Evolving Perspectives on Measles: Analyzing the Rash as a Key Indicator Amid Vaccine Hesitancy (1998-2025)

Kallie Crowl, OMS-II[1], Anna Kotula, OMS-II[1], Radhika Misra, OMS-II[1] , Seth Quam, D.O[1]

[1]Des Moines University College of Osteopathic Medicine, West Des Moines, Iowa, USA

ABSTRACT

Context

Although measles was declared nearly eliminated in the United States, recent years have witnessed a troubling resurgence due to increasing vaccine hesitancy. This study explores the clinical presentation, progression, and diagnostic challenges of pediatric measles during the post-vaccine-hesitancy era, focusing on the diagnostic utility of the characteristic morbilliform rash.

Methods

A structured literature review was conducted on pediatric measles cases. Reports in this study were only included if they contained sufficient detail on three primary variables: vaccination status, dermatologic findings (rash onset and distribution), and systemic symptoms. With this criterion, we identified and analyzed ten peer-reviewed pediatric measles case reports across the nation published between 1998 and 2025, beginning with the dissemination of the now-discredited Andrew Wakefield study falsely associating the MMR vaccine with autism. Extracted variables include vaccination status, rash morphology and timing, associated symptoms, initial misdiagnoses, and time to correct diagnosis.

Results

Findings reveal that while 80% of cases demonstrated the classic cephalocaudal progression, several presented with atypical rash patterns, such as sparing of extremities or back-to-front distribution, particularly among partially vaccinated or immunocompromised patients. Recognizing this evolving spectrum is critical for timely diagnosis and outbreak containment, especially amid the current rise in measles cases and renewed spread.

Conclusions

This review underscores a concerning erosion in clinical recognition of measles and calls on the osteopathic medical community to renew education around early diagnosis, particularly the hallmark rash and its characteristic progression. As vaccination rates decline and herd immunity weakens, timely diagnosis is both a clinical necessity and public health priority. Osteopathic physicians, trained to see the body as a whole and the significance of preventive care, are uniquely positioned to bridge this diagnostic gap. Strengthening knowledge of vaccine-preventable diseases among emerging physicians will help curb the resurgence of measles while reaffirming the osteopathic commitment to proactive, patient-centered care and community well-being.

INTRODUCTION

- Between January and April 2025, over 2,300 confirmed measles cases were reported across six countries in the Americas, an elevenfold increase compared to the same period in 2024.[1]
- Texas reported 750 cases and 2 deaths, primarily in rural regions with low vaccination coverage.[2]
- U.S. MMR vaccination rates among U.S. kindergarteners declined to 92.7% in 2023-2024, falling below the critical 95% threshold to prevent sustained transmission.[3]
- Near-elimination of measles in prior decades has limited clinical exposure for new healthcare practitioners, making disease recognition and timely diagnosis more challenging. [4]

METHODOLOGY

- **Design:** Structured literature search of pediatric measles case reports and case series (January 1998-May 2025) using PubMed and Google Scholar.
- **Inclusion criteria :** Reports with detailed vaccination status, dermatologic findings (rash onset and distribution), and associated systemic symptoms.
- **Screening:** 46 reports met initial criteria; 36 were excluded for insufficient documentation or patient age fell outside the range defined in this study.
- **Final sample:** 10 cases (ages 34 days–15 years) spanning a broad geographic range.

CLINICAL PRESENTATION

Measles Rash
An erythematous maculopapular rash typically emerges 3-5 days after initial symptom onset, classically spreading from the head downward to involve the rest of the body.[4] Images illustrating the characteristic dermatologic manifestations of measles are courtesy of Centers for Disease Control and Prevention.[5]

RESULTS

Case	Year	Age	MMR Doses	Initial Differentials	Measles Diagnosis Post-Rash	Citation
1	2012	6 y/o	0	Not Mentioned	Not Mentioned	[6]
2	2013	7 y/o	0	Not Mentioned	4 weeks	[7]
3	2014	12 y/o	1	Varicella, Zoster Virus	Not Mentioned	[8]
4	2014	11 months	1	Kawasaki Disease	5 days	[9]
5	2016	14 months	1	Hand-Foot-and-Mouth Disease	4 days	[10]
6	2016	15 y/o	1	Leptospirosis, Dengue Fever, Typhoid Fever, Drug Allergy, Atypical	2 days	[11]
7	2019	13 months	0	Common Respiratory Pathogen	1 day prior	[12]
8	2020	7 months	0	Irritability relieved post-lumbar puncture; suspected intracranial hypertension	3 days	[13]
9	2023	34 days old	0	Sepsis	16 days	[14]
10	2024	*7 y/o	2	Viral exanthems	*1–2 days	[15]

- 50% of cases took 3 or more days after rash onset to get a confirmed diagnosis.
- 90% of patients were incompletely vaccinated due to age or parental choice.

Case	Rash Morphology	Rash Progression	Rash Onset	Koplik Spots	Three "C"s Hallmark Symptoms	Other Symptoms	Citation
1	Maculopapular	Started as a facial rash, followed by trunk and extremities	Day 3	Negative	Mild non-productive cough	Rhinorrhea, tactile fever, tachycardia	[6]
2	Not Mentioned	Behind the ears, spreading all over the body	Day 3	Not Mentioned	Conjunctivitis and cough	Fever, inability to walk or talk, altered level of consciousness, encephalitis	[7]
3	Blanching morbilliform	Behind ears, then to face, neck, back, chest, limbs	Day 2	Negative	Conjunctivitis	Palatal petechiae, posterior pharyngeal erythema, mild postauricular cervical lymphadenopathy	[8]
4	Variably sized macules, more pronounced on the back	Back to trunk, face, and extremities	Day 2	Negative	Cough, conjunctival infection	Fever, runny nose, diarrhea, bilateral submandibular lymphadenopathy	[9]
5	Diffuse maculopapular	Head to torso and legs	Day 4	Positive	Conjunctivitis, coryza	Fever, lethargy, anorexia	[10]
6	Exanthematous maculopapular, pruritic	Face, anterior trunk, back, upper extremities, palms. Lower limbs spared	Day 3	Negative	Conjunctivitis	Fever, chills, vomiting, diarrhea, splenomegaly, bilateral posterior cervical lymphadenopathy	[11]
7	Mild maculopapular	Head to torso and extremities	Day 4	Not Mentioned	Cough, conjunctivitis	Diarrhea, vomiting, hyperemic pharynx, acute cholecystitis, interstitial peribranchial thickening	[12]
8	Maculopapular	Face to whole body	Day 4	Positive	Cough and cough	Fever, watery nasal secretion, bugling fontanel	[13]
9	Post-inflammatory hyperpigmentation	Started behind the ear and face to the neck, trunk, and extremities	Day 18 of life	Not Mentioned	Cough, conjunctivitis	Watery eye discharge, septic shock, pneumonia, diarrhea, mucopurulent encephalitis	[14]
10	Classic morbilliform	Face to trunk followed by extremities	Day 3-4	Not Mentioned	Cough, conjunctivitis, coryza	Rash, fatigue	[15]

- 80% of cases exhibited the classic measles rash; 2 cases presented atypically:
  - One 15 y/o with rash sparing the lower extremities.
  - One with the rash beginning on the back and spreading anteriorly to the trunk and face.
- 60% of rashes appeared within 3 days of symptom onset.
- 60% presented with 2 of 3 "classic triad" symptoms: cough, conjunctivitis, and coryza.

CONCLUSIONS

- The characteristic measles rash remains a powerful clinical indicator and should be recognized promptly to facilitate early and accurate diagnosis.
- Recognition of measles is rapidly declining, resulting in delayed or missed diagnoses, even in patients with classic clinical features.
- Atypical presentations and partial vaccination history can lead to diagnostic delays.
- Declining MMR coverage and rising vaccine hesitancy pose serious public health risks, increasing the potential for severe complications and sustained disease transmission.
- Targeted provider education, guided by dermatology experts, is essential to improve early recognition of both classic and modified measles presentations.
- Prioritizing measles education for new healthcare practitioners is vital to rebuild frontline diagnostic expertise, minimize delays in recognition, and prevent avoidable outcomes and complications.

REFERENCES

1. World Health Organization. Measles in the Region of the Americas; 2025 [cited 2025, Aug 23]. Available from: https://www.who.int/emergencies/disease-outbreak-news/item/2025-DON565
2. Texas Department of State Health Services. Measles outbreak; 2025. [cited 2025 Aug 23]. Available from: https://www.dshs.texas.gov/news-alerts/measles-outbreak-2025
3. Seither R, Yusuf OB, Dramann D, et al. Coverage with selected vaccines and exemption rates among children in kindergarten—United States, 2023–24 school year. *MMWR Morb Mortal Wkly Rep*. 2024;73(41):925-932. doi:10.15585/mmwr.mm7341a3
4. Naureckas Li C, Kaplan SL, Edwards KM, et al. What's old is new again: Measles. *Pediatrics*. 2025;155(6):e2025071332. doi:10.1542/peds.2025-071332
5. Measles Images. Saint Paul (MN). Immunize.org; 2025 [cited 2025 Sept 1]. Available from: https://www.immunize.org/clinical/image-library/measles/
6. Kongthavonsakul K, Washington CH, Oberdorfer P. A 6-year-old boy with fever, rash and severe pneumonia. *BMJ Case Rep*. 2012;2012:bcr1220115411. doi:10.1136/bcr.12.2011.5411
7. Al-Qayoudhi A, Al-Kindi H, Meki N, Al-Maani A. Acute measles encephalitis in an immigrant Syrian child: Case report and review of the literature. *Oman Med J*. 2016;31(2):150-153. doi:10.5001/omj.2016.29
8. Iroh Tam P-Y, Hanisch BR, Klammer K, DeVries AS. Measles vaccine strain from the skin rash of a DiGeorge patient receiving tumor necrosis factor inhibitor. *Pediatr Infect Dis J*. 2014;33(1):117. doi:10.1097/INF.0000000000000073
9. Lueker A-L, Erdem G. Progressive rash and fever in an infant. *Clin Pediatr (Phila)*. 2015;54(9):875-877. doi:10.1177/0009922814547567
10. Marx GE, Chase J, Jasperse J, et al. Public health economic burden associated with two single measles case investigations—Colorado, 2016–2017. *MMWR Morb Mortal Wkly Rep*. 2017;66:1272-1275. doi:10.15585/mmwr.mm6646a3
11. Raman P, Hussaini SB, Saravanan P, Jeyaram K. Fever with rash, an alarm to the physicians—A case report of atypical measles. *J Clin Diagn Res*. 2016;10(2):OD12-OD13. doi:10.7860/JCDR/2016/16170.7206
12. Piccirilli G, Gennari M, Gabrielli L, et al. Measles virus and cytomegalovirus co-infection, in a child with recent SARS-CoV-2 infection, during COVID-19 pandemic: A case report. *Virol J*. 2023;20:157. doi:10.1186/s12985-023-02099-8
13. Şahin K, Bayhan Gİ, Alan B. Bulging fontanel during a measles infection. *Germs*. 2020;10(4):385-387. doi:10.18683/germs.2020.1231
14. Sharma SR, Sawant V, Save SU, et al. A rare presentation of measles and post-measles complications in a neonate: Case report. *Egypt Pediatr Assoc Gaz*. 2023;71:59. doi:10.1186/s43054-023-00203-9
15. Stefanos R, Schatzman S, Wakeman B, et al. Pediatric rash illness outbreak with initial positive measles immunoglobulin M antibody test results—American Samoa, March–July 2023. *MMWR Morb Mortal Wkly Rep*. 2024;73:1030-1035. doi:10.15585/mmwr.mm7345a3