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# **Measles, Mumps and Rubella**

# Measles

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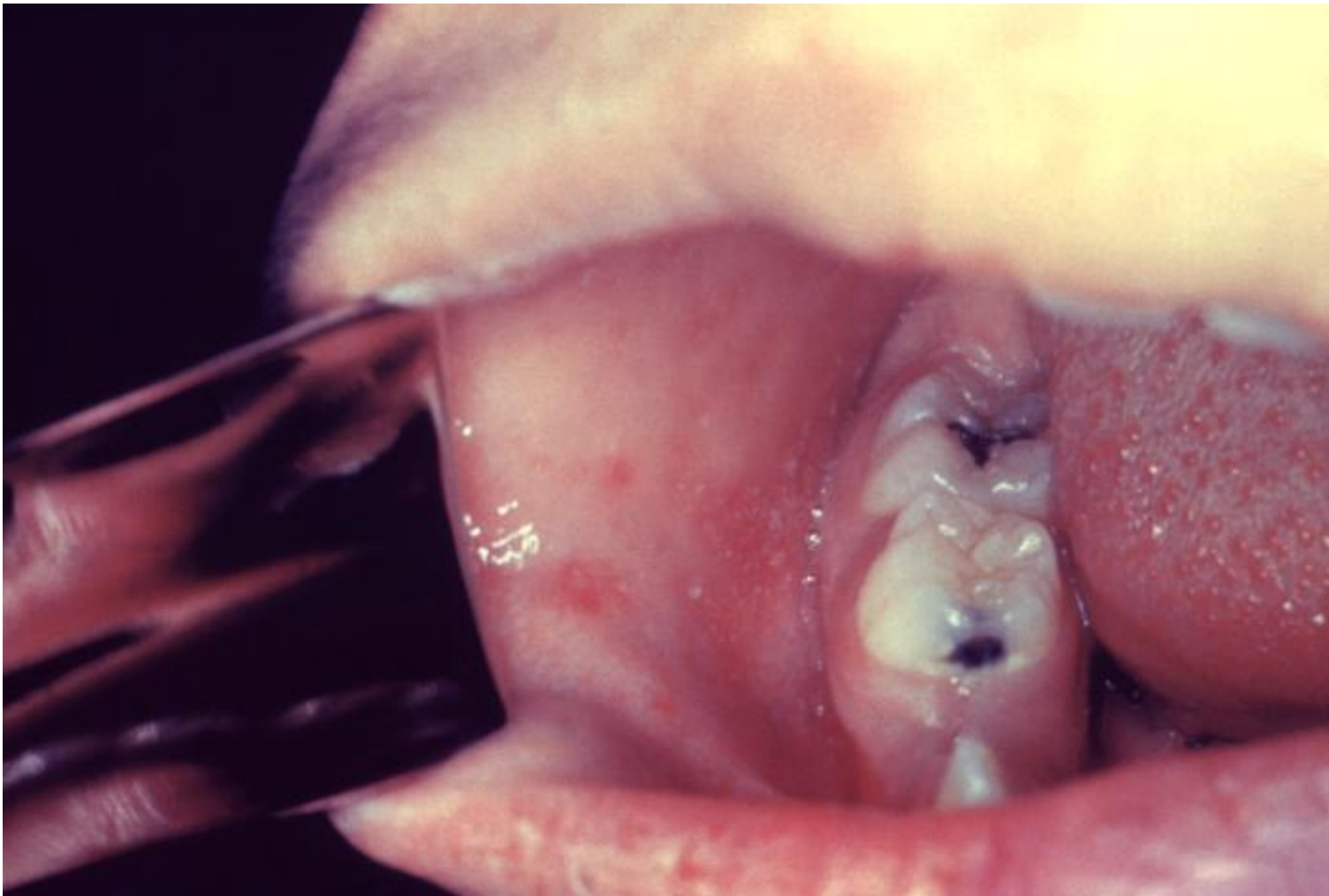
- Highly contagious viral illness
- First described in 7th century
- Near universal infection of childhood in prevaccination era
- Remains the leading cause of vaccine-preventable death in children
- Paramyxovirus (RNA)
- Rapidly inactivated by heat and light

# Measles Pathogenesis and Clinical Features

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- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
- Primary viremia 2-3 days after exposure
- Secondary viremia 5-7 days after exposure with spread to tissues
- Incubation period 10-12 days
- Stepwise increase in fever to 103°F or higher
- Cough, coryza, conjunctivitis
- Koplik spots
- 2-4 days after prodrome, 14 days after exposure
- Maculopapular, becomes confluent
- Begins on face and head
- Persists 5-6 days
- Fades in order of appearance





**KOPLIK SPOT**



 ADAM

# Measles Complications

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<u>Condition</u>	<u>Percent reported</u>
Diarrhea	8
Otitis media	7
Pneumonia	6
Encephalitis	0.1
Hospitalization	18
Death	0.2

Based on 1985-1992 surveillance data

# Measles Epidemiology

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- Reservoir Human
- Transmission Respiratory Airborne
- Temporal pattern Peak in late winter–spring
- Communicability 4 days before to 4 days after rash onset



# Measles Vaccine

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- Composition                      Live virus
- Efficacy                            95% (range, 90%-98%)
- Duration of  
Immunity                            Lifelong
- Schedule                           2 doses
- Should be administered with mumps and rubella as MMR, or with mumps, rubella and varicella as MMRV
- 1941 - 894,134 U.S. cases
- 1995 - 288 U.S. cases

# Vaccine Failure

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- Infants vaccinated at  $<12\text{m}$  who were born to naturally-infected mothers may not develop sustained antibody levels when later revaccinated
- Primary failure
  - No seroconversion
- Secondary failure
  - Loss of protection after seroconversion

# **Measles Vaccine**

## **Indications for Revaccination**

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- Vaccinated before the first birthday
- Vaccinated with killed measles vaccine
- Vaccinated prior to 1968 with an unknown type of vaccine
- Vaccinated with IG in addition to a further attenuated strain or vaccine of unknown type

# Mumps

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- Acute viral illness
- Parotitis and orchitis described by Hippocrates in 5th century BC
- Viral etiology described by Johnson and Goodpasture in 1934
- Frequent cause of outbreaks among military personnel in prevaccine era

# Mumps Virus

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- Paramyxovirus
- RNA virus
- One antigenic type
- Rapidly inactivated by chemical agents, heat, and ultraviolet light

# Mumps Pathogenesis

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- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
- Viremia 12-25 days after exposure with spread to tissues
- Multiple tissues infected during viremia

# Mumps Clinical Features

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- Incubation period 14-18 days
- Nonspecific prodrome of myalgia, malaise, headache, low-grade fever
- Parotitis in 30%-40%
- Up to 20% of infections asymptomatic





# Mumps Complications

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<b>CNS involvement</b>	<b>15% of clinical cases</b>
<b>Orchitis</b>	<b>20%-50% in post-pubertal males</b>
<b>Pancreatitis</b>	<b>2%-5%</b>
<b>Deafness</b>	<b>1/20,000</b>
<b>Death</b>	<b>Average 1 per year (1980 – 1999)</b>

# Mumps Epidemiology

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- Reservoir                      Human  
Asymptomatic infections may transmit
- Transmission                Respiratory drop nuclei
- Temporal pattern          Peak in late winter and spring
- Communicability          Three days before to four days after onset of active disease

# Mumps Outbreak, 2006

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- Source of the initial cases unknown
- Outbreak peaked in mid-April
- Median age of persons reported with mumps was 22 years
- Highest incidence was among young adults 18-24 years of age, many of whom were college students
- Transmission of mumps virus occurred in many settings, including college dormitories and healthcare facilities

# Factors Contributing To Mumps Outbreak, 2006

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- College campus environment
- Lack of a 2-dose MMR college entry requirement or lack of enforcement of a requirement
- Delayed recognition and diagnosis of mumps
- Mumps vaccine failure
- Vaccine might be less effective in preventing asymptomatic infection or atypical mumps than in preventing parotitis
- Waning immunity

# Passive immunization against mumps

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- Immune globulin ineffective for postexposure prophylaxis
  - does not prevent disease or reduce complications
- Transplacental maternal antibody appears to protect infants for first year of life

# Mumps Vaccine

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- Composition                      Live virus (Jeryl Lynn strain)
- Efficacy                              95% (Range, 90%-97%)
- Duration of Immunity              Lifelong
- Schedule                             $\geq 1$  Dose
- Should be administered with measles and rubella (MMR) or with measles, rubella and varicella (MMRV)

# Rubella

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- From Latin meaning "little red"
- Discovered in 18th century - thought to be variant of measles
- First described as distinct clinical entity in German literature
- Congenital rubella syndrome (CRS) described by Gregg in 1941

# Rubella Virus

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- Togavirus
- RNA virus
- One antigenic type
- Rapidly inactivated by chemical agents, ultraviolet light, low pH, and heat



# Rubella Pathogenesis

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- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
- Viremia 5-7 days after exposure with spread to tissues
- Placenta and fetus infected during viremia

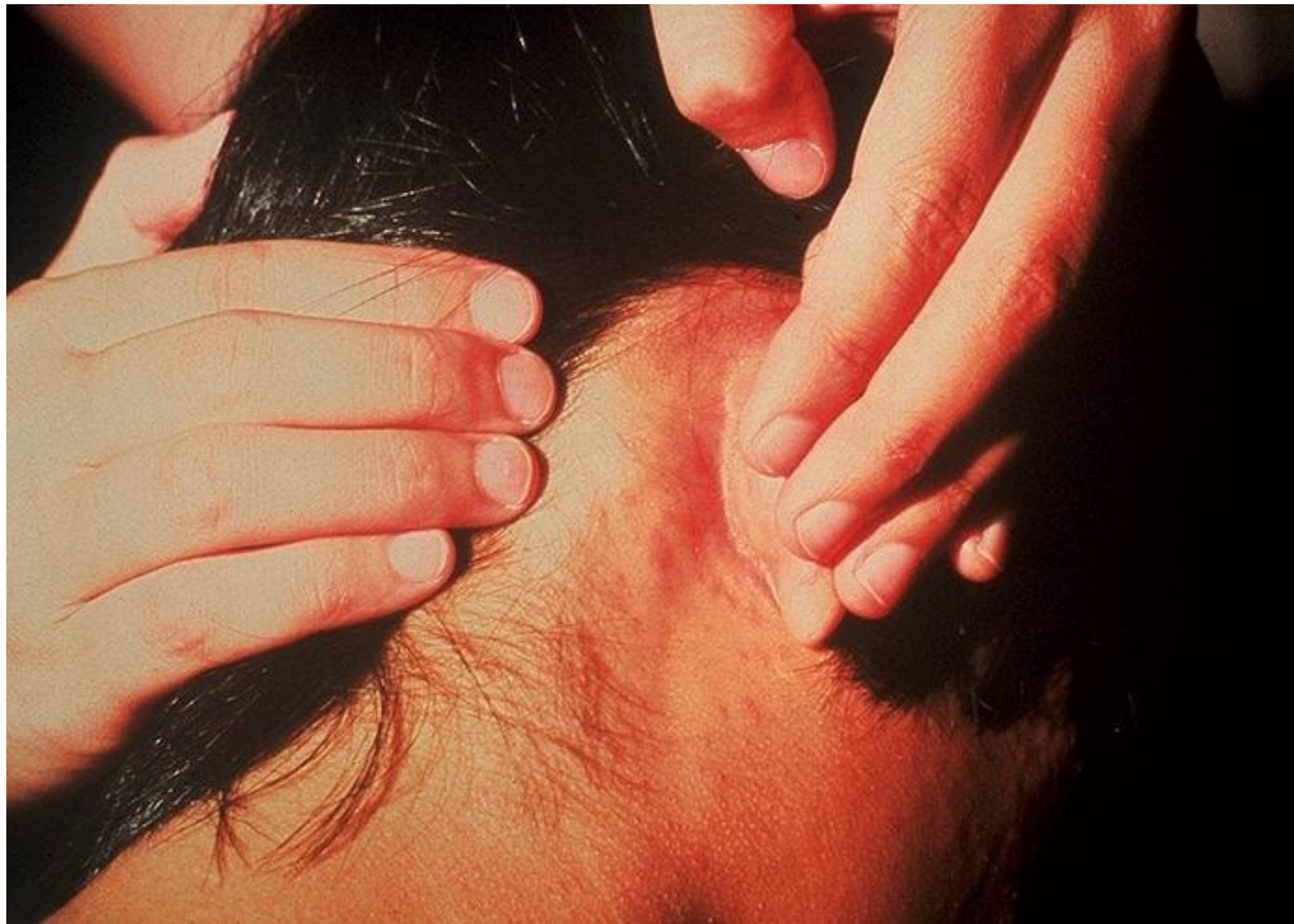
# Rubella Clinical Features

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- Incubation period 14 days  
(range 12-23 days)
- Prodrome of low-grade fever
- Maculopapular rash 14-17 days after exposure
- Usually quite mild



Image in a 4-year-old girl with a 4-day history of low-grade fever, symptoms of an upper respiratory tract infection, and rash.  
Courtesy of Pamela L. Dyne, MD.



# Epidemic Rubella – United States, 1964-1965

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- 12.5 million rubella cases
- 2,000 encephalitis cases
- 11,250 abortions (surgical/spontaneous)
- 2,100 neonatal deaths
- 20,000 CRS cases
  - deaf - 11,600
  - blind - 3,580
  - mentally retarded - 1,800

# Congenital Rubella Syndrome

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- Infection may affect all organs
- May lead to fetal death or premature delivery
- Severity of damage to fetus depends on gestational age
- Up to 85% of infants affected if infected during first trimester

# **Congenital Rubella Syndrome**

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- Deafness
- Cataracts
- Heart defects
- Microcephaly
- Mental retardation
- Bone alterations
- Liver and spleen damage





Photo source: U.S. Centers for Disease Control and Prevention





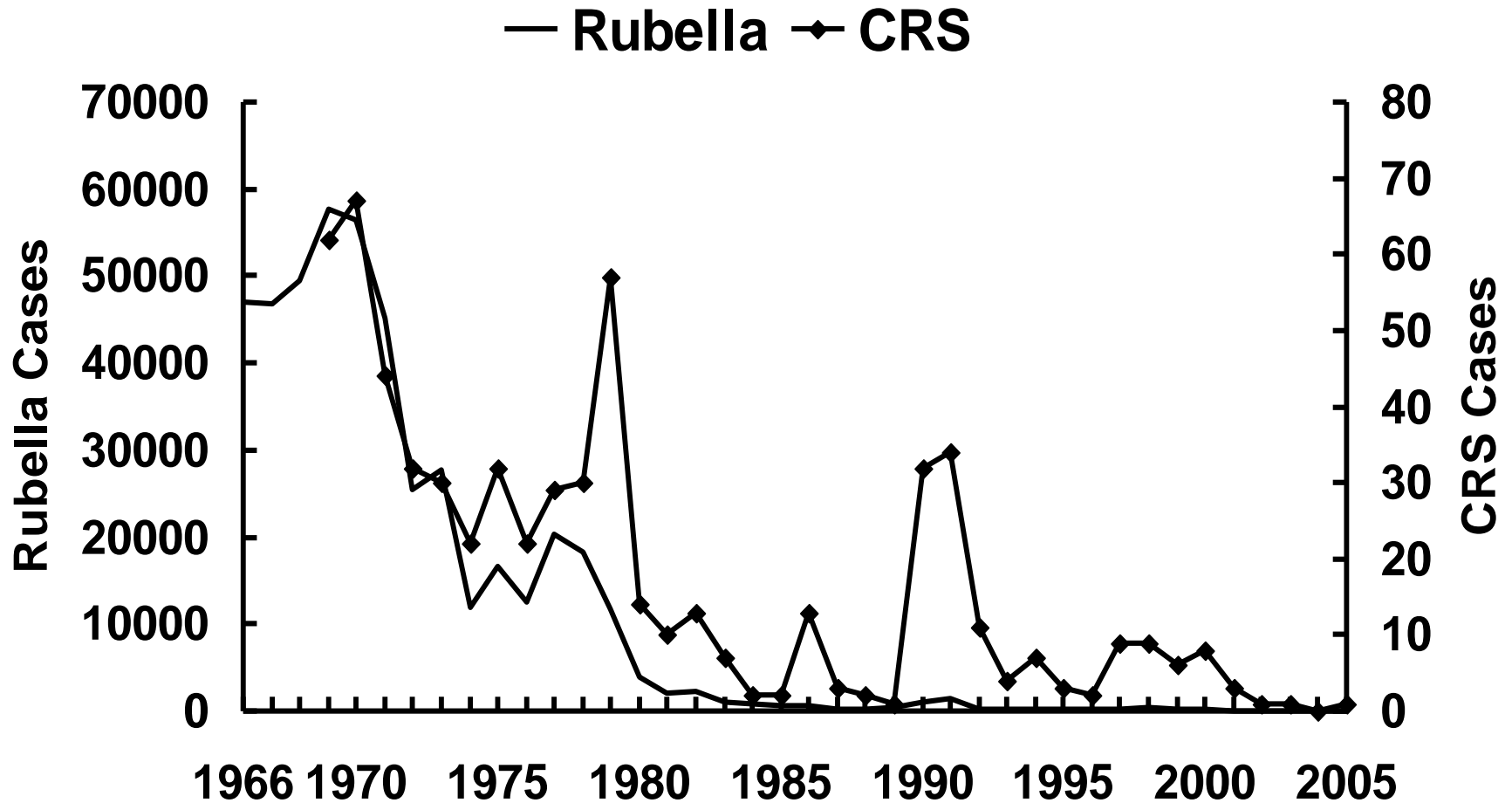
# Rubella Epidemiology

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- Reservoir Human
- Transmission Respiratory Subclinical cases may transmit
- Temporal pattern Peak in late winter and spring
- Communicability 7 days before to 5-7 days after rash onset  
Infants with CRS may shed virus for a year or more

# Rubella - United States, 1966-2005

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# Rubella Vaccine

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- Composition Live virus (RA 27/3 strain)
- Efficacy 95% (Range, 90%-97%)
- Duration of Immunity Lifelong
- Schedule At least 1 dose
- Should be administered with measles and mumps as MMR or with measles, mumps and varicella as MMRV

# Rubella Vaccine Arthropathy

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- Acute arthralgia in about 25% of vaccinated, susceptible adult women
- Acute arthritis-like signs and symptoms occurs in about 10% of recipients
- Rare reports of chronic or persistent symptoms
- Population-based studies have not confirmed an association with rubella vaccine

# Vaccination of Women of Childbearing Age

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- Ask if pregnant or likely to become so in next 4 weeks
- Exclude those who say "yes"
- For others
  - explain theoretical risks
  - vaccinate

# **Vaccination in Pregnancy**

## **Study 1971-1989**

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- 321 women vaccinated
- 324 live births
- No observed CRS
- 95% confidence limits 0%-1.2%

# Measles Mumps Rubella Vaccine

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- 12 -15 months is the recommended and minimum age (more effective at 15 months)
- MMR given before 12 months should not be counted as a valid dose
- 2<sup>nd</sup> dose at 4-6 years



# MMR Adverse Reactions

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- Fever 5%-15%
- Rash 5%
- Joint symptoms 25%
- Thrombocytopenia <1/30,000 doses
- Parotitis rare
- Deafness rare
- Encephalopathy <1/1,000,000 doses

# MMR Vaccine and Autism

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- Measles vaccine connection first suggested by British gastroenterologist
- Diagnosis of autism often made in second year of life
- Multiple studies have shown **NO** association

# **MMR Vaccine**

## **Contraindications and Precautions**

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- Severe allergic reaction to vaccine component or following prior dose
- Pregnancy
- Immunosuppression
- Moderate or severe acute illness
- Recent blood product

# Measles and Mumps Vaccines and Egg Allergy

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- Measles and mumps viruses grown in chick embryo fibroblast culture
- Studies have demonstrated safety of MMR in egg allergic children
- Vaccinate without testing

# Measles Vaccine and HIV Infection

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- MMR recommended for persons with asymptomatic and mildly symptomatic HIV infection
- NOT recommended for those with evidence of severe immuno- suppression

# MMR Vaccines

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<b>Component, per 0.5 ml dose</b>	<b>Measles (Attenuvax) Merck</b>	<b>Mumps Jeryl Lynn Strain Merck</b>	<b>Rubella (Meruvax) Merck</b>	<b>MMR-II Merck</b>
<b>Measles virus</b>	>1,000 TCID <sub>50</sub>			>1,000 TCID <sub>50</sub>
<b>Mumps virus</b>		>20,000 TCID <sub>50</sub>		>20,000 TCID <sub>50</sub>
<b>Rubella virus</b>			>1,000 TCID <sub>50</sub>	>1,000 TCID <sub>50</sub>
<b>Sorbitol</b>	14.5 mg	14.5 mg	14.5 mg	14.5 mg
<b>Sodium phosphate</b>				
<b>Sucrose</b>	1.9 mg	1.9 mg	1.9 mg	1.9 mg
<b>NaCl</b>				
<b>Gelatin</b>	14.5 mg	14.5 mg	14.5 mg	14.5 mg
<b>Human albumin</b>	0.3 mg	0.3 mg	0.3 mg	0.3 mg
<b>Fetal bovine serum</b>	<1 ppm	<1 ppm	<1 ppm	<1 ppm
<b>Neomycin</b>	~25µg	~25µg	~25µg	~25µg