over 20,000 suspected cases. Their mean age was 6.4 ± 8.4 years (ranging from 2 days to 79 years). The most affected age group was 1–4 years (42. 5%). Males represented 52.34% of the cases, while females accounted for 47.66%. 77.35% of the patients were unvaccinated, 10.02% were vaccinated, and 12.63% had unknown vaccination status, as illustrate in Table 1.

Table 1: Distribution of demographic characteristics among tinea patients

		No.	%
Age (years)	<1month	42	0.21
	1m-5months	778	3.84
	6m-11months	2317	11.45
	1---4years	8607	42.54
	5---9	4703	23.24
	10---14	1650	8.15
	15---19	492	2.43
	20---24	366	1.81
	25---29	474	2.34
	30---34	401	1.98
	35---39	223	1.10
	40---44	85	0.42
	45---49	46	0.23
	50---54	24	0.12
	55---59	11	0.05
	=>60years	16	0.08
	Mean±SD (Range)	**6.4±8.4 (2days-79years)**	
Gender	Male	10591	52.34
	Female	9644	47.66
Occupation	Infant	3137	15.50
	Child	10087	49.85
	Pupil	5112	25.26
	Employed	130	0.64
	Doctor/ HCW	42	0.21
	Worker	289	1.43
	Retired	25	0.12
	Others	895	4.42
	Housewife	518	2.56
Vaccination Status	Vaccinated	2027	10.02
	Not	15652	77.35
	Unknown	2556	12.63

No: Number, %: Percentage, Arithmetic Mean and Std. Dev. (S.D.)

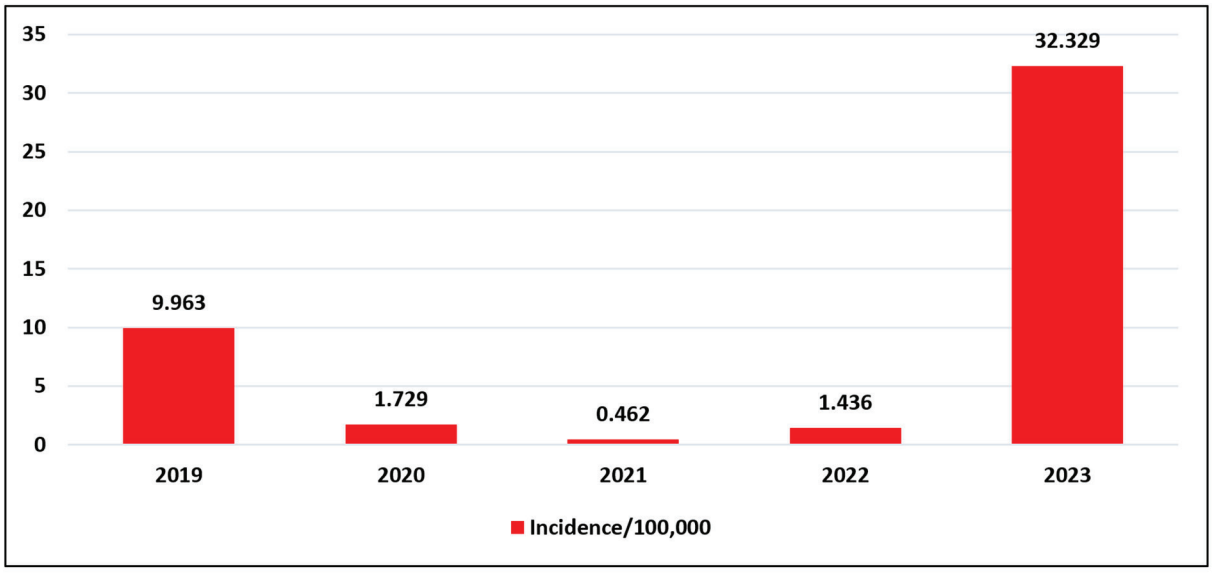

Figure 1: The distribution of the cases by year and incidence rate

Figure 1 shows the distribution of the cases by year and incidence rate. Iraq witnessed a significant surge in measles cases in 2023, with 14,571 cases, representing 72.01% of the total 20,235 cases. In contrast, only 199 cases were recorded in 2021 (0.98%). The incidence rate in 2023 reached 32.3 per 100,000 populations, the highest during the study period.

As shown in Table 2, the highest number of cases was reported in Baghdad–Karkh (15.32%). The lowest was in Erbil (0.36%), Nineveh (10.83%), and Anbar (10.24%).

As shown in Table 3 displays the assocition between the distribution of the cases in different provinces in the years of the study, showing a significant assocation between them (p-value 0.0001).

Table 4 shows the assocition between demoghrapgic characteristics, revealing the cases with significant assocition(p-value =0.0001).

Discussion

According to the present study, the age group of 1-4 years old accounted for 42.54% of all instances, followed by the group of 5-9 years old (23.24%). With a range of 2 days to 79 years, the mean age was 6.4±8.4 years. The age range of 1 to 4 years old accounted for the hieghest percentage of cases (42.5%) in previous research

Table 2: The geoghraphic disturbution of Measles cases

		No.	%
Province	Erbil	72	0.36
	Sulaymaniya	123	0.61
	Missan	147	0.73
	Duhuk	183	0.90
	Kirkuk	532	2.63
	Wasit	541	2.67
	Thi-Qar	571	2.82
	Basrah	636	3.14
	Kerbala	728	3.60
	Diwaniya	754	3.73
	Najaf	881	4.35
	Salah Eldin	970	4.79
	Diyala	1493	7.38
	Muthana	1664	8.22
	Babylon	1771	8.75
	Baghdad-Risafa	1804	8.92
	Anbar	2072	10.24
	Nineveha	2192	10.83
	Baghdad-Karkh	3101	15.32

No: Number, %: Percentage

Table 3: Assocation by years

		2019 (n=4104)		2020 (n=728)		2021 (n=199)		2022 (n=633)		2023 (n=14571)		P value
		No.	%	No.	%	No.	%	No.	%	No.	%	
Province	Anbar	32	0.78	7	0.96	2	1.01	13	2.05	2018	13.85	0.0001*
	Babylon	410	9.99	42	5.77	20	10.05	28	4.42	1271	8.72	
	Baghdad-Karkh	164	4.00	30	4.12	9	4.52	82	12.95	2816	19.33	
	Baghdad-Risafa	479	11.67	29	3.98	22	11.06	52	8.21	1222	8.39	
	Basrah	129	3.14	16	2.20	24	12.06	157	24.80	310	2.13	
	Duhuk	44	1.07	6	0.82	11	5.53	15	2.37	107	0.73	
	Diwaniya	549	13.38	22	3.02	5	2.51	19	3.00	159	1.09	
	Diyala	82	2.00	1	0.14	5	2.51	7	1.11	1398	9.59	
	Erbil	12	0.29	-	-	5	2.51	2	0.32	53	0.36	
	Kerbala	165	4.02	127	17.45	8	4.02	24	3.79	404	2.77	
	Kirkuk	50	1.22	3	0.41	11	5.53	33	5.21	435	2.99	
	Missan	15	0.37	4	0.55	5	2.51	11	1.74	112	0.77	
	Muthana	1034	25.19	278	38.19	5	2.51	4	0.63	343	2.35	
	Najaf	505	12.31	127	17.45	18	9.05	48	7.58	183	1.26	
	Nineveha	48	1.17	14	1.92	42	21.11	81	12.80	2007	13.77	
	Salah Eldin	123	3.00	2	0.27	1	0.50	11	1.74	833	5.72	
	Sulaymaniya	23	0.56	2	0.27	2	1.01	5	0.79	91	0.62	
	Thi-Qar	125	3.05	17	2.34	-	-	3	0.47	426	2.92	
	Wasit	115	2.80	1	0.14	4	2.01	38	6.00	383	2.63	

*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.

Table 4: The association between demoghrapgic characteristics and measles cases

		Confirmed Measles (n=3873)		Non-Confirmed Measles (n=16036)		Others (n=326)		P value
		No.	%	No.	%	No.	%	
Age (years)	<1month	8	0.21	17	0.11	17	5.21	0.0001*
	1m-5months	174	4.49	521	3.25	83	25.46	
	6m-11months	544	14.05	1736	10.83	37	11.35	
	1---4years	1455	37.57	7026	43.81	126	38.65	
	5---9	617	15.93	4045	25.22	41	12.58	
	10---14	295	7.62	1343	8.37	12	3.68	
	15---19	145	3.74	345	2.15	2	0.61	
	=>20years	635	16.4	1003	6.3	8	2.5	
	Mean ±SD	8.1±10.1		6.0±7.9		3.0±5.4		0.0001^
Gender	Male	1995	51.51	8437	52.61	159	48.77	0.201
	Female	1878	48.49	7599	47.39	167	51.23	
Occupation	Infant	726	18.75	2274	14.18	137	42.02	0.0001*
	Child	1661	42.89	8286	51.67	140	42.94	
	Pupil	746	19.26	4325	26.97	41	12.58	
	Employed	41	1.06	89	0.56	-	-	
	Doctor/ HCW	4	0.10	38	0.24	-	-	
	Worker	247	6.38	42	0.26	-	-	
	Retired	2	0.05	23	0.14	-	-	
	Others	30	0.77	859	5.36	6	1.84	
	Housewife	416	10.74	100	0.62	2	0.61	

*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level. ^Significant difference among more than two independent means using ANOVA-test at 0.05 level.

conducted in republic of Congo with a mean age of 36 months (about 3 years), ranging from 1 to 193 months.[12] According to a study in Yemen, 49.5% of cases were in children under five, while another found that 69.34% of cases were in the 0–4 age group.[13] There was no statistically significant difference between the genders of the cases in our study; 52.34% of the cases were male and 47.66% were female. This is consistent with the conclusions of other research in republic of Congo in which women made up 48.6% and men 50.6% of cases; another study in Yemen found that the incidence rate was higher for males (19.8 per 10,000) than for females (17.75 per 10,000), with 54.72% of the population being male and 45.28% being female.[14] This disparity can be a result of exposure-influencing sociocultural factors. HCWs made up a relatively small percentage (0.21 %), while children (49.85%) and students (25.26%) were the most impacted categories. Another study in South Korea on healthcare workers found that 92% of them had measles, with the rate differing by employment (e.g., doctors, nurses).[15] There were notable differences between governorates, with the most affected provinces being Baghdad-Karkh (15.32%), Nineveh (10.83%), and Anbar (10.24%), according to the present study carried out in Iraq. Less than 1% of instances were reported in Duhok and Erbil. On the other hand, an Oman investigation found that the Dhofar and Sharqiyah governorates had the widest epidemic, with 90 cases associated with a single outbreak. South Sharqiyah had the second-largest outbreak, with 36 cases. A wider distribution of cases across multiple provinces, indicative of a widespread geographic diffusion, was a defining feature of the Iraqi study. However, with fewer confirmed cases overall (191 cases), the Omani investigation showed that cases clustered among particular outbreak sites.[16] In contrast to Iraq, where more than 3,000 cases were reported in Baghdad-Karkh alone, due to the decline in vaccine availability, distance from health centers, or maternal awareness. Significant discrepancies between provinces were confirmed by statistical analysis in the Iraqi study, showing actual disparities that call for specialized health interventions. The Omani study, on the other hand, concentrated on outbreak classification and the genetic sources of the viruses rather than reporting statistical tests for regional differences. According to another study, in Yemen the measles incidence rate was highest in the Abyan governorate (89.06 per 10,000), followed by Aden (80.21 per 10,000), and lowest in Al Jawf (0.17 per 10,000). The study was conducted in Afghanistan. Prior to the outbreak (2019–2021), the most impacted regions were the southern (26.2%), southeastern (18.7%), and northern parts (16.1%). With statistically significant variations, the geographic burden of the outbreak (2021–2023) moved to the central-eastern (19.9%), northeastern (16.5%), and eastern (16.0%) regions. The survey conducted from 2019 to 2023 found that measles incidence rates in Iraq differed significantly. The rates were comparatively low from 2020 to 2022, but they peaked in 2023 with 14,571 instances reported, or 72.01% of all cases throughout the research period. A major outbreak was indicated by the peak incidence rate of 32.3 per 100,000, which was probably caused by declining vaccination rates or a lack of effective public health interventions. This suggests a major outbreak in 2023, possibly due to declining vaccination rates or inadequate public health responses.

Ethiopian research, on the other hand, showed comparable variations over a longer time frame (2005–2023). After a notable increase in incidence in 2015, which reached 173.2 cases per million people, the incidence began to drop until 2020. However, there was another spike in 2022, indicating that illness management efforts have not always been successful and that the incidence has not continuously decreased.[14] Another study conducted in Iran between 2014 and 2019 displayed erratic trends with ups and downs. 2018 saw the greatest number of confirmed cases, and 2019 saw a precipitous decline to zero instances effective vaccination efforts or enhanced epidemiological surveillance at that time may have contributed to the study's 2019 case decline to zero.[17] The measles incidence peaked in 2023 (9.5 per 10,000 people) and 2022 (4.17 per 10,000), according to a similar study conducted in Yemen. Nonetheless, the rates were far lower than those in Iraq, which might be due to variations in immunization policies or epidemiological circumstances in the two areas.[18]

Conclusion

Higher incidence rate of Measles (32.329) was seen in the year 2023, while the lowest rate was 0.436 in 2021; the higher prevalance rate was observed in Baghdad and the lowest prevalance rate in Sulaymania (0.61%); also, more than 50% of cases had been diagnosed clinically, while 17.4% had Epilink diagnosis. Misinformation and vaccine hesitancy continue to be significant obstacles to the disease's eradication.

The strenghth of the study

The recovery rate was high (about 99%) and mortality rate was 0.06%, which is considered a positive result.

The weakness of the study

About three quarter of the cases were unvaccinated ,12.63% were unkowon vaccinated state, and 68.8% of the sample were from cases who were pending .

Recommendation

Public health continues to be threatened by the resurgence of measles. In order to overcome this obstacle, international collaboration is needed to improve immunization practices, particularly the administration of a third dose of the vaccine to high-risk groups, bridge immunity gaps, and rebuild public confidence in vaccination. Reaching and sustaining vaccination coverage above (95%) is essential to eradicating measles.

Recommendations for future reserch

Enhance the method of the diagnosis and increase the awearnes abuot the disease to avoid future outbreak and facilate the coverage of the vaccination .

Ethical Approval

Ethical approval was obtained from the Middle Technical University and Iraqi Ministry of Health\-Department of Public Health\Communicable Disease Control Center from section of epidemiological surveillance that locates in Baghdad Governorate. The code is 6332 in 25/11/2024.

1. Informed Consent: Participants were fully informed about the research purpose, procedures, risks, and benefits, and they must voluntarily agree to participate.

2. Data Privacy and Confidentiality: Researchers ed the privacy of participants and ensured that personal data was handled securely.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Acknowledgement

I would like to express my sincere thanks to all health providers across Baghdad Governorate who participated in this research and generously gave some of their valuable time.

Artificial Intelligence

We did not usethe Artificial Intelligence.

Conflict of Interest

The author declares no conflict of interest in this study.

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