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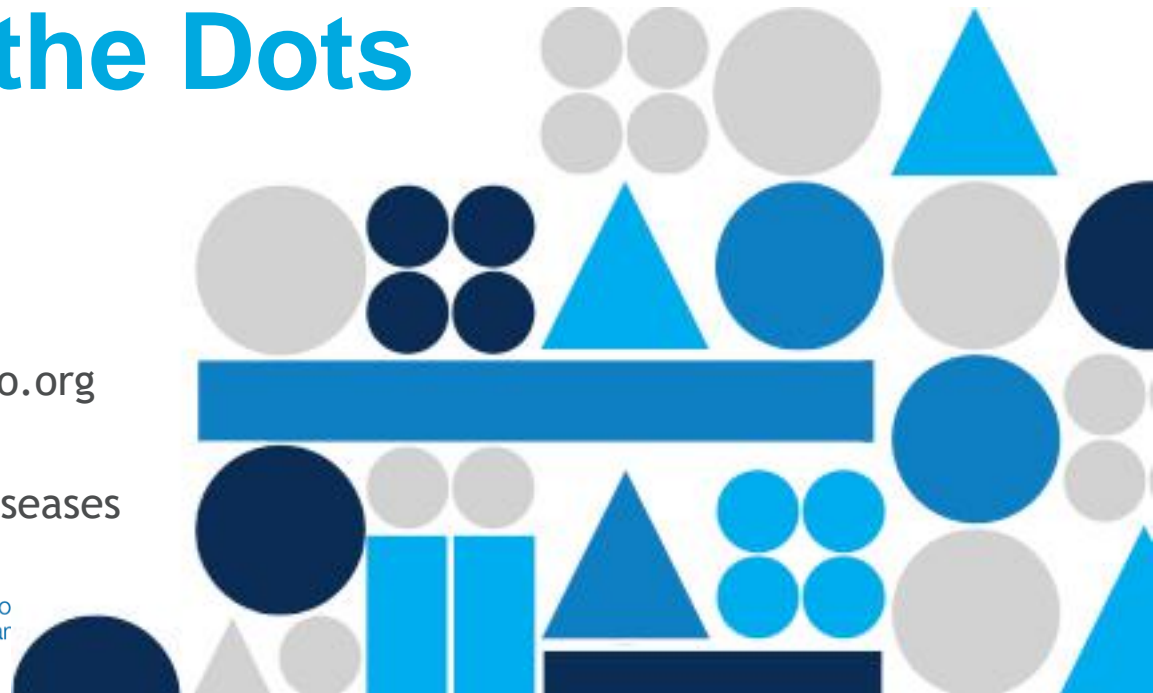
# Measles: Connecting the Dots

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# Disclosure

I have no financial disclosures or conflicts of interest relevant to this presentation.

I made version 1 of these slides in 2019. I've been giving this talk since then. Measles is not going away.

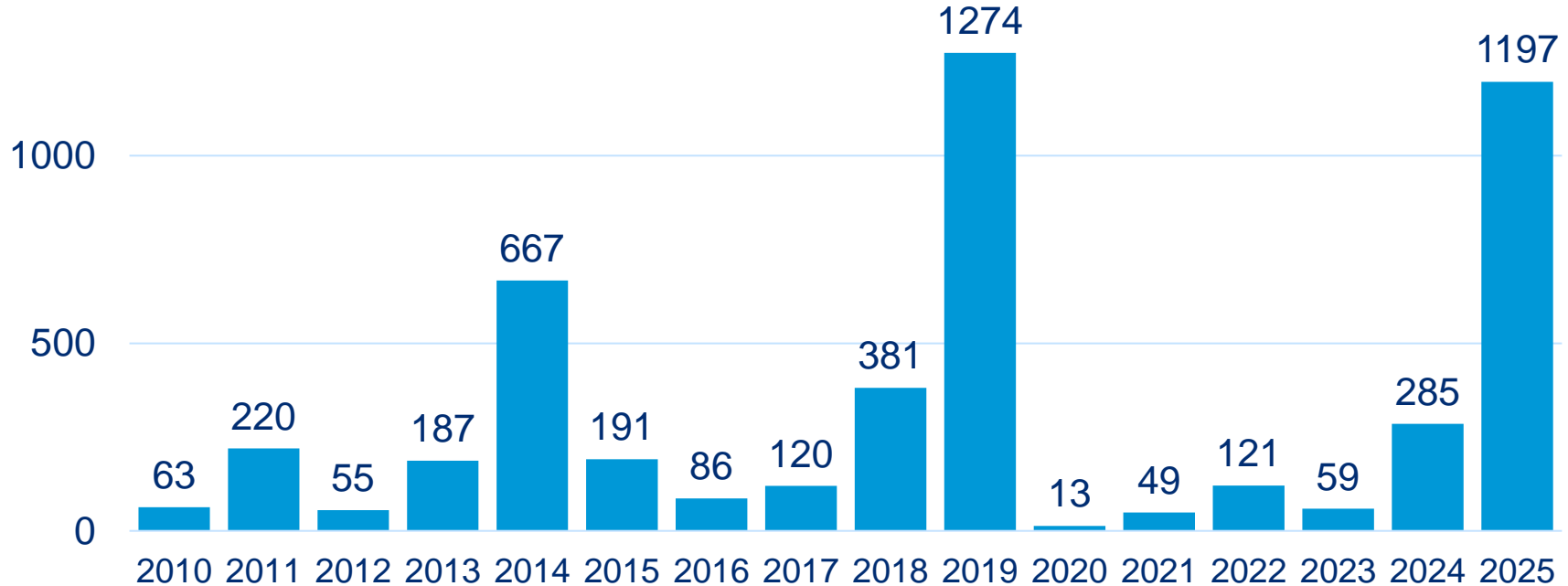
# Objectives

- Describe clinical presentation and complications of measles
- Identify diagnostic testing approach for measles
- Describe infection prevention and control measures to prevent transmission of measles
- Review current immunization recommendations

# Recent epidemiology



# Number of Measles Cases in the US Reported by Year 2010-2025\*\*

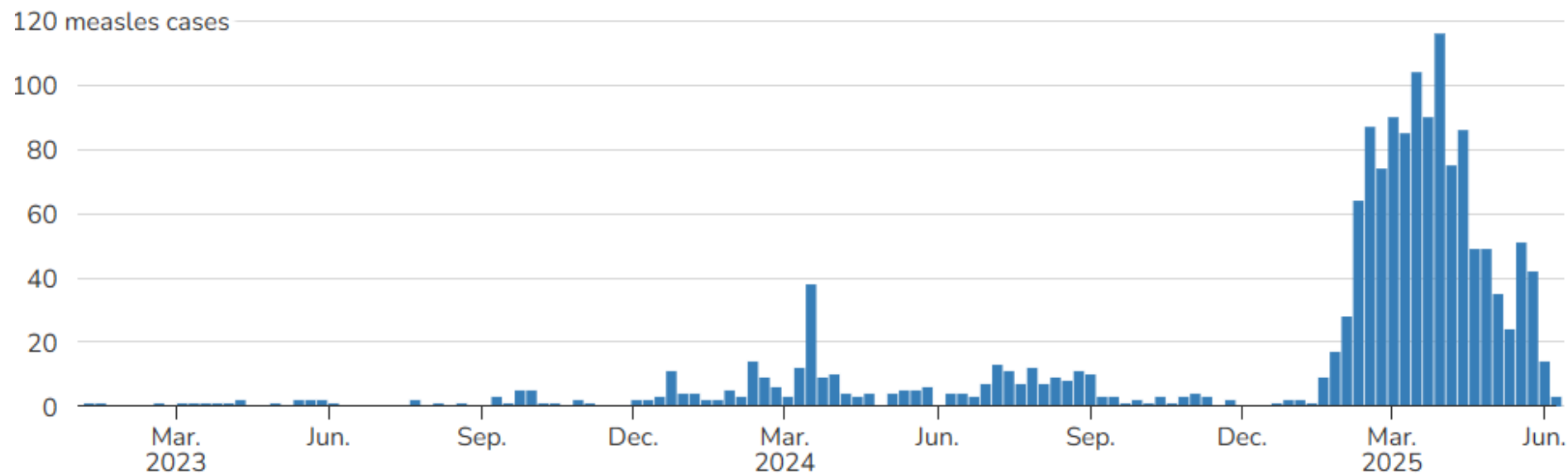


\*\*Cases as of 6/13/25. Case count is preliminary and subject to change.

Source: Center for Disease Control and Prevention: <https://www.cdc.gov/measles/data-research/>

# Weekly measles cases by rash onset date

2023–2025\* (as of June 12, 2025)



## U.S. Cases in 2025

Total cases

**1197**

### Age

**Under 5 years: 347 (29%)**

5-19 years: **446 (37%)**

20+ years: **393 (33%)**

Age unknown: **11 (1%)**

### Vaccination Status

**Unvaccinated or Unknown: 95%**

One MMR dose: **2%**

Two MMR doses: **3%**

## U.S. Hospitalizations in 2025

**12%**

12% of cases hospitalized (144 of 1197).

### Percent of Age Group Hospitalized

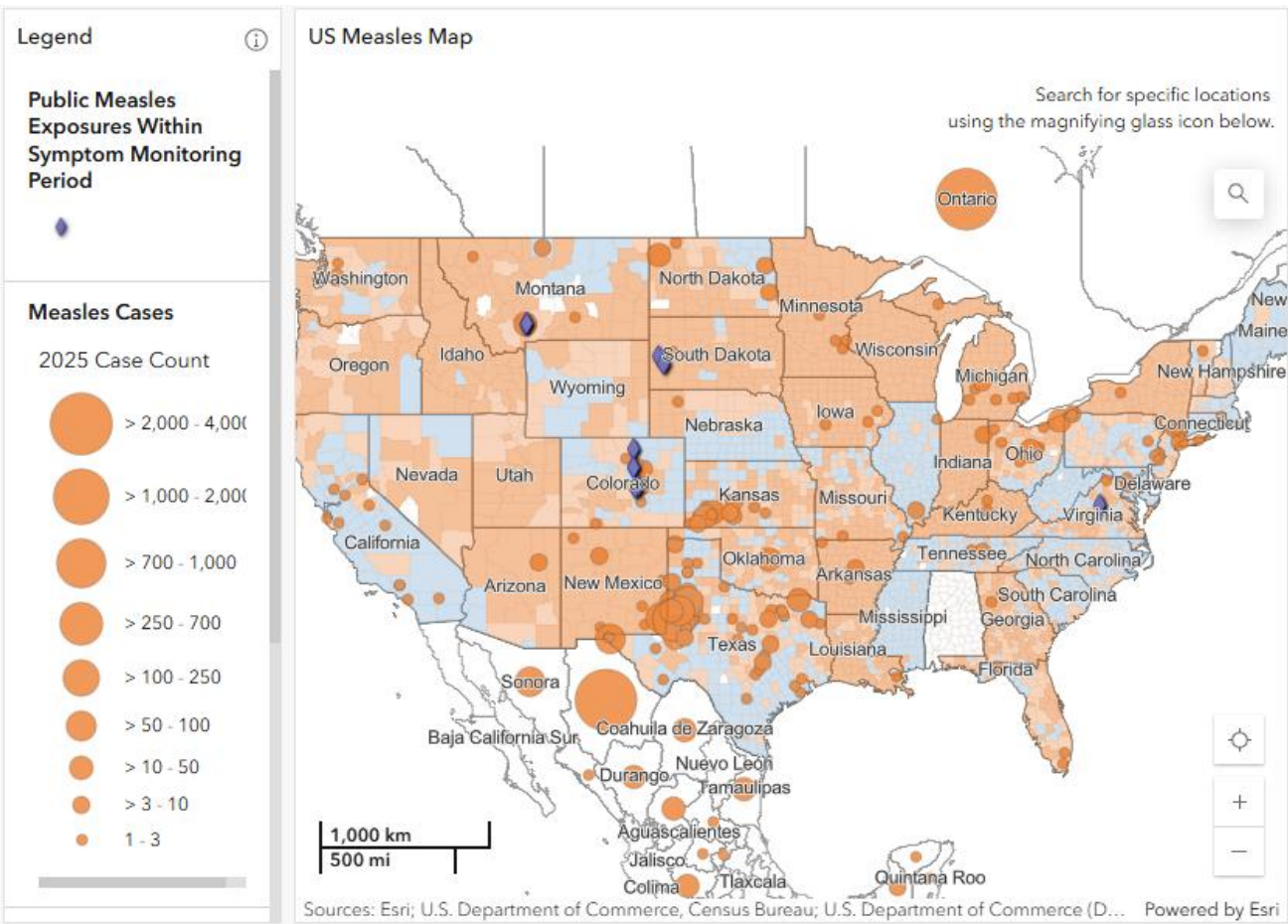
**Under 5 years: 21% (72 of 347)**

**5-19 years: 8% (35 of 446)**

**20+ years: 9% (36 of 393)**

**Age unknown: 9% (1 of 11)**





**Table of US Measles Cases in 2025** ⓘ

State	Confirmed Cases	Probable Cases
Texas	782	
New Mexico	81	
Kansas	78	
Ohio	35	
North Dakota	34	
Montana	22	
Oklahoma	17	3
California	15	
Colorado	15	0
Pennsylvania	15	
New York	13	
<b>Total</b>	<b>1,203</b>	<b>3</b>

To suggest data or provide feedback, please fill this [form](#).

Last update: 39 seconds ago

US Cases (Multiple Tabs)

**3**

Deaths from Measles in US

**5**

Deaths from Measles in Mexico

## Measles epidemiology- 6/18/25

- US:
  - Texas outbreak slowing down
  - Many other states with outbreaks smaller than Texas
  - Many individual cases associated with international travel (many different countries)
- Canada:
  - >2900 cases in 2025
  - Highest numbers in Ontario and Alberta
- Mexico:
  - >1900 confirmed cases in 2025, more probable cases
  - Highest numbers in Chihuahua
- Canadian, US, and Mexico outbreaks are linked

# Local and regional measles epidemiology- 6/18/25

- Colorado:
  - 5 cases March-April. Window for exposures in Colorado is closed.
    - 1 of these without international travel, worked in ski resort
  - 10 cases May-June
    - 8 of these linked to out-of-state traveler who flew while infectious; 4 with airport and 4 with plane exposures
    - Still within time window when contacts of some June cases could develop symptoms if infected.
  - All but 1 of cases have had international travel or been a contact of an international traveler.
  - No local spread outside the airport cases

# Colorado exposure location information

<https://cdphe.colorado.gov/diseases-a-to-z/measles/colorado-exposure-location-information>

Last updated: June 16, 2025

[Measles home](#)

If you were at any of the locations during the dates and times listed below, you may have been exposed to measles. People exposed to measles typically develop symptoms 7 to 21 days after exposure. People exposed to measles should monitor for symptoms for 21 days after exposure and consider avoiding public gatherings or high-risk settings. Monitoring for symptoms is especially critical for people who have not been vaccinated with the measles, mumps, and rubella (MMR) vaccine. Symptoms of measles include fever, cough, runny nose, red eyes, and a characteristic rash that usually starts several days later along the hair and face and spreads.

If you were at one of these locations during the exposure window and develop symptoms, immediately contact your health care provider by phone. If you do not have a provider, call an urgent care center or emergency department and explain that you may have been exposed to measles. Calling ahead helps prevent additional exposures.

[Expand All](#)

▼ Aurora

^ Boulder

Location	Date/time	When symptoms may develop
RTD Flatiron Flyer (Denver and Boulder) Exposure possible for travelers in both directions of bus route, morning and evening	Tuesday, June 3 6:45 - 9:35 a.m. 4:05 - 7:15 p.m.	Through June 24
RTD Flatiron Flyer (Denver and Boulder) Exposure possible for travelers in both directions of bus route, morning and evening	Thursday, June 5 6:45 - 9:35 a.m. 4:05 - 7:15 p.m.	Through June 26
RTD Flatiron Flyer (Denver and Boulder) Exposure possible for travelers in both directions of bus route, morning and evening	Friday, June 6 6:45 - 9:35 a.m. 4:05 - 7:15 p.m.	Through June 27

Communicable Diseases

Animal-related diseases >

Communicable Disease Manual

Diseases A to Z

Measles ▼

Colorado exposure location information

Measles vaccination recommendations with case(s) in Colorado

2025 Colorado measles case information

Emerging Infections Program (EIP)

Foodborne illness >

Healthcare-associated infections (HAIs) >

Infectious disease guidelines >

Project Firstline

Report a disease >

TB (tuberculosis) >



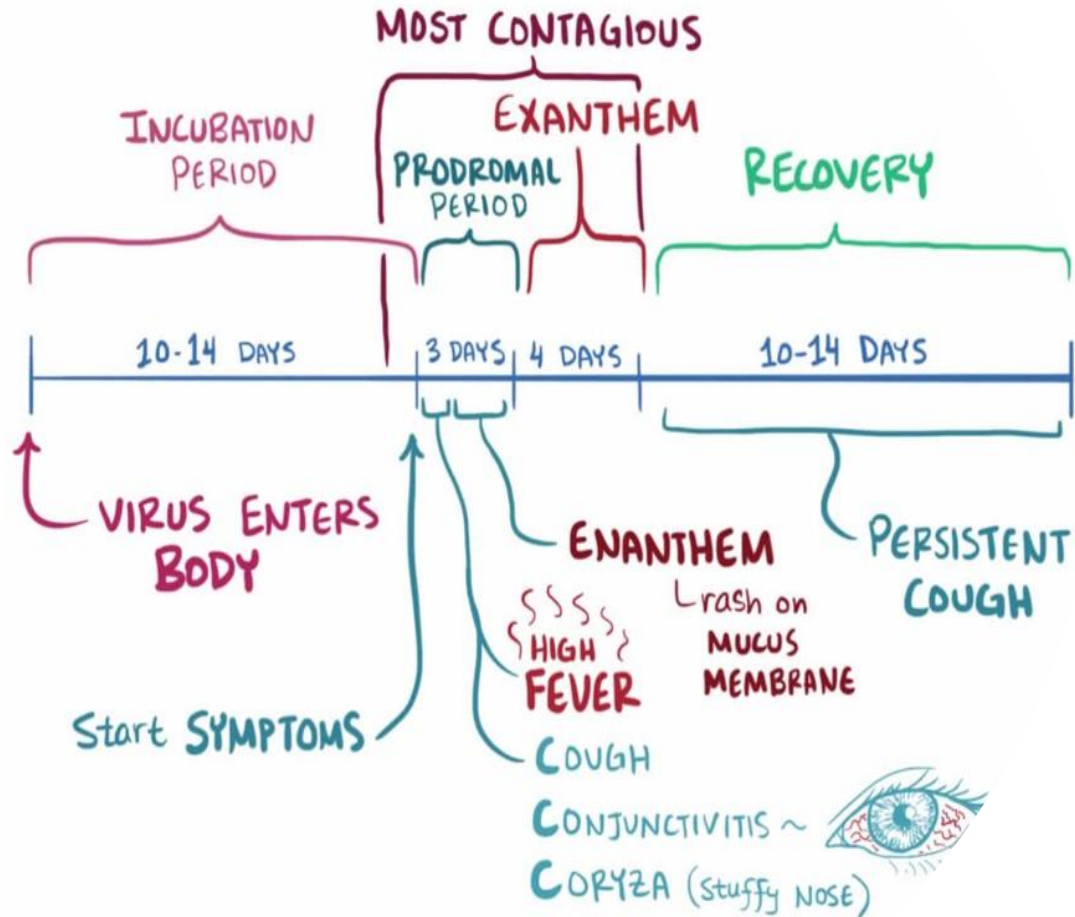
# IDENTIFY ISOLATE INFORM

# IDENTIFY:

## Clinical presentation, recognizing measles

A three-year-old boy has a chief complaint of **fever**. He also has a **rash**, is **coughing** and has **rhinorrhea**. His temperature is 39.2. Your colleague asks you if this patient could have measles.

What information will help you to assess the risk of measles in this patient?



## Measles symptoms

Long incubation

Contagious 4 days \*before\* rash

Koplik spots are uncommon

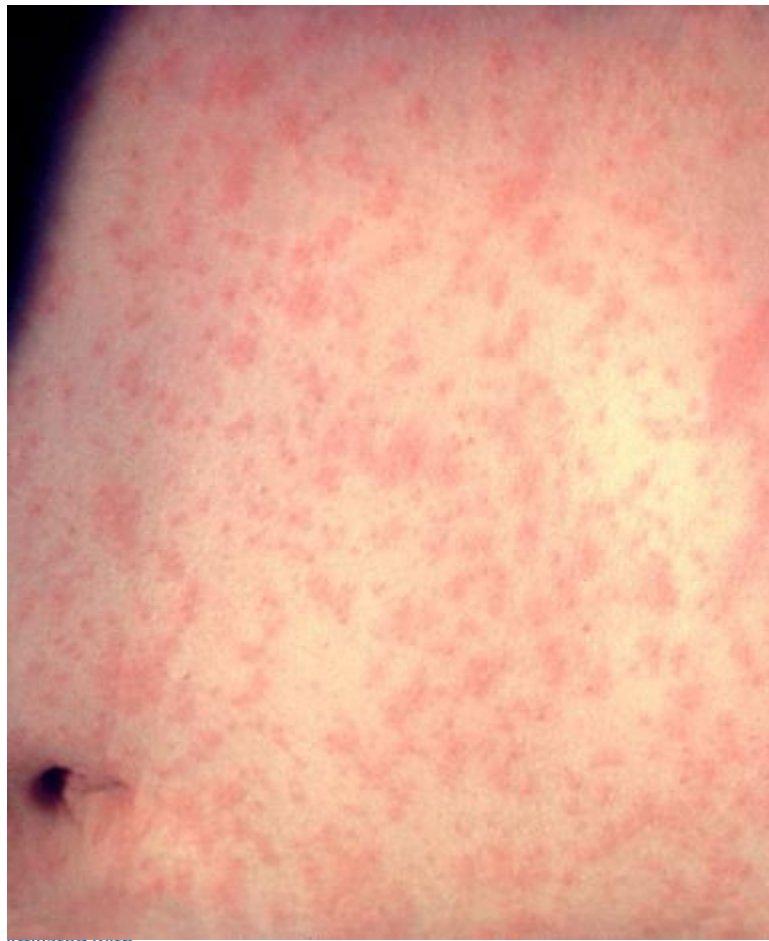
Rash:

- Starts on forehead, sometimes behind ears, then spreads downward
- Maculopapular → confluent

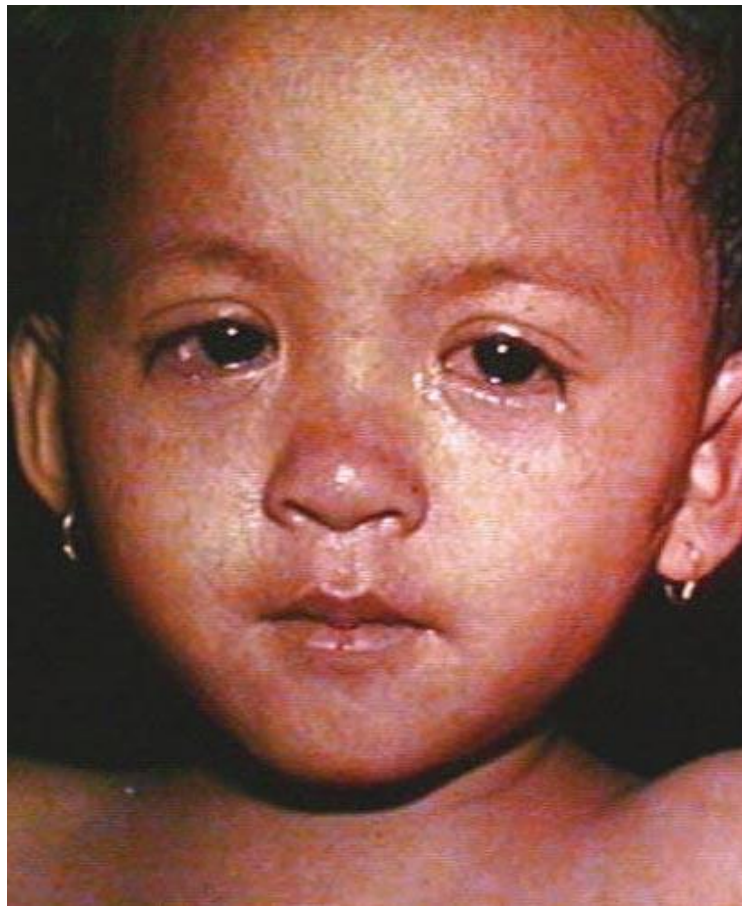






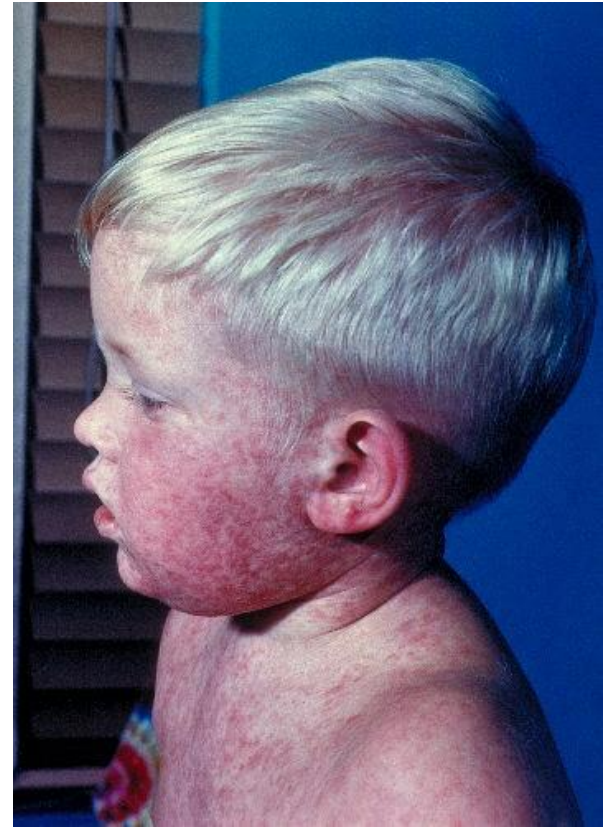


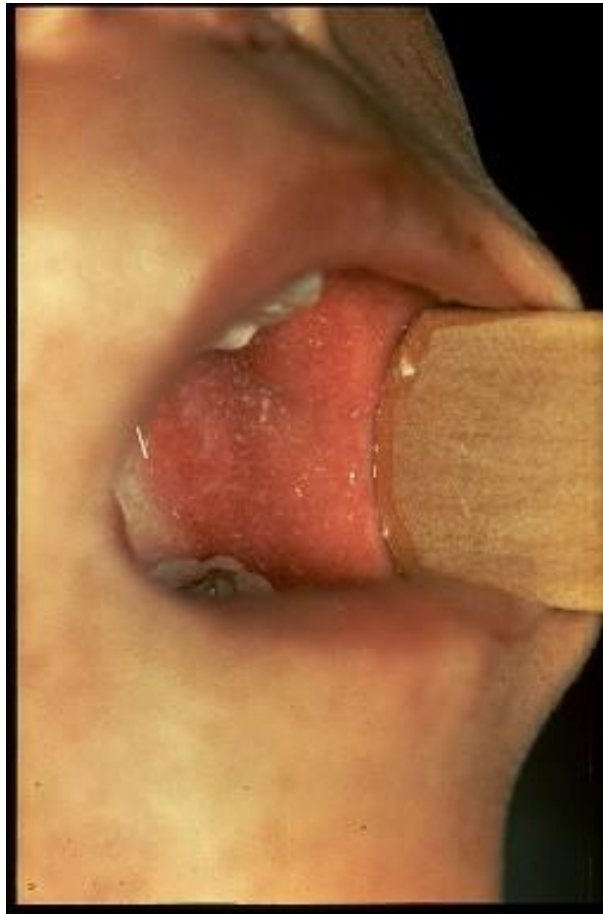
Animated with











# Assess History and Epidemiologic Risk factors

- History
  - Fever and rash after cough, coryza, conjunctivitis
  - Rash starting on head, consistent appearance & time course
- Epidemiologic risk factors:
  - Exposure to known measles case
  - International travel or travel within US to areas with known measles cases (check CDC website)
  - Has received fewer than 2 doses of MMR vaccine
  - Immune compromised- may have atypical presentation, less prominent rash





☐ 1. Does the patient have a fever (38.5 C or higher or subjective fever) in ED or at home?



# Firstline

☐ 2. Does the rash have any of the following clinical characteristics?

- Preceded by cough, red eyes (conjunctivitis), or runny nose (coryza)
- Fever overlapping with rash
- Rash starting on head or face

☐ 3. Does the patient have any of the following clinical symptoms?

- Cough
- Red eyes (conjunctivitis)
- Runny nose (coryza)

☐ 4. Is patient unvaccinated against measles?



☐ 5. Patient exposure to a known or suspected measles case?



☐ 6. Travel (international or somewhere other than Colorado) or other known high-risk exposure in past 21 days?



☐ 7. Is the patient immunocompromised?

▼ **When to Highly Suspect Measles**

**Note:** Algorithm will evolve as cases increase in CO

After downloading app/going to website, choose 'Children's Hospital Colorado' setting

## Download Firstline on Mobile

Scan the QR code with your device



## Measles resources in Firstline

- Targeted Guidance: Measles Evaluating Risk in Patients with **Fever and Rash**
- Targeted Guidance: Measles **Vaccination and Post-Exposure Prophylaxis**
- Measles virus page: includes **Vitamin A** information

After downloading app/going to website, choose 'Children's Hospital Colorado' setting

## Download Firstline on Mobile

Scan the QR code with your device



# Clinical Characteristics of 232 Laboratory-confirmed Measles Cases in California, Analyzed by the Number of Doses of MMR

		0 MCV Doses	1 MCV Dose	≥2 MCV Doses
Characteristic		(n = 186)	(n = 20)	(n = 26)
Hospitalized	Yes	53 (29)	5 (26)	2 (8)
	No	127 (71)	14 (74)	24 (92)
Cough	Yes	172 (94)	16 (80)	13 (50)
	No	11 (6)	4 (20)	13 (50)
Coryza	Yes	150 (83)	15 (88)	5 (20)
	No	30 (17)	2 (12)	20 (80)
Conjunctivitis	Yes	123 (71)	9 (53)	6 (24)
	No	50 (29)	8 (47)	19 (76)
Fever	Yes	180 (98)	19 (95)	22 (85)
	No	3 (2)	1 (5)	4 (15)

Fever and rash are most common

People with ≥1 MMR less likely to have cough, coryza, conjunctivitis

# Measles Mimickers:

consider age,  
history, rash  
morphology

## Infectious

- Roseola
- Enterovirus (hand-foot-mouth)
- EBV/CMV
- Scarlet fever
- Adenovirus
- Parvovirus
- Varicella
- Rickettsial disease
- HIV acute retroviral syndrome

## Non-infectious

- Urticaria
- Atopic dermatitis
- **Kawasaki Disease**
- Drug reaction /  
DRESS / Stevens  
Johnson Syndrome

Kawasaki Disease may  
be most difficult to  
distinguish: red eyes,  
red mouth, fever, rash

A three-year-old boy with a chief complaint of **fever**. He also has a **rash**, is **coughing** and has **rhinorrhea**. His temperature is 39.2. Your colleague asks you if this patient could have measles.

- Has **received 1 MMR**. Recent international travel.
- Fever started 3 days ago; **still febrile with rash**
- **Morbilliform rash started on forehead**, now on trunk and arms
- Has cough, coryza, no conjunctivitis

**You have decided to test the patient for measles. How will you do that?**



## Poll #1

How do you test this patient for measles?

1. Naso/oropharyngeal swab PCR
2. Serum IgM
3. Serum PCR
4. Naso/oropharyngeal swab PCR & serum IgM
5. Naso/oropharyngeal swab PCR & serum PCR

# Complications of Measles: Why do we care?

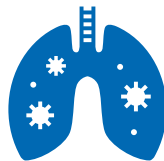
# Measles Complications: common

30% have  $\geq 1$  complication even in well-resourced settings

- Diarrhea 8%
- Otitis media 7%
- Pneumonia 6%
- Viral or bacterial superinfection



Hospitalization: 1 in 5 unvaccinated people with measles



Pneumonia: 1 in 20 children with measles



Encephalitis: 1 in 1000 children with measles



Death: 1-3 in 1000 children with measles



# Measles Complications

- **Pregnancy:** higher rates of fetal loss, preterm delivery
- **Immune compromised:** more complications, more severe disease, may have fewer / incomplete symptoms

# Measles

IT ISN'T JUST A LITTLE RASH



Measles can be dangerous, especially for babies and young children.

# Measles Complications: rare

- Encephalitis (1 in 1000)
  - Likely immune-mediated
  - Supportive care
  - Most often mild/self-limited, but can have lasting sequelae
- Subacute sclerosing pan-encephalitis (SSPE, 1 in 100,000)
  - Mean time from infection to SSPE = 10 years
  - Progressive deterioration in cognitive function, behavior → myoclonus → autonomic dysfunction → non-responsive state
  - May have seizures, rate of progression variable, often fatal

# Diagnostic testing

# Order and send testing

- Call your state and/or local health department
- $\leq 7$  days after rash onset:
  - Consult with public health department
  - Naso-/oropharyngeal swab for measles PCR testing
  - Blood (1-2mL) in red top or serum separator tube for measles IgM test.
  - Typically send these to public health lab

# Order and send testing

- >7 days after rash onset:
  - Blood (1-2mL) in red top or serum separator tube for measles IgM test
  - Respiratory specimen less likely to be positive
  - Typically send specimen to public health lab

## \*NOTES:

- Measles IgM testing can also be sent to commercial labs
- State health department lab may perform tests only after consultation and for high suspicion of measles



# ISOLATE:

## Infection prevention/control

# Measles transmission

- Very contagious:  $R^0 \approx 18$
- Airborne spread and contact with infectious droplets
- Patient infectious 4 days before through 4 days after rash onset
- Most infectious just before rash starts
- Cough associated with infectiousness

# Preventing exposures:

## Ideas for clinic and waiting room safety

- Screening questions:
  - Fever, rash, travel, exposure
  - Pre-visit, at check-in, in clinic
- Assess and record measles vaccination status for all visits
- Masking in waiting room:
  - Suspected measles, respiratory symptoms
  - Universal? Maybe if local outbreak
- For suspected measles, place in room ASAP
- Parking lot visit for testing



# Measles infection prevention and control

- Place patient in airborne and contact precautions immediately
- Gown, gloves, N95 for health care providers
- If negative pressure not available
  - Patient and any accompanying individuals should wear procedure mask
  - Place patient in regular room and keep door closed

# Measles infection prevention and control

- After patient leaves:
  - Patient and accompanying individuals should be masked if sending to another facility
  - Exam room (or other enclosed space) considered infectious for 2 hours after patient leaves.
  - Keep door closed.
  - Clean exam room using standard cleaning and disinfection protocols after 2 hours

**INFORM:**

**Call Public Health**

**Call other facilities if needed**

# Contact Public Health

- Call your state and/or local health department
- Colorado Department of Public Health and Environment:
  - 303-692-2700 (business hours)
  - 303-370-9395 (after hours)
- Call to report **suspected** case and determine procedure for recommended testing
- Measles information from CDPHE online here:  
<https://cdphe.colorado.gov/diseases-a-to-z/measles>

## If needed: communicate with other facilities

- If sending the patient to another facility (lab, ED, hospital):
  - Consult with public health department regarding suspect measles case
  - Contact receiving facility to be sure they can put patient on airborne and contact isolation
    - Most outpatient labs **DO NOT** have this ability
  - Provide facility with estimated time of arrival and parent cell phone number.

## If needed: communicate with other facilities

- If sending the patient to another facility (lab, ED, hospital):
  - Information for family:
    - Ask which entrance patient should use
    - Ask for phone number family can call on arrival and before they enter the facility
  - Give procedure masks to patient and any accompanying individuals for them to put on before they enter the facility

# If needed: communicate with other facilities

Children's Hospital Colorado: suspected measles, testing

- **Testing CANNOT be done in outpatient lab** (no negative pressure room), will need to be done in ED
- **Patients needing eval/testing should be seen in ED**
  - CHCO Anschutz, Colorado Springs, Broomfield, or Highlands Ranch
- Call
  - CDPHE (state health department)
  - CHCO Infectious Diseases **AND** CHCO ED
  - Provide family with instructions on prior slide



# Post-Exposure Prophylaxis



# Measles cases and exposures

- Any person with confirmed or suspected measles exposure should be reported to your public health department ASAP
- Measles **cases** should be isolated (stay home) through at least 4 days after rash onset

# Measles exposures

- Measles immunity: documentation of vaccination, +measles IgG, or history of measles infection
- **Non-immune contacts** of a measles case:
  - $\geq 6$  months age, immunocompetent: give **MMR vaccination** within 72 hours of exposure
  - $< 6$  months age, immune compromised, or pregnant: give **immune globulin** within 6 days of exposure
- **Quarantine: non-immune contacts** must quarantine

# Current immunization recommendations

# Measles vaccination recommendations

- Routine immunization: 2 dose series at 12-15 months & 4-6 years
- Catch-up: 2 doses given at least 4 weeks apart
- International travel, travel to or living in outbreak area:

## Infants under 12 months

- Get an **early dose at 6-11 months**
- Follow regular schedule: another dose at 12-15 months, final dose at 4-6 years

## Children over 12 months old

- Get **first dose immediately**
- Get **second dose 28 days after first dose**

## Teens / adults with no evidence of immunity

- Get **first dose immediately**
- Get **second dose 28 days after first dose**



## Poll #2

The mother of a 15- month-old patient living in Denver calls and would like the second dose of measles vaccine. No planned travel, immunizations are up-to-date.

Do you recommend early immunization?

1. Yes
2. No

# Measles vaccination questions

- When do we start widespread early MMR doses here?
  - Look for guidance from state and local public health
  - Single case different from outbreak, ongoing transmission
- Why not just give all children early doses?
  - MMR at <12 months: may have decreased immune response to later doses, still need 2 doses after 12 months
  - Doses after 12 months of age spaced 28 days apart count
  - Vaccine purchasing, stocking, delivery logistics

# Measles vaccination questions

- How to respond to families requesting an early dose?
  - Yes for international travel, living in or traveling to outbreak setting.
- Are MMR vaccines dangerous for immunocompromised people?
  - Immunocompromised person: should NOT get MMR (live vaccine)
  - Household contacts of immunocompromised person: SHOULD get MMR. Other people getting MMR vaccination does not pose risk to immunocompromised person.

# Measles vaccination recommendations: adults

- Presumptive immunity: documentation of vaccination, positive measles IgG, documentation of measles infection, birth before 1957
- Adults **born 1957 or later** without evidence of measles immunity should get at least 1 MMR. If high risk\* of exposure/travel, 2 doses.
- Adults **born after 1957 and vaccinated 1963-1967** may have received less effective measles vaccine and should be revaccinated with 1 or 2 MMR depending on risk\*.



- \*2 doses for health care workers, college students, international travelers, household contacts of immunocompromised people, people living with HIV



# Measles Treatment

# Measles treatment:

## Vitamin A does not prevent measles

- Treatment: Strong evidence for preventing complications, reducing morbidity and mortality among undernourished young children. Evidence outside that population less clear.
- Recommend Vitamin A treatment for children hospitalized with measles (CDC); and for outpatient measles disease too (WHO, AAP RedBook ‘many US experts’).

Vitamin A deficiency uncommon in US; children with selective eating habits or gastrointestinal disease may be at risk



# Measles treatment:

## Vitamin A does not prevent measles

Vitamin A dosing as part of measles supportive care

- < 6 months of age: 50,000 IU/dose
- 6-11 months of age: 100,000 IU/dose
- > 12 months of age: 200,000 IU/dose

Give once daily for 2 days

**Vitamin A toxicity:** GI/liver, neurologic, skin, musculoskeletal pathology, birth defects

Nausea/vomiting, headache, dizziness, hepatitis



# Measles treatment:

## Vitamin A does not prevent measles

- There is no effective antiviral treatment for measles.
- Treatment for measles is supportive care and directed treatment of complications.
- Antibiotics may be indicated for bacterial pneumonia if it occurs as a complication of measles.
- Inhaled budesonide is not an effective measles treatment.
- Clarithromycin is not an effective measles treatment.



# Useful Links

CDPHE: <https://cdphe.colorado.gov/diseases-a-to-z/measles>

Includes FAQs for measles in health care settings, EMS guidance

CDC: <https://www.cdc.gov/measles/>

AAP: <https://www.aap.org/en/patient-care/measles>

CHCO Measles Resources for Providers: <https://www.childrenscolorado.org/health-professionals/clinical-resources/measles/>



Charting Pediatrics Podcast: <https://www.childrenscolorado.org/health-professionals/professional-resources/charting-pediatrics-podcast/managing-measles-2025/>

# Questions?



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# Extra slides

# Post Vaccination Rash

- Occurs in about 5% of vaccinees
- Occurs 7-10 days post vaccination
- Can be accompanied by fever
- Can have similar presentation to wild type measles disease
- Will test + by PCR testing
- Many public health labs can distinguish shedding of wild-type virus from vaccine virus by PCR testing