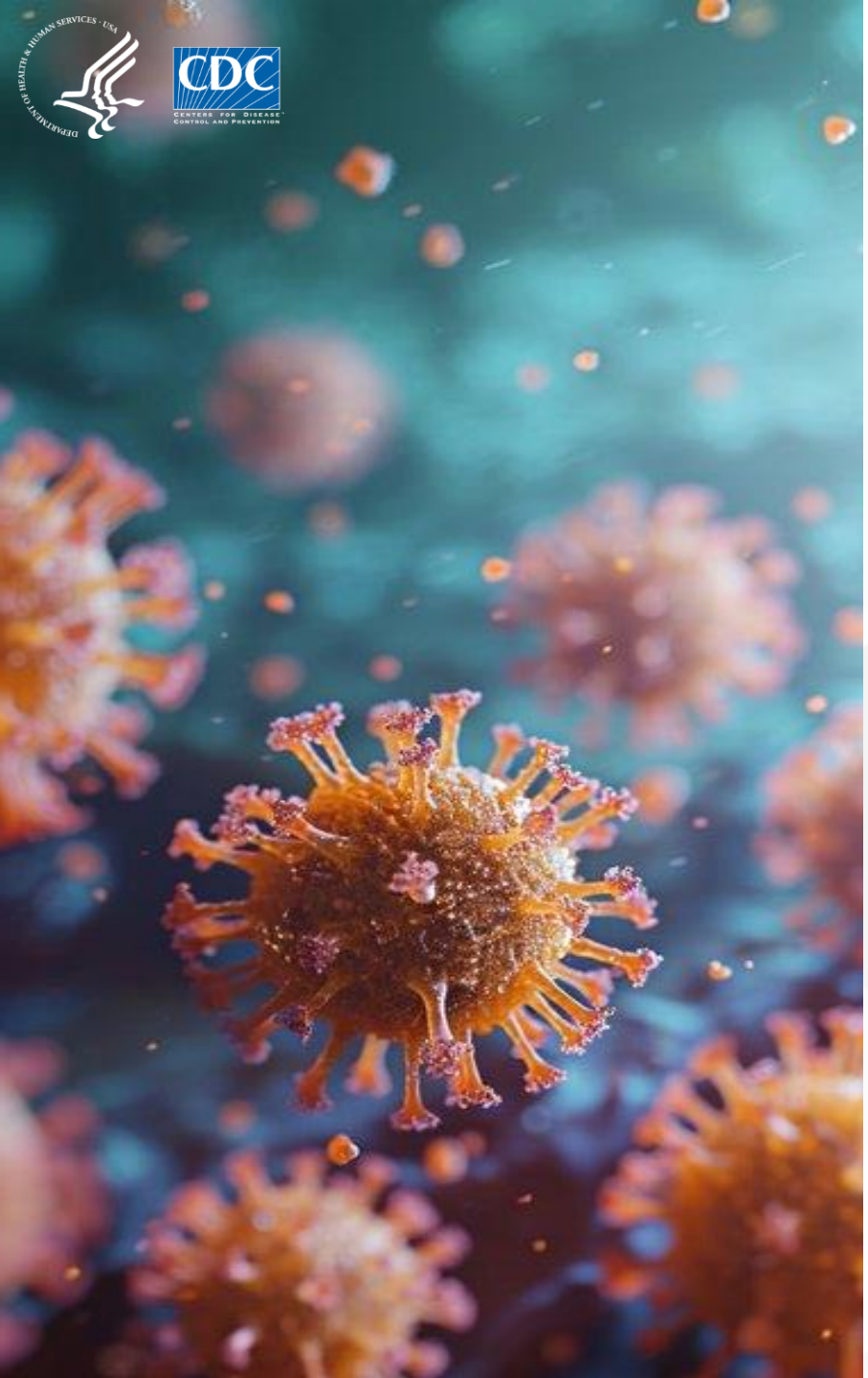
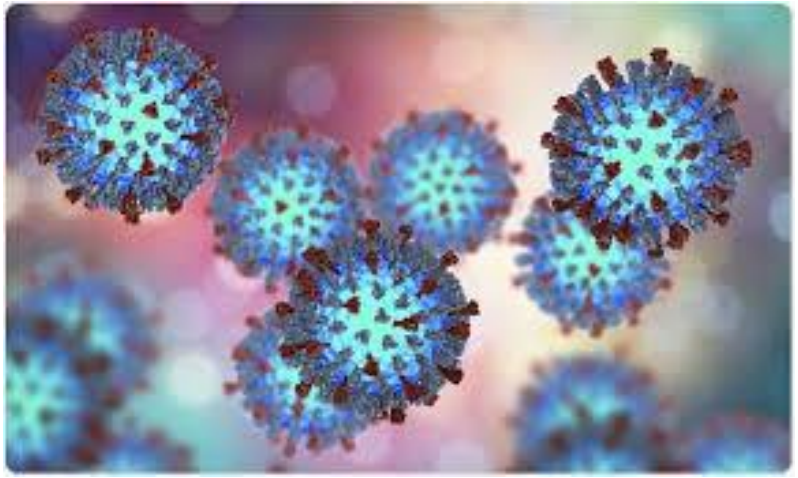


Measles Clinical Presentation, Epidemiology, and Prevention

Thomas (Dan) Filardo, MD
Medical Officer– MeRC (Measles, Rubella, and CMV) Team
Division of Viral Diseases (DVD)
National Center for Immunization and Respiratory Diseases (NCIRD)

Measles

- An acute, febrile rash illness caused by the measles virus
- Transmitted by direct contact with infectious droplets or airborne route
- Measles is highly contagious
  - 90% of susceptible household contacts will develop illness
  - R_o (the number of people who are infected by a single case) is estimated to be 12–16 in an unvaccinated population



Measles virus

Measles rash

Clinical Case Definition

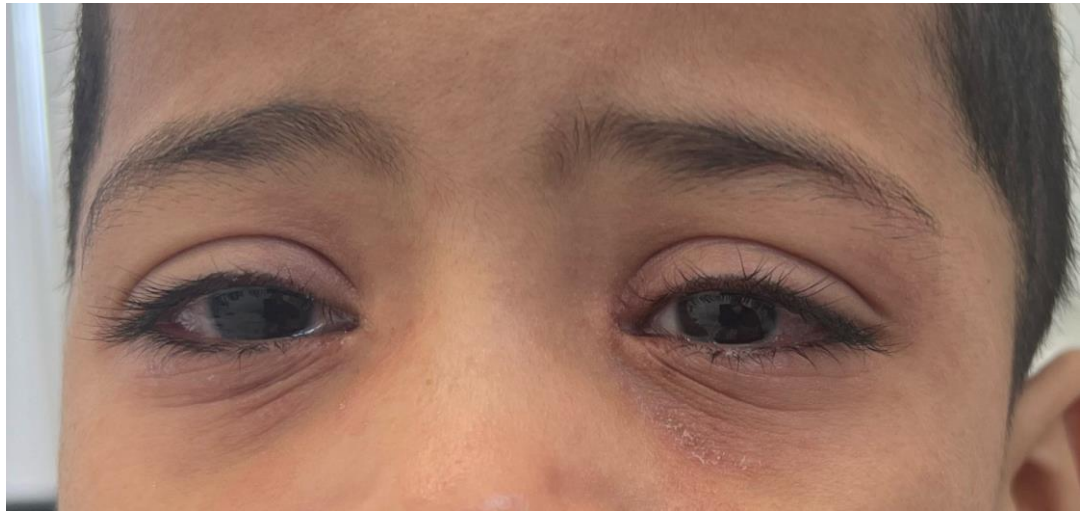
- Fever (up to 105°F)

  AND

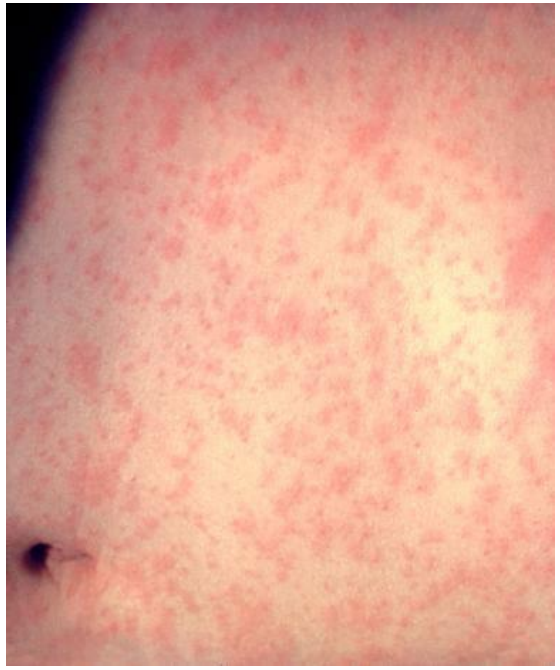
- Rash

  AND

- At least 1 of “The 3 C’s”
  - Cough
  - Coryza (runny nose)
  - Conjunctivitis

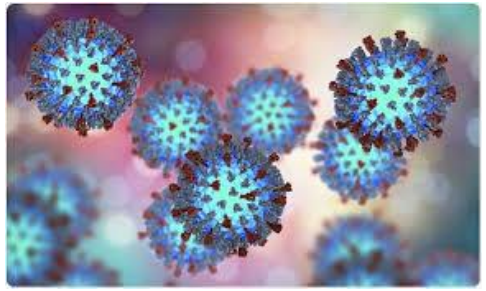


Measles conjunctivitis



Measles rash

Measles Timeline



Incubation period 7 - 21 days between exposure and rash onset (average 10-14)

Symptoms begin

Rash Onset

Out of isolation

-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5

Infectious Period
4 days before – 4 days after rash onset

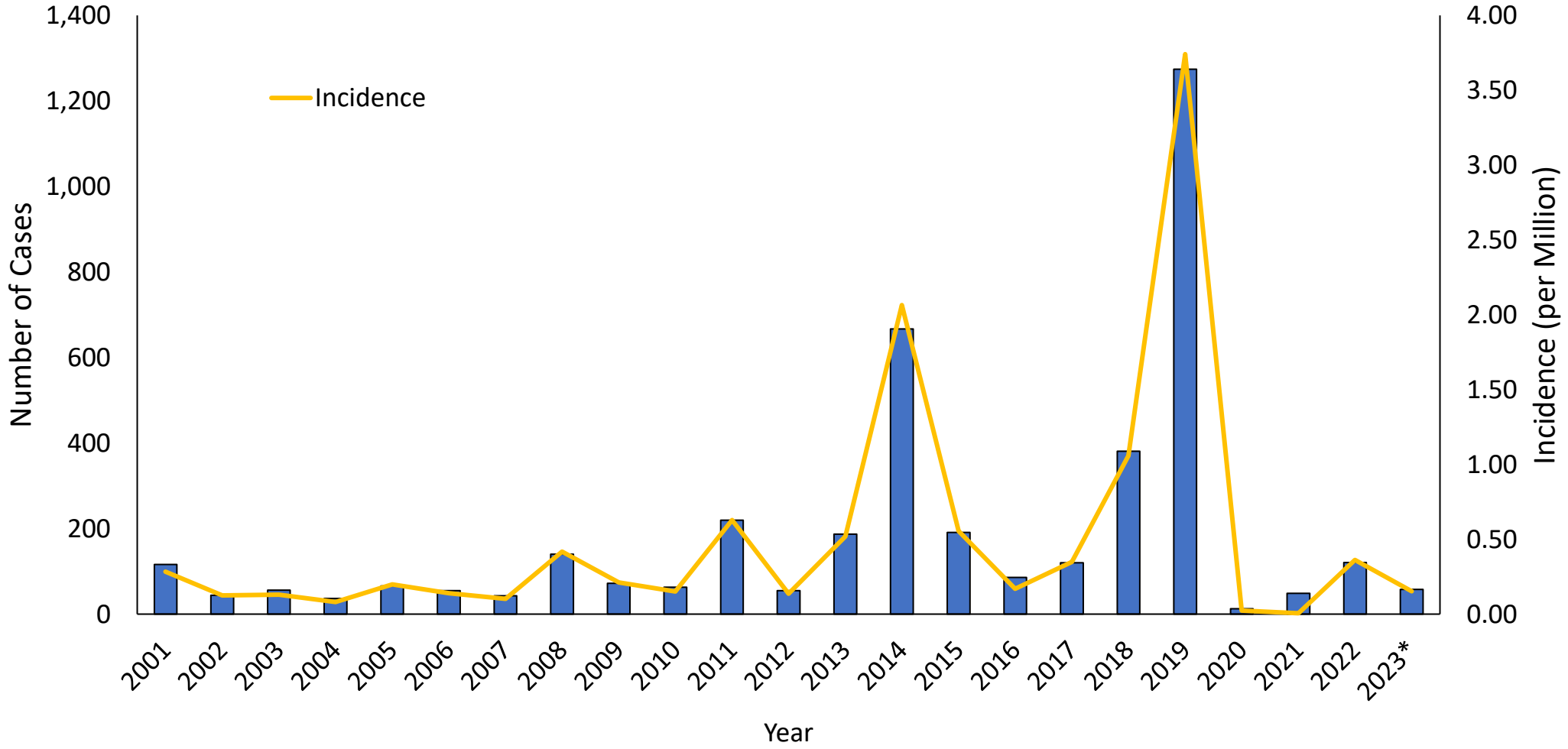
https://www.cdc.gov/vaccines/pubs/pinkbook/meas.html

Measles Complications

Hospitalization	20%
Diarrhea	8%
Otitis media	7 – 9%
Pneumonia	1 – 6%
Encephalitis	1 per 1,000 cases
Death	1 – 3 per 1,000 cases
Subacute Sclerosing Panencephalitis (SSPE)	1 per 100,000 cases

Complications are more common in children <5 years and adults

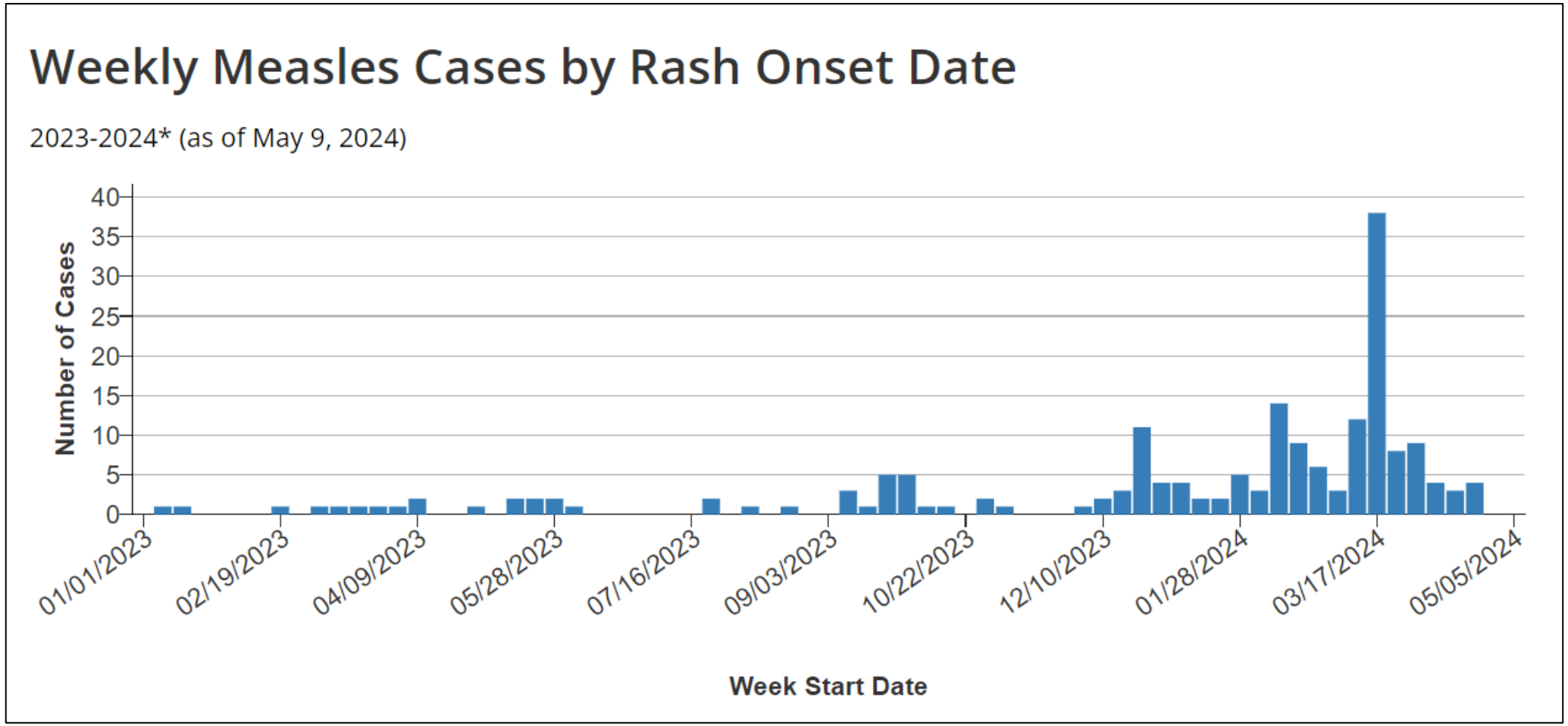
Reported Measles Cases, United States, 2001-2023 (N=4,114)



Median of 72 cases/year (range: 13– 1,274)

*2023 data are preliminary.

U.S. Measles Cases, January 1, 2023– May 9, 2024 (N=132)



Data are preliminary and subject to change.

For the most up-to-date information visit:
https://www.cdc.gov/measles/cases-outbreaks.html

Characteristics of reported measles case-patients, January 1– May 2, 2024 (N=132)

- **Age groups**
  - Under 5 years: 58 (44%)
  - 5-19 years: 30 (23%)
  - 20+ years: 44 (34%)
- **Vaccination Status**
  - Unvaccinated or unknown: 81%
  - One MMR dose: 14%
  - Two MMR doses: 5%

- **Hospitalizations**
  - **53% (70 of 132 cases)**

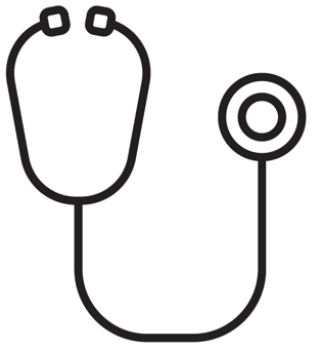
Hospitalizations were for isolation or management of measles complications

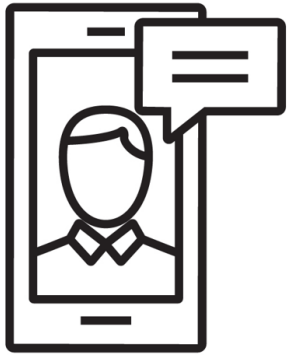
Data are preliminary and subject to change

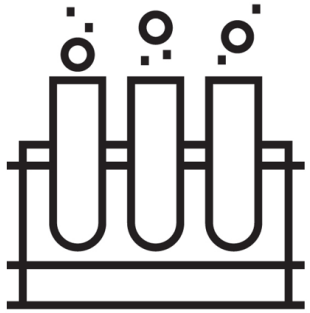
For the most up-to-date information visit:
https://www.cdc.gov/measles/cases-outbreaks.html

Measles Diagnostic Testing

- Clinical, epidemiologic, and laboratory data should all be considered when diagnosing measles infection
- Using serology (IgM) alone to test patients with low pre-test probability of having measles will result in more false positives than true positives
- Both NP/OP swabs (for RT-PCR) **and** serum (for serology) should be collected for all suspect cases







Measles RT-PCR Testing

- RT-PCR testing is most often performed on NP/OP swabs (urine also)
- Specimens are ideally collected within 3 days of rash onset
- Proper specimen collection, storage, and processing is critical
- **rRT-PCR has much higher sensitivity and specificity than serology**
- CDC and state public health labs can perform rRT-PCR

NP: Nasopharyngeal
OP: Oropharyngeal
RT-PCR: reverse transcriptase polymerase chain reaction

Measles Serology

- IgM testing alone can pose challenges in settings with low measles incidence
  - Cross-reactivity with other causes of febrile rash illness has been documented*
  - False positive results are relatively common when the likelihood of measles is low:
    - There isn't local active transmission and patients have not traveled†
    - Patients without known exposure have been fully vaccinated

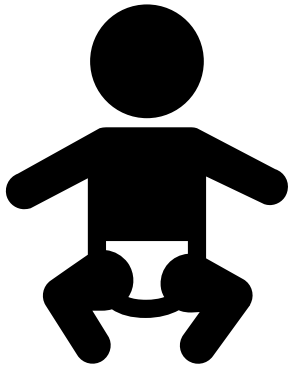
*Jenkerson SA et al.*N Engl J Med*. 1995;332(16):1103-1104.
† Ciccone FH et al. *Rev Soc Bras Med Trop*. 2010;43(3):234-239.
Hiebert J et al. *J Clin Microbiol*. 2021;59(6):e03161-20.

Measles Treatment

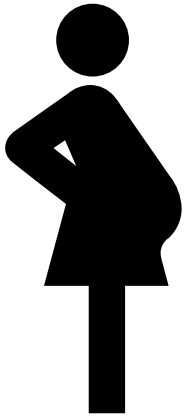
- There is no specific antiviral agent for measles treatment
- CDC recommends vitamin A supplementation for hospitalized children
  - Vitamin A dosing (once daily x2 days):
    - Infants <6 months: 50,000 international units
    - Infants 6 to 12 months: 100,000 international units
    - Children ≥12 months: 200,000 international units
- Measles virus is susceptible to ribavirin in vitro but data on clinical use and efficacy are extremely limited
  - Ribavirin could be considered, in consultation with an infectious disease expert, for patients with severe measles complications or immunocompromised patients

Identify and Prioritize Susceptible Contacts

- Contacts without presumptive evidence of immunity are at high risk to develop measles
- Exposed persons who are at higher risk for severe disease include:



Infants aged <1 year



Pregnant people

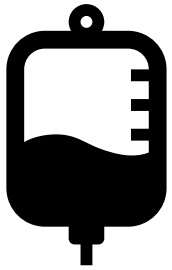
People with immunocompromising conditions or medications

Control Measures: Postexposure prophylaxis (PEP)

PEP within the target window may provide measles protection or modify the clinical course of disease among susceptible people

MMR

- Should be given within 72 hours (3 days) of initial measles exposure
- Vaccination can be given after this window, but would only be expected to protect from future exposures and is not considered “adequate PEP”



Immunoglobulin

- Needs to be given within 6 days of initial exposure
- Can be given intramuscularly (IMIG) or intravenously (IVIG)
  - IVIG should be prioritized for adults at high risk of severe disease

Measles, Mumps, Rubella (MMR) Vaccination

- Licensed in 1971
- Highly effective
  - 2 doses is 97% effective, 1 dose is 93% effective
- Routine vaccination schedule
  - Dose 1: age 12 – 15 months
  - Dose 2: age 4 – 6 years
- International travelers aged ≥ 6 months
  - Age 6–11 months: 1 documented dose prior to departure
  - Age ≥ 12 months: 2 documented doses prior to departure, separated by at least 28 days
- 2 doses recommended for healthcare and post-secondary school enrollment

MMR Vaccine Contraindications

- Severe immunocompromising conditions (e.g., hematologic malignancy, receipt of chemotherapy, long-term immunosuppressive therapy)
  - HIV if CD4 % < 15% or absolute CD4 <200
- Family history suggestive of a congenital immunocompromising condition, unless assessed to be immunocompetent by a clinician or laboratory testing
- History of severe allergic reaction to MMR or to an MMR vaccine component
- Pregnancy

https://www.cdc.gov/vaccines/vpd/mmr/public/index.html

MMR Can Cause a Self-limited Rash

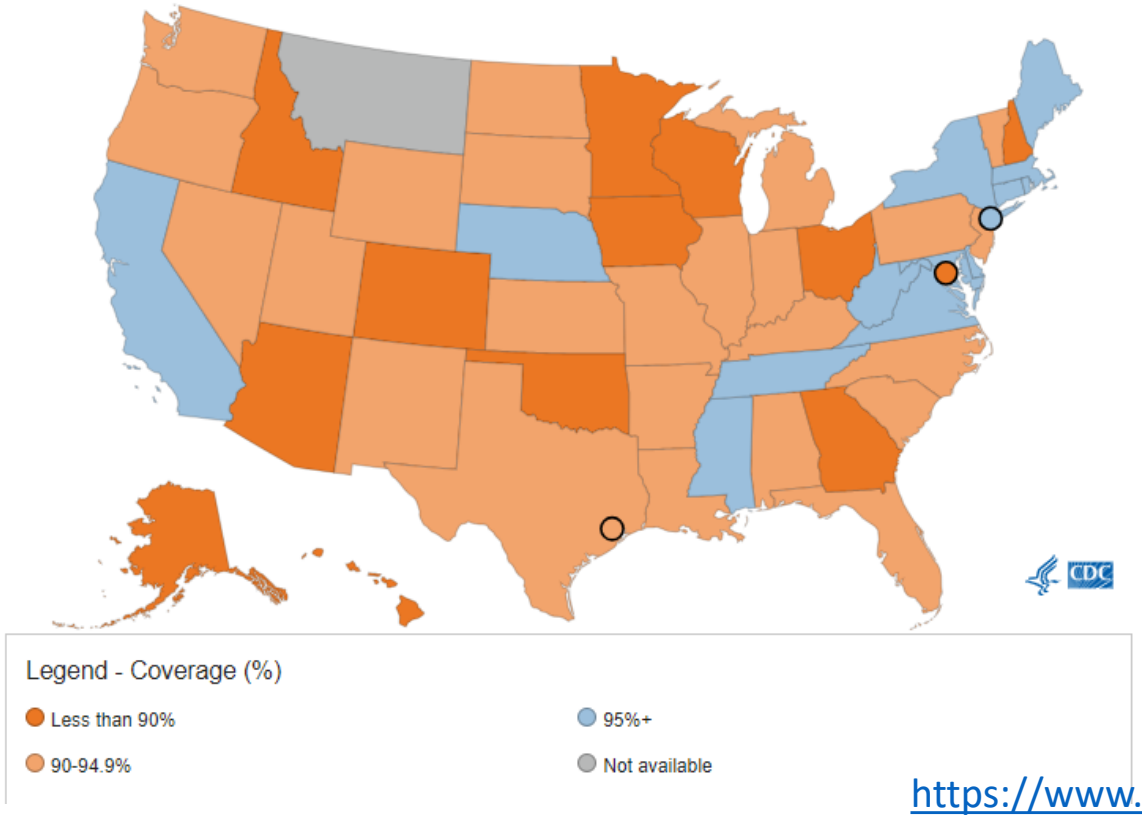
- MMR can cause a short-lived febrile rash syndrome that is not contagious to others
- Differentiating measles from an MMR reaction in the setting of an outbreak can be challenging, especially if MMR was given to prevent measles after an exposure
  - Serology cannot differentiate measles infection from measles vaccination
  - Molecular testing (MeVA) can differentiate measles from an MMR reaction

MMR reaction (not contagious)

National and State Level 2-dose MMR Coverage

	2019-2020	2020-2021	2021-2022	2022-2023
MMR (2 doses)	95.2	93.9	93.0	93.1

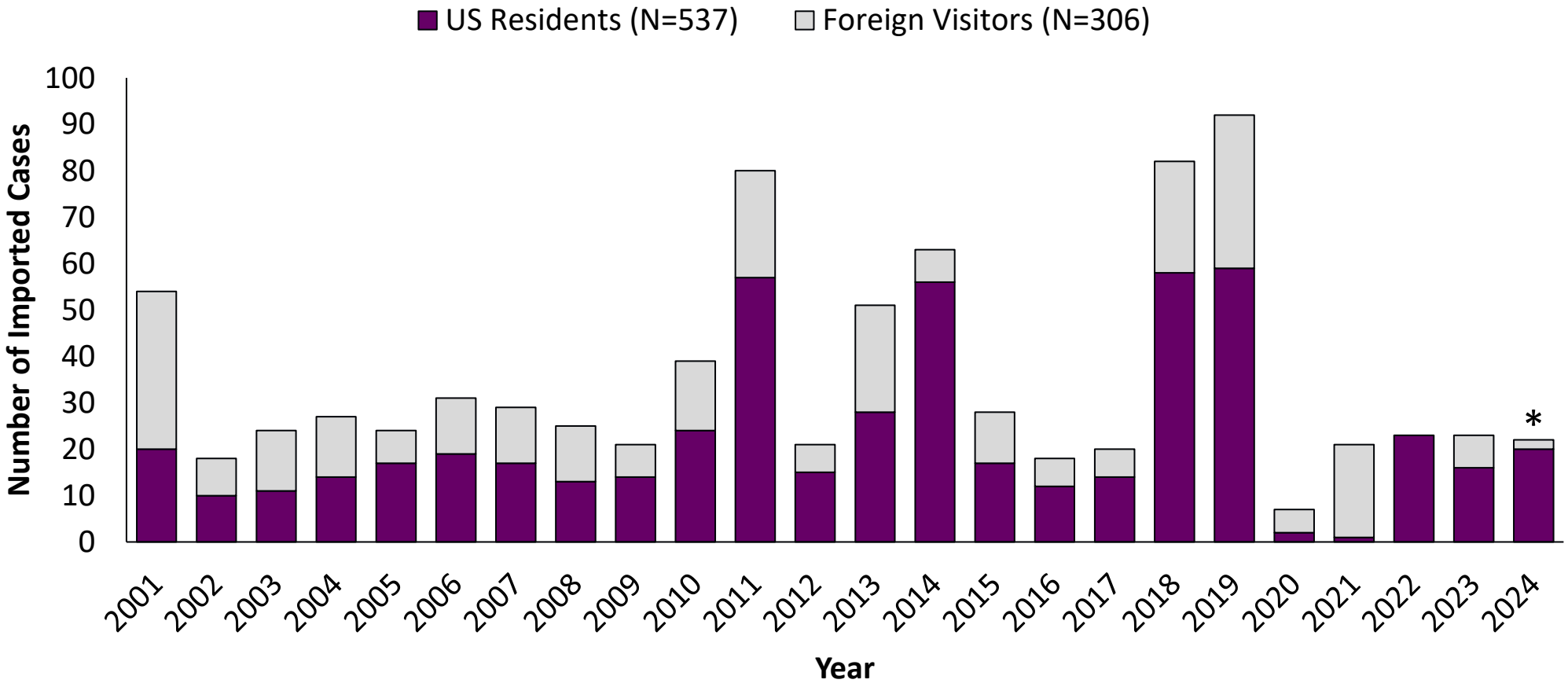
MMR Vaccination among Kindergartners 2022 - 2023



https://www.cdc.gov/measles/cases-outbreaks.html

International importations, 2001–2024*

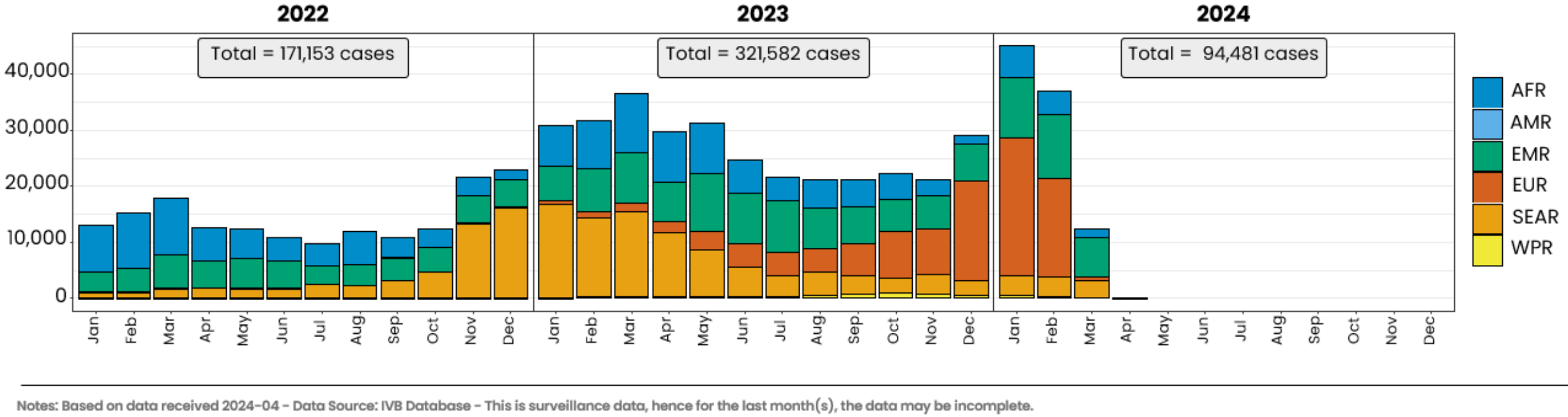
- During 2001–2024, 64% of measles importations occurred among US residents



*2024 data shown here as of 3/28/2024. Data summarizing measles surveillance during 01/01/2020–3/28/2024 can be found here: https://www.cdc.gov/mmwr/volumes/73/wr/mm7314a1.htm

Global Increases in Measles During 2023–2024

Measles case distribution by month and WHO Region (2022–2024)

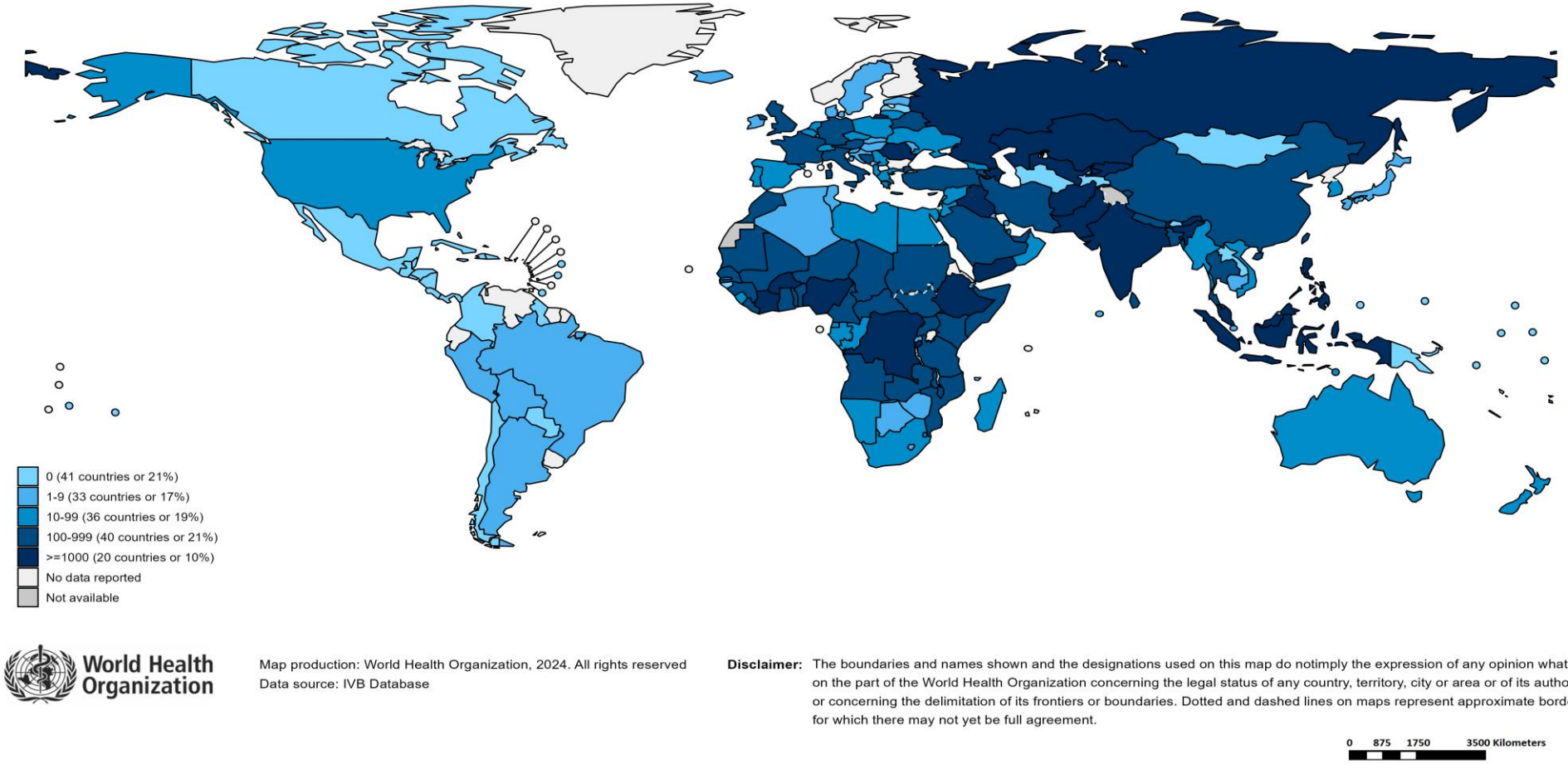


Notes: Based on data received 2024-04 - Data Source: IVB Database - This is surveillance data, hence for the last month(s), the data may be incomplete.

Provisional Data based on monthly data reported to WHO (Geneva) as of April 2024.
https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insights/surveillance/monitoring/provisional-monthly-measles-and-rubella-data

Large Global Measles Outbreaks

September 2023 – February 2024



World Health Organization

Map production: World Health Organization, 2024. All rights reserved
Data source: IVB Database

Disclaimer: The boundaries and names shown and the designations used on this map do notimply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

0 875 1750 3500 Kilometers

Country	Cases*
Kazakhstan	27,280
Azerbaijan	26,744
Iraq	20,469
India**	13,523
Yemen	12,785
Kyrgyzstan	10,024
Pakistan	9,575
Russian Federation	9,373
Ethiopia	6,724
Indonesia	4,380

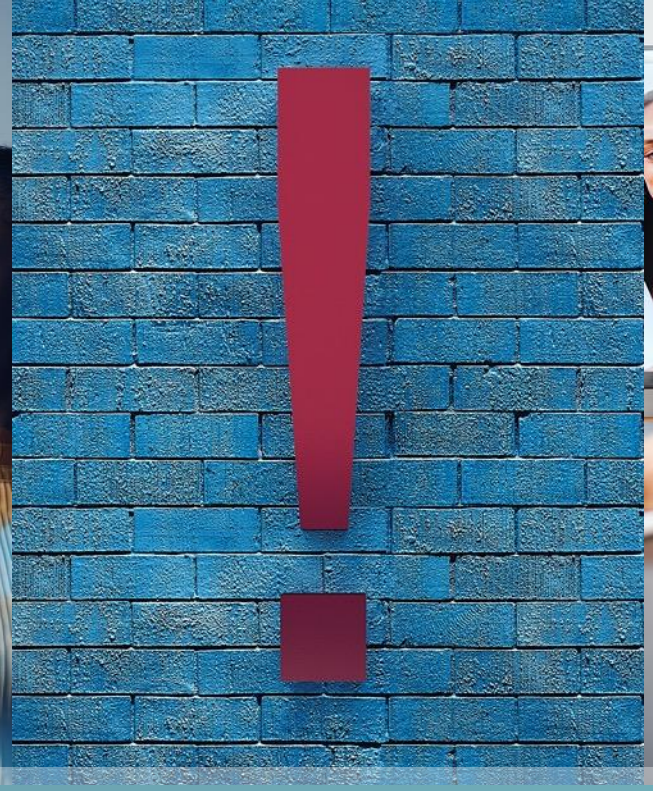
Provisional Data based on monthly data reported to WHO (Geneva) as of April 2024.
https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insights/surveillance/monitoring/provisional-monthly-measles-and-rubella-data

Summary

- The U.S. has maintained measles elimination since 2000.
- Early recognition of measles and appropriate diagnostic testing (RT-PCR and serology) are essential to measles control
- Immunization gaps place communities at risk for measles cases and outbreaks
- We must remain vigilant due to the risk of measles importation

https://www.cdc.gov/vaccines/vpd/mmr/public/index.html






THANK YOU

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov