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Emerging Problems in Infectious Diseases

Epidemiological evaluation of measles cases seen in 2019-2023: an example from Türkiye

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Abstract

Introduction: Measles is highly contagious and transmitted via droplets, leading to complications such as encephalitis, pneumonia, diarrhea, and death. Although global vaccination efforts have reduced cases, gaps in vaccination coverage and vaccine hesitancy continue to cause outbreaks. This study aims to evaluate measles cases reported in Kayseri, Türkiye, from 2019 to 2023.

Methodology: The study analysed measles cases reported to the Kayseri Provincial Health Directorate's İZCİ system from 1 January 2019 to 31 December 2023. Demographic characteristics, vaccination status, symptoms, complications, and case classifications were recorded. Annual incidence rates were calculated using data from the Turkish Statistical Institute.

Results: A total of 137 measles cases were reported, of which 126 were included in the analysis. Among confirmed cases, 48.2% were children aged 0–4 years. The most common symptoms were rash (89.7%) and fever (81.0%). Among confirmed cases, 17.9% developed complications, including pneumonia (12.5%) and diarrhea (1.8%). The incidence of measles peaked in 2019 and 2023.

Conclusions: The resurgence of measles is driven by factors such as inadequate vaccination coverage, with 35.7% of the population remaining unvaccinated. Strengthening immunization programs and primary healthcare services is essential for the elimination of measles.

Key words: Incidence; measles; vaccination; epidemiology.

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Introduction

Measles, one of the most contagious diseases in the world, spreads easily through respiratory droplets, leading to severe illness and complications such as encephalitis, pneumonia, diarrhea, dehydration, and even death. While high fever and widespread rash are the primary symptoms, other symptoms such as cough and runny nose may also accompany the disease [1]. Measles is classified as a Group A notifiable disease, requiring notification by physicians working in all healthcare institutions across the country [2].

The most effective and safest way to prevent measles is through vaccination [1]. An individual infected with measles can transmit the virus to nine out of ten unvaccinated close contacts [1]. Before the discovery of the measles vaccine in 1963 and widespread vaccination, large outbreaks occurring every two to three years caused approximately 2.6 million deaths annually. As a result, measles was one of the first diseases targeted in the World Health Organization's (WHO) Expanded Program on Immunization, established in 1974 [3]. Although widespread vaccination policies against measles have reduced global measles case numbers, outbreaks and deaths continue to occur, particularly in countries with gaps in immunisation coverage [3]. The high contagiousness of the measles virus requires a very high herd immunity threshold, with at least 95% immunity in the population to prevent outbreaks. Gaps in vaccination schedules or vaccine hesitancy can lead to declining vaccination coverage, which may increase case numbers, outbreaks, and deaths [3]. On the other hand, measles is a potentially eradicable disease since the measles virus has a single reservoir, only one serotype, and genetic stability [4].

To reduce the global measles disease burden, the World Health Assembly in 1989 and the World Summit for Children in 1990 set targets to reduce measles mortality by 95% and morbidity by 90%. As part of these goals, the World Health Organization (WHO) aimed for measles elimination in the Americas by 2000 and in the European and Eastern Mediterranean regions by 2010 [5]. The WHO reported that an estimated 15.6 million deaths were prevented by vaccination between 2000 and 2013. The Centers for Disease Control and Prevention (CDC) declared measles eliminated in the Americas in 2000. However, since then, there has been a rise in the number of cases and outbreaks in the

Americas, Europe, and other countries. WHO data show an increase in measles cases in regions outside the Americas and Europe, particularly in Africa between 2018 and 2020. According to WHO data for 2022, the African region ranks first in the world in measles cases (97,230 cases). In contrast, the American region has the lowest number of measles cases worldwide (47 cases). In the WHO Europe region, which includes Türkiye, 852 cases were reported [6].

In Türkiye, the Measles Control Programme was launched in 2002 in line with the WHO European Region's Measles Elimination Goal. School-based measles vaccination days were conducted in 2003 and 2005. As a result, between 2007 and 2011, the number of cases remained below five. Although no domestically acquired cases were reported between 2008 and 2010, following migration due to internal conflict and unrest in Syria in 2011 and the insufficient vaccination coverage in Europe, measles outbreaks occurred, leading to a rapid increase in cases in Türkiye. In 2011, a localized outbreak, mostly in Istanbul, was reported and was believed to have been caused by imported cases. In 2013, a national outbreak affected 41 provinces, with the total number of cases reaching 7,405. After 2013, the number of measles cases in Türkiye peaked again in 2019, with 2,905 cases reported to WHO [7,8].

The aim of this study is to conduct an epidemiological evaluation of measles cases reported in Kayseri, located in Türkiye Central Anatolia region, from 2019 (the year when case numbers peaked nationally) through to 2023.

Methodology

This study examines measles cases reported to the Kayseri Provincial Health Directorate's İZCİ system (Communicable Disease Surveillance and Early Warning System) between 1 January 2019 and 31 December 2023. The patient's gender, date of birth, residence, case type (suspected, probable, confirmed), case status (alive, deceased), vaccination status, symptoms, and complications were recorded. Additionally, population data for Kayseri for the relevant years were obtained from the Turkish Statistical Institute (TURKSTAT) website, and annual measles incidence was calculated [9]. The classification of measles cases in our study is as follows [10].

Clinical Definition of Measles

A disease characterized by a fever higher than 38°C, maculopapular rash, and at least one of the following symptoms: cough, runny nose, or conjunctivitis.

Laboratory Criteria for Measles Diagnosis: Detection of measles-specific IgM antibodies, isolation of the measles virus, detection of measles viral RNA by RT-PCR, or a significant (at least four-fold) increase in measles-specific IgG antibody titers in serum samples taken 2–4 weeks apart.

Measles Case Classification

Suspected Case: Any disease characterized by a maculopapular rash.

Probable Measles Case (Clinical Case): A case compatible with clinical definition.

Confirmed Measles Case: a) Laboratory-Confirmed Case: A probable case confirmed by one of the necessary laboratory criteria, or a laboratory-confirmed case epidemiologically linked to another case, or a case recently vaccinated. b) Epidemiologically-Linked Case: A probable case epidemiologically linked to another laboratory-confirmed case (based on exposure and incubation period, with a contact relationship within 7–18 days prior to the onset of symptoms).

Ethical Approval

Ethical approval for the study was obtained from the Erciyes University Health Sciences Research Ethics Committee (Date: 09.10.2024, No: 2024/193) and research permission was granted by the Provincial Health Directorate (Date: 26.08.2024, No: 202416).

Statistical Analysis

Statistical analysis was performed using SPSS version 26.0. Descriptive statistics, including percentages, frequencies, and means ± standard deviations, were used. The chi-square test was used to compare sociodemographic characteristics and

Figure 1. Distribution of reported cases by year.

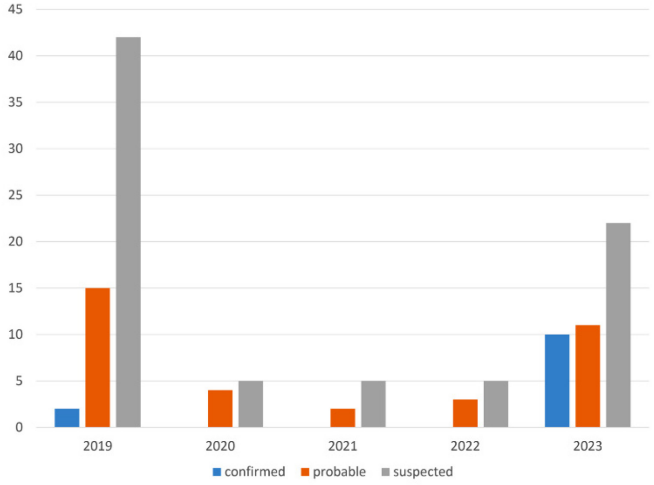

Table 1. Symptoms seen in reported measles cases.

Symptom	Yes (%)	No (%)	Unknown (%)
Fever	102 (81.0%)	20 (15.9%)	4 (3.2%)
Runny nose/cough/conjunctivitis	59 (46.8%)	60 (47.6%)	7 (5.6%)
Lymphadenopathy/Arthralgia/Arthritis	12 (9.5%)	97 (77.0%)	17 (13.5%)
Rash	113 (89.7%)	13 (10.3%)	0 (0.0%)

vaccination status with measles status, and $p < 0.05$ was considered statistically significant.

Results

A total of 137 measles cases were reported in Kayseri between 2019 and 2023. The analysis could not be conducted for four probable and four suspected cases due to delayed reporting; two suspected cases could not be analyzed as the patients could not be reached, and one suspected case did not provide consent for the interview. Therefore, 126 reports were included in the analysis.

Of the 126 reports, 59 were from 2019, 9 from 2020, 7 from 2021, 8 from 2022, and 43 from 2023 (Figure 1). Cases under the age of one accounted for 18.3%, with the age range spanning from 0 to 44 years and a mean age of 7.48 ± 9.83 years. A total of 80.2% of the cases were from the two largest districts, Kocasinan and Melikgazi. Males comprised 65.1% of the cases and females 34.9%; among the 44 female cases, 2 were pregnant. Turkish citizens accounted for 76.2% of the cases, while 23.8% were foreign nationals; among the foreign nationals, 73.3% were of Syrian origin. A total of 82.5% of the cases lived in the city centre, and 17.5% resided in district centres. Regarding case classification, 62.7% were classified as suspected, 27.8% as probable, and 9.5% as confirmed. With respect to vaccination status, 32.5% were fully vaccinated, 23.0% had received one dose, 26.2% were unvaccinated, and the vaccination status of 18.3% was unknown. After further testing, 56 out of the 126 reported cases were classified as confirmed measles.

The most common symptoms reported in measles cases were rash (89.7%) and fever (81.0%) (Table 1). The mean duration of the rash was 3.16 ± 2.54 days. A total of 31.0% of the cases required hospitalization.

Among confirmed measles cases, 17.9% developed complications, including pneumonia (12.5%), diarrhea (1.8%), otitis (1.8%), and malnutrition (1.8%) (Table 2). The distribution of measles cases by age and gender is shown in Table 3. Of the 56 confirmed cases, 36 (64.3%) were male, and 20 (35.7%) were female. A total of 48.2% were aged 0–4 years, 26.8% were aged 5–9 years, 10.7% were aged 10–14 years, and 14.3% were 15 years or older. In terms of citizenship, 39.3% of confirmed cases were not Turkish nationals. The sociodemographic characteristics of the cases compared with their measles status are presented in Table 4. Confirmed measles cases were significantly more common among foreign nationals. Among confirmed cases, 17.9% were fully vaccinated, 21.4% had received one dose, 35.7% were unvaccinated, and the vaccination status of 25.0% was unknown. A comparison of vaccination status and measles status is shown in Table 5. Confirmed measles cases were significantly higher among those who were unvaccinated or whose vaccination status was unknown, compared to those who were fully vaccinated.

Table 2. Complications seen in confirmed measles cases.

Complication	Case
Pneumonia	7 (12.5%)
Diarrhea	1 (1.8%)
Otitis	1 (1.8%)
Malnutrition	1 (1.8%)

Discussion

In our study, the measles incidence was 1.56 per 100,000 in 2019, decreased between 2020 and 2022, and then rose to 2.07 in 2023. Globally, the number of cases was 873,373 in 2019, 159,240 in 2020, 123,152 in 2021, 205,200 in 2022, and 663,830 in 2023. The incidence rates were 11.8 per 100,000 in 2019, 2.1 in 2020, 1.6 in 2021, 2.8 in 2022, and 9.0 in 2023 [11]. In the WHO European region, the incidence was 11.5 per 100,000 in 2019, 1.33 in 2020, 0.01 in 2021, 0.09 in 2022, and 7.1 in 2023. Although the incidence rates in Türkiye are lower, they declined between 2020 and

Table 3. Distribution of confirmed measles cases by age and gender.

Age	Male	Female	Total
0-4	17	10	27 (48.2%)
5-9	12	3	15 (26.8%)
10-14	2	4	6 (10.7%)
15+	5	3	8 (14.3%)
Total	36 (64.3%)	20 (35.7%)	56 (100.0%)

Table 4. Comparison of measles status with sociodemographic characteristics.

Feature	n	Measles Status	
		Confirmed cases (%)	Other cases (%)
Gender			
Male	82	36 (43.9%)	46 (56.1%)
Female	44	20 (45.5%)	24 (54.5%)
		χ^2=0.028	p=0.867
Age			
0-4	83	27 (42.9%)	36 (57.1%)
5-9	33	15 (45.5%)	18 (54.5%)
10-14	15	6 (40.0%)	8 (60.0%)
15+	15	8 (53.3%)	7 (46.7%)
		χ^2 =0.678	p=0.878
Nationality			
TR	96	34 (35.4%)	62 (64.6%)
Other	30	22 (73.3%)	8 (26.7%)
		χ^2 =13.309	**p=0.000**
Residence			
City center	104	50 (48.1%)	54 (51.9%)
District center	22	6 (27.3%)	16 (72.7%)
		χ^2 =3.183	p=0.074
Total	**126**		

2022, followed by an increase in 2023. The number of cases in the WHO European region also decreased in 2020–2021 but showed a sharp rise in 2023. The highest number of cases were reported in Kazakhstan (15,111), Azerbaijan (13,735), and Russia (12,872). In Türkiye, approximately 5,000 cases were reported [12].

There could be several reasons for this sharp increase. Increased social isolation and quarantine measures due to the COVID-19 pandemic, along with the closure of mass gathering places like schools, may have reduced the spread of contagious diseases such as measles. Pandemic measures, such as quarantine, curfews, and the cancellation of public events, significantly hindered the spread of respiratory diseases like measles. Furthermore, the diversion of healthcare system resources to COVID-19 may have resulted in reduced detection and reporting of other diseases. Limited access to healthcare services and interruptions in vaccination campaigns during the pandemic may have led to an increase in the number of susceptible individuals in 2023. As most resources were redirected to combat COVID-19 during the pandemic, the reporting of other infectious diseases, such as measles, may have decreased, leading to lower case reports in 2020–2022. Following the return to normalcy in 2023, increased social mobility facilitated the spread of the disease.

Measles immunity is generally achieved through vaccination or natural infection. In our study, confirmed measles cases were found to be higher among the unvaccinated population than among the fully vaccinated (Table 5). Due to the pandemic, incomplete vaccination coverage may have resulted in an immunity gap in later years such as 2023. Disruption to routine vaccination programmes during the pandemic likely contributed to reduced levels of population immunity. GAVI (Global Alliance for Vaccines and Immunization), WHO, and UNICEF have highlighted that the interruption to routine vaccination services due to COVID-19 placed at least 80 million children under the age of one at risk of diseases like diphtheria, measles, and polio [13]. A study conducted in Türkiye found that 79.15% of participants reported the COVID-19 pandemic negatively affected their attitudes toward childhood vaccinations [14].

The earthquakes on 6 February, which affected 11 provinces and surrounding areas, disrupted healthcare services in the region, including vaccination programmes, and may have contributed to the increase in measles cases in 2023. Additionally, population migration from affected areas to Kayseri may have been another contributing factor.

Table 5. Measles status compared with vaccination status.

Vaccination status*	n	Measles Status	
		Confirmed cases (%)	Other cases (%)
Fully vaccinated	41	10^{a} (24.4%)	31^{a} (75.6%)
Single vaccinated	29	12^{a,b} (41.4%)	17^{a,b} (58.6%)
Unvaccinated	33	20^{b} (60.6%)	13^{b} (39.4%)
Unknown	23	14^{b} (60.9%)	9^{b} (39.1%)
		χ^2 =12.792	**p=0.005**
Total	**126**		

*Different letters represent different groups.

According to the 2018 Türkiye Demographic and Health Survey (TNSA) Syrian Migrant Sample, the percentage of children aged 12-23 months who had received all age-appropriate vaccinations was 60.4% [15]. Although there is no specific measles data, it is known that vaccination rates among migrants are generally lower. In our study, the confirmed measles rate was found to be significantly higher among foreign nationals (Table 4). The finding that approximately 40.0% of measles cases occurred in individuals who were not Turkish citizens may be attributable to incomplete vaccination coverage in the migrant population.

In recent years, increasing vaccine opposition and vaccine hesitancy may also have contributed to the rise in cases by creating an immunity gap. Due to the rapid global spread of anti-vaccine rhetoric, the World Health Organization (WHO) established the Vaccine Hesitancy Working Group and expanded its research on this issue. In 2019, WHO listed vaccine opposition as one of the top ten global health threats to be addressed [16]. In Türkiye, a study by Argın *et al.* (2022) investigated parents' willingness to follow the vaccination schedule determined by the Ministry of Health for their children. The study found that 21.8% of parents did not want to vaccinate their children, while 19.6% were undecided [17].

Conclusions

Evidence shows that measles cases have been increasing. The reasons for this increase are multifactorial. Some of the key contributing factors include the finding that 39.3% of confirmed measles cases involved individuals who were not Turkish citizens, as well as insufficient vaccination coverage among migrant populations. Additionally, 21.4% of cases were partially vaccinated and 35.7% were unvaccinated, leading to inadequate herd immunity. In order to eliminate measles, it is essential to strengthen immunization programmes and primary healthcare services. The underlying reasons for individuals remaining unvaccinated or under-vaccinated must be thoroughly investigated. Such understanding will contribute to the design and implementation of effective, evidence-based interventions.

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Conflict of interests

No conflict of interests is declared.

References

1. World Health Organization (2024) Measles. Available: https://www.who.int/news-room/fact-sheets/detail/measles. Accessed: 18 September 2024.
2. Republic of Türkiye, Ministry of Health (2015) General directorate of public health. Communicable diseases notification and reporting system circular. Available: https://hsgm.saglik.gov.tr/depo/Mevzuat/Genelgeler/201518_Bulasici_Hastaliklarin_Ihbar_ve_Bildirim_Sistemi_Genelgesi.pdf. Accessed: 22 September 2024.
3. World Health Organization (2024) History of measles vaccination. Available: https://www.who.int/news-room/spotlight/history-of-vaccination/history-of-measles-vaccination?topicsurvey=ht7j2q)&gad_source=1&gclid=Cj0KCQjw9Km3BhDjARIsAGUb4nx7IdGd14yOyof8OFdEA7448OqMlwJNoNcGj0BEJKHNmWfXuURkW4aAjdjEALw_wcB. Accessed: 18 September 2024.
4. Bankamp B, Hickman C, Icenogle JP, Rota PA (2019) Successes and challenges for preventing measles, mumps and rubella by vaccination. Curr Opin Virol 34: 110–116. doi: 10.1016/j.coviro.2019.01.002.
5. Tanir G, Yalcinkaya R (2022) The re-emergence of measles in the world and in our country: reasons and results. Klimik J 35: 120-126.
6. World Health Organization (2020) Measles number of reported cases. Available: https://www.who.int/data/gho/data/indicators/indicator-details/GHO/measles---number-of-reported-cases. Accessed: 20 September 2024.
7. Nayir T, Nazlican E, Sahin M, Kara F, Mese EA (2020) Effects of immunization program on morbidity and mortality rates of vaccine-preventable diseases in Turkey. Turk J Med Sci 50: 1909–1915. doi: 10.3906/sag-2008-177.
8. Republic of Türkiye (2022) Ministry of Health. Health statistics yearbook. Available: https://dosyasb.saglik.gov.tr/Eklenti/48054/0/siy202205042024pdf.pdf. Accessed: 20 September 2024.
9. Turkish Statistical Institute (2024) Population and demography. Available: https://data.tuik.gov.tr/Kategori/GetKategori?p=Nufus-ve-Demografi-109. Accessed: 18 November 2024.
10. Republic of Türkiye, Ministry of Health (2010) General directorate of public health. Measles, rubella and congenital rubella syndrome surveillance circular. Available: https://www.saglik.gov.tr/TR-11146/kizamik-kizamikcik-ve-konjenital-kizamikcik-kks-surveyansi-genelgesi-2010.html. Accessed: 18 November 2024.
11. World Health Organization (2024) Measles reported cases and incidence. Available: https://immunizationdata.who.int/global/wiise-detail-page/measles-reported-cases-and-incidence?CODE=Global&YEAR=. Accessed: 20 November 2024.

12. World Health Organization (2024) Measles and rubella monthly update WHO European Region. Available: https://www.who.int/europe/publications/m/item/measles-and-rubella-monthly-update---who-european-region---january-2024. Accessed: 21 November 2024.
13. World Health Organization (2024) At least 80 million children under one at risk of diseases such as diphtheria, measles and polio as COVID-19 disrupts routine vaccination efforts, warn Gavi, WHO and UNICEF. Available: https://www.who.int/news/item/22-05-2020-at-least-80-million-children-under-one-at-risk-of-diseases-such-as-diphtheria-measles-and-polio-as-covid-19-disrupts-routine-vaccination-efforts-warn-gavi-who-and-unicef. Accessed: 18 December 2024.
14. Turan FD (2022) Attitudes of parents towards childhood vaccines in the national immunization program: The case of Aksaray. J Public Health Nurs 4: 239–250. doi: 10.54061/jphn.1183177.
15. TNSA (Türkiye Demographic and Health Survey) (2018) Syrian immigrants sample (2018). Hacettepe University Institute of Population Studies, Ankara, Türkiye.
16. World Health Organization (2024) Ten threats to global health. Available: https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019. Accessed: 19 December 2024.
17. Argın V, Akalın D, Güngör S (2022) Parental thoughts and attitudes towards vaccination of their children: The case of Kahramanmaraş. Kastamonu Acad Health J 7: 300–313. doi: 10.25279/sak.795110.