



Measles, Mumps, and Rubella

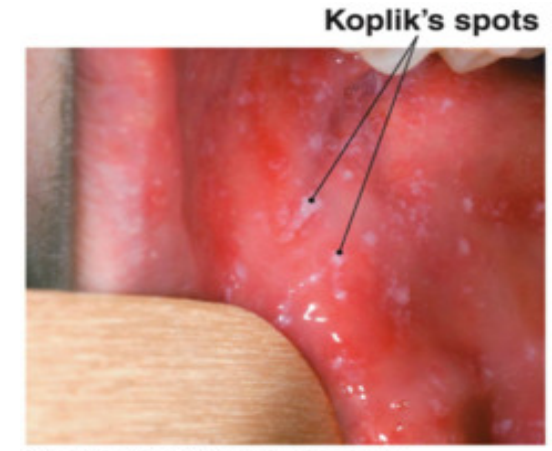
Chapters 13, 15, and 20

1

Disease

Measles

- **Paramyxovirus**
 - Nasopharynx is primary site of infection
- **Incubation period is 10–12 days**
- **Prodrome is 2–4 days**
 - 3 Cs – cough, coryza, and conjunctivitis
 - Stepwise increase in fever up to 103°F–105°F
 - Koplik spots
- **Rash occurs 2–4 days after prodrome, 14 days after exposure, and persists 5–6 days**
 - Begins on face and upper neck
 - Maculopapular, becomes confluent
 - Fades in order of appearance



Measles Complications

Complication	Rate
Diarrhea	8%
Otitis media	7%
Pneumonia	6%
Encephalitis	0.1%
Seizures	0.6–0.7%
Death	0.2%

Mumps

- **Paramyxovirus**
 - Nasopharynx and regional lymph nodes are primary sites of infection
- **Incubation period is 12–25 days**
- **Prodrome is nonspecific**
 - Myalgia
 - Anorexia
 - Malaise
 - Headache
 - Low-grade fever
- **Parotitis in 9%–94%, typically occurs within 16–18 days**
- **Prevaccine era: 15%–27% of infections were asymptomatic**



Mumps Complications

Complication	Rate
Orchitis	12%–66% in postpubertal males (prevaccine) 3%–10% (postvaccine)
Pancreatitis	3.5% (prevaccine)
Unilateral deafness	1/20,000 (prevaccine)
Death	2/10,000 from 1966–1971

Rubella

- **Togavirus**
- **Incubation period is 14 days (range: 12–23 days)**
- **Prodrome**
 - Rare in children
 - Low-grade fever in adults
- **Maculopapular rash 14–17 days after exposure**
- **Lymphadenopathy occurs before rash and lasts for several weeks**



Rubella Complications

Complication	Rate
Arthritis or arthralgia	May occur in up to 70% of adult women, but is rare in children and adult males
Encephalitis	1/6,000 cases
Hemorrhagic manifestations (e.g., thrombocytopenic purpura)	1/3,000 cases
Orchitis, neuritis, progressive panencephalitis	Rare

Congenital Rubella Syndrome

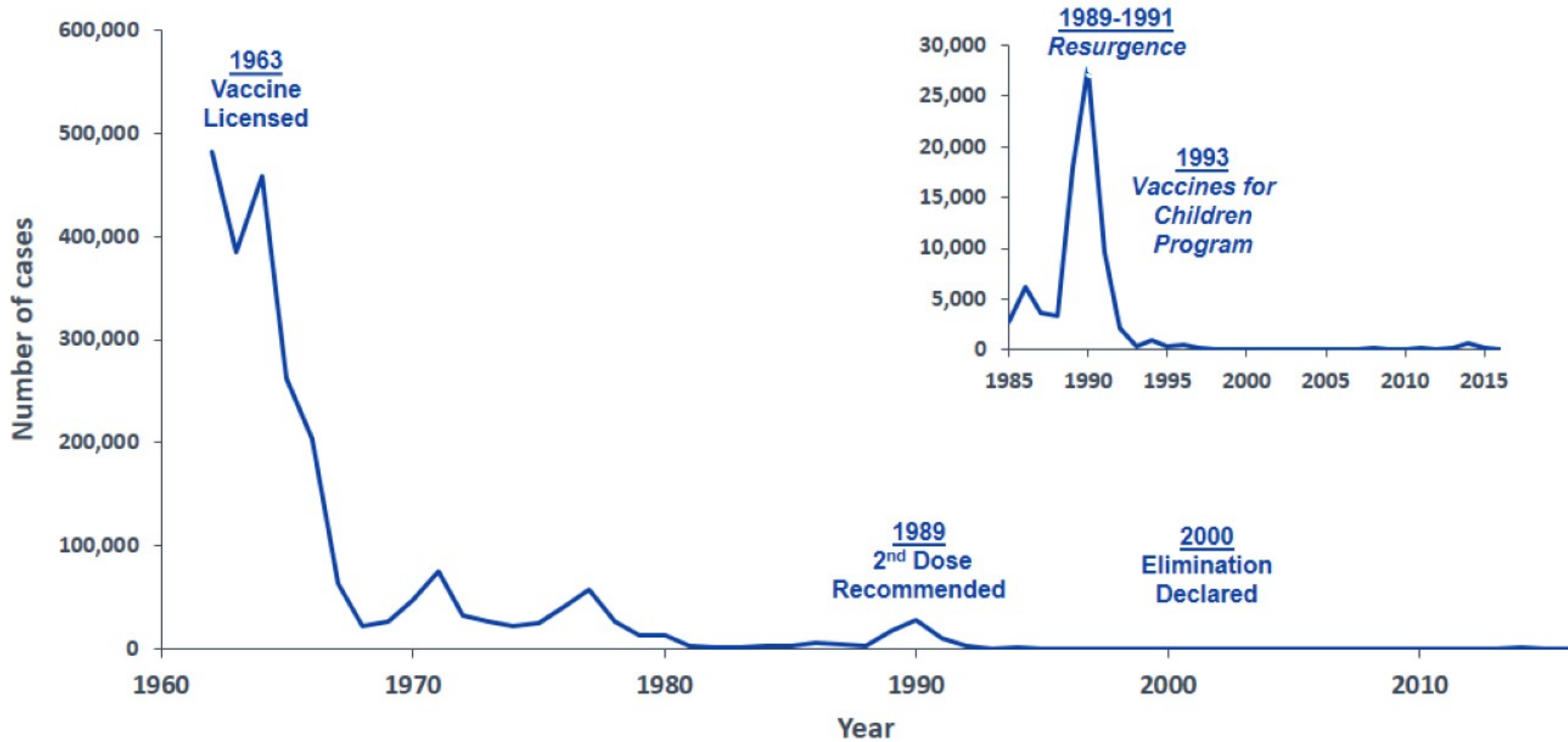
- **Rubella infection may affect fetal organs, causing:**
 - Hearing impairment
 - Eye defects
 - Cardiac defects
 - Microcephaly
 - Intellectual disabilities
 - Bone alterations
 - Liver and spleen damage
- **May lead to fetal death or preterm delivery**
- **Severity of damage to fetus depends on gestational age**



Epidemiology

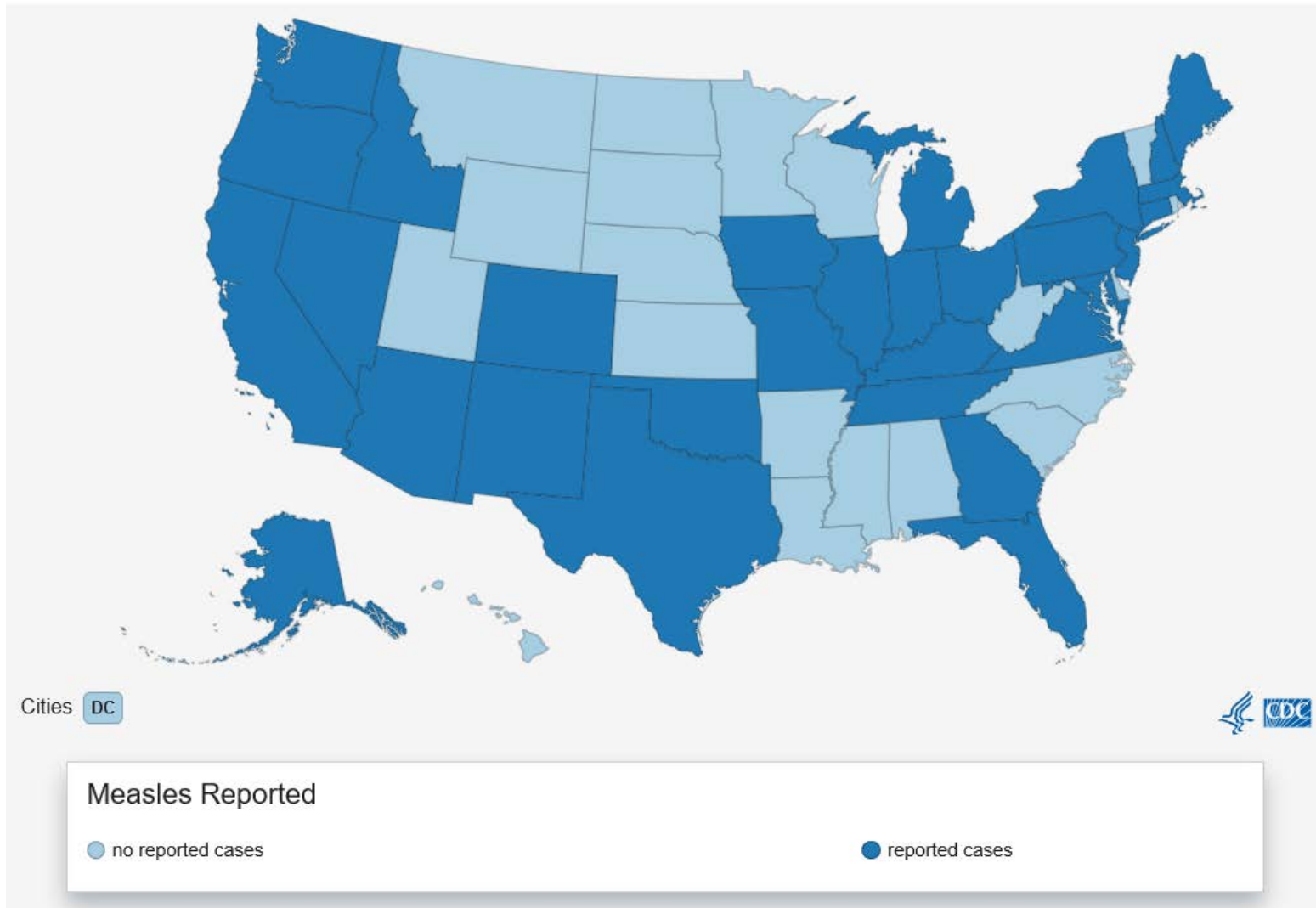
	Measles	Mumps	Rubella
Reservoir	Human	Human	Human
Transmission	Direct contact with infectious droplets or by airborne spread	Direct contact with saliva or respiratory droplets	Direct or droplet contact from nasopharyngeal secretions
Temporal Pattern	Peaks in late winter/spring	Peaks in late winter/spring	Peaks in late winter/spring
Communicability	4 days before to 4 days after rash onset	Several days before and after onset of parotitis	7 days before to 5–7 days after rash onset

Measles Cases, United States, 1962-2016*



*2016 data is preliminary and subject to change

States with Reported Measles Cases (as of 8/1/2019)

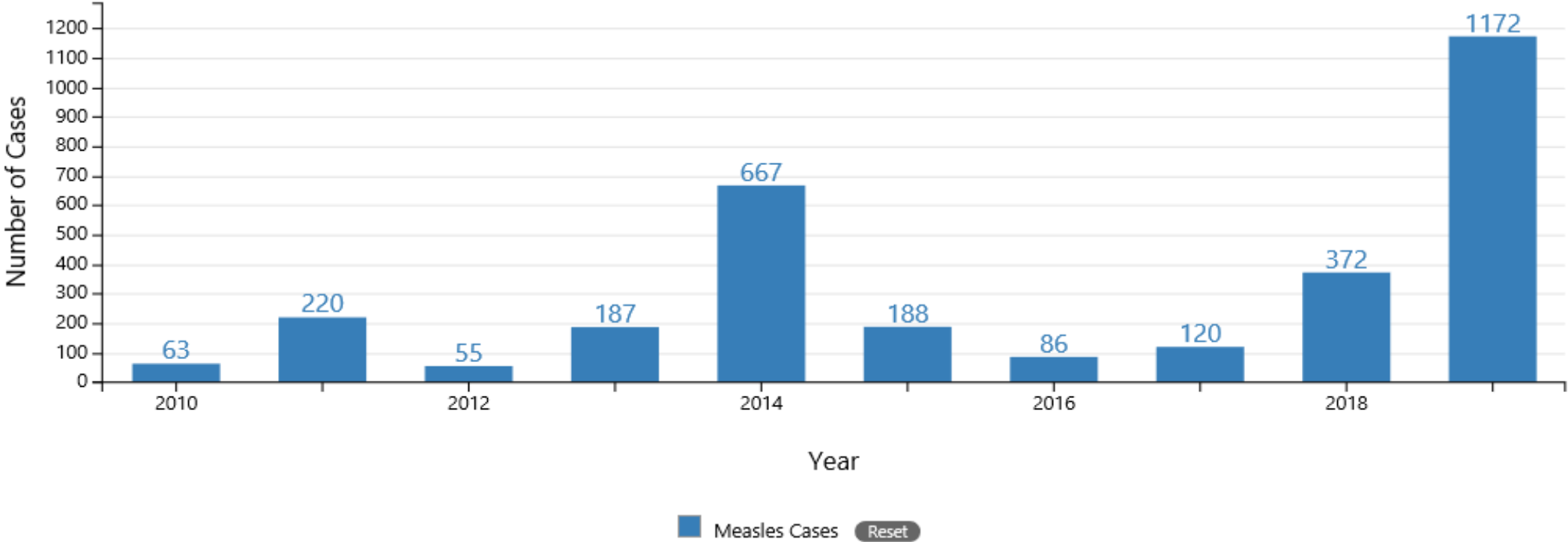


The states that have reported cases to CDC are Alaska, Arizona, California, Colorado, Connecticut, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Missouri, New Mexico, Nevada, New Hampshire, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Texas, Tennessee, Virginia, and Washington.

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

Number of Measles Cases Reported by Year

2010-2019** (as of August 1, 2019)



Data Table -

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Measles Cases	63	220	55	187	667	188	86	120	372	1172

Guidance for Health Care Personnel

- **Be vigilant about measles**
- **Ensure EVERYONE is up to date on MMR vaccination**
 - Staff and patients—children, adolescents, and adults
- **Consider measles in patients with febrile rash illness and clinically compatible measles symptoms (cough, coryza, and conjunctivitis)**
- **Ask patients about:**
 - Recent travel internationally
 - Recent travel to domestic venues frequented by international travelers
 - Recent contact with international travelers
 - History of measles in the community
- **Promptly isolate patients with suspected measles**

Measles Resources


CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People™

A-Z Index

Search

Measles (Rubeola)

Facebook Twitter Email Print



Prevent Measles with MMR Vaccine

Make sure you and your loved ones are up to date with the measles vaccine, especially if you're traveling.

Vaccines for Measles

Questions About Measles

Signs and Symptoms

For Healthcare Professionals

Top Things Parents Need to Know


Resources

About Measles

For Health Departments


Transmission

Lab Tools




Passport

Planning a trip outside the U.S?
[Find out if you need measles vaccine](#)



Measles Outbreaks Reported to CDC

Measles cases and outbreaks related to unvaccinated international travelers are ongoing in several jurisdictions in the U.S. in 2019.



Know what to look for in patients that may have measles, when to recommend MMR vaccine, and other details about the virus.

Learn More

www.cdc.gov/measles/index.html, www.cdc.gov/measles/toolkit/index.html,
and www.cdc.gov/measles/resources/multimedia.html

Measles Outbreak Toolkits



OUTBREAK RESPONSE

communications toolkit



CS269662

CDC would like to support communities being affected by measles outbreaks by providing them with accurate, scientific-based information to counter misinformation. Click below to find resources designed for you:



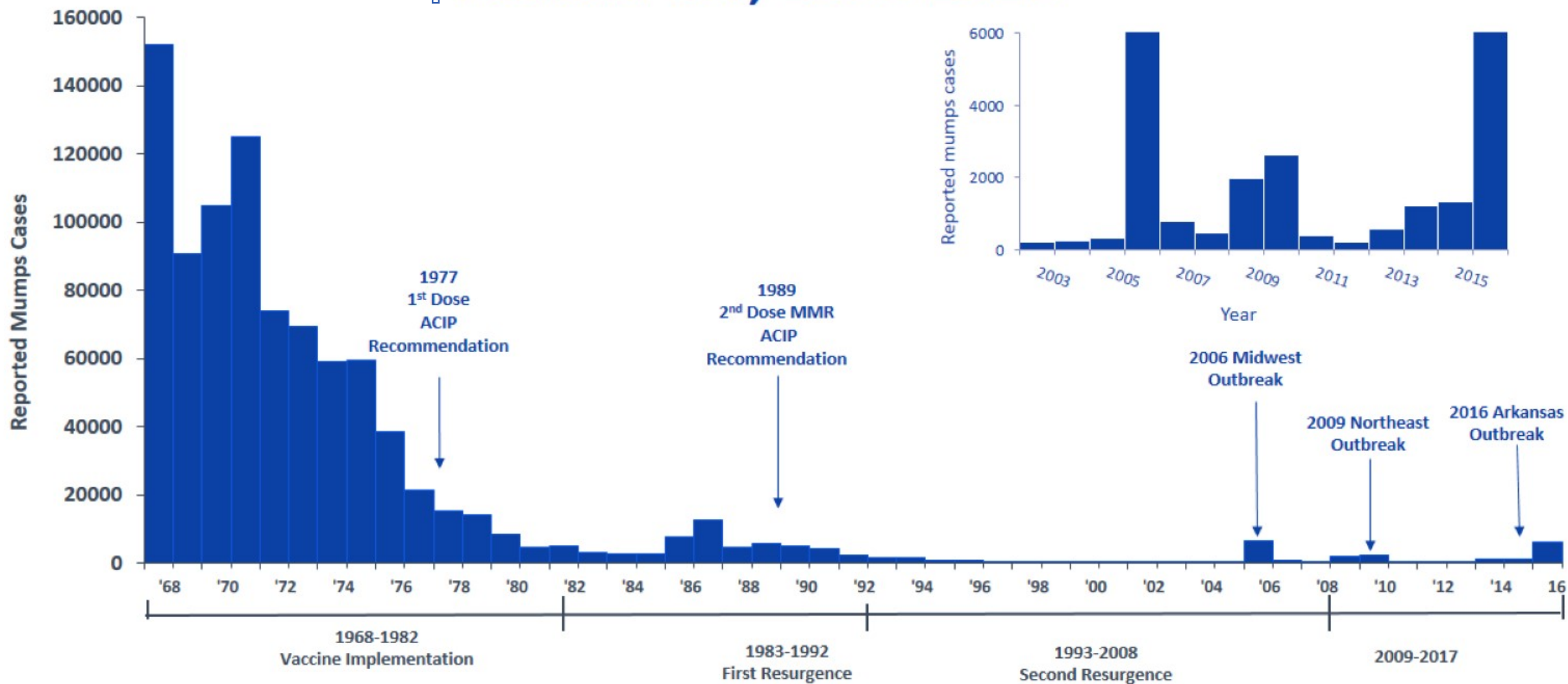
Healthcare Providers



Local/State Health Departments

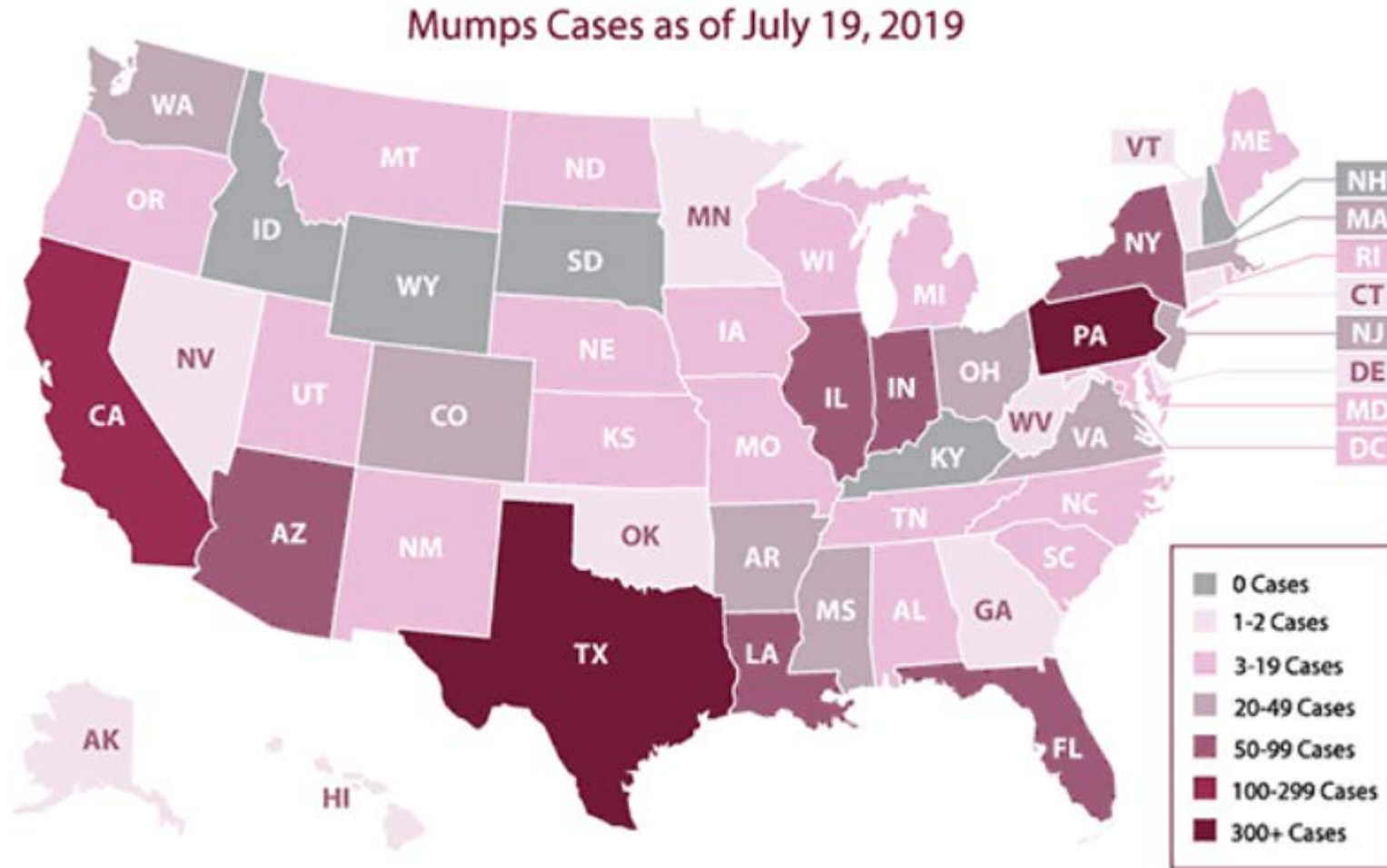


Reported Mumps Cases, United States, Vaccine Era, 1968-2016*



Source: National Notifiable Disease Surveillance System (passive surveillance); 2016 data is preliminary and subject to change

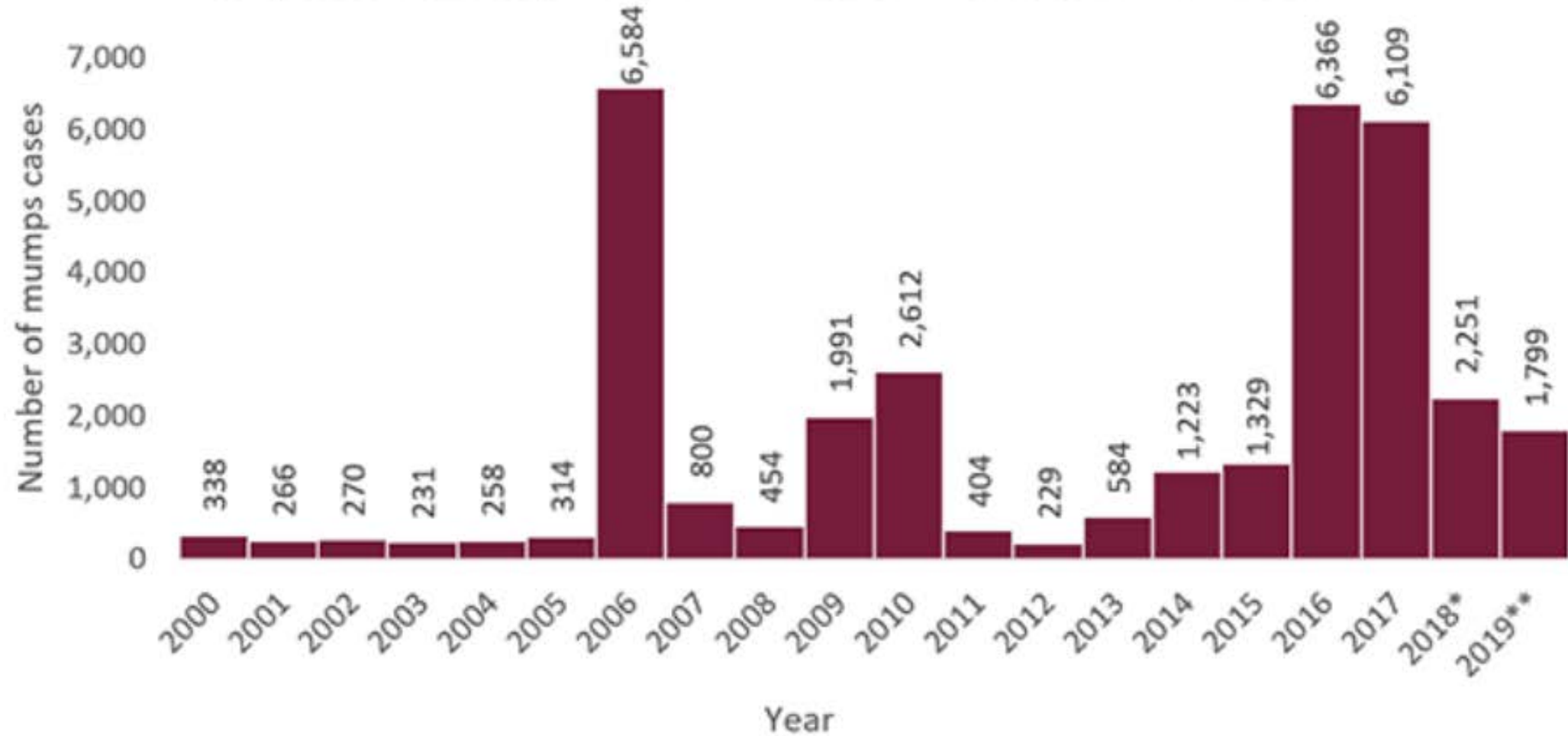
U.S. Mumps Cases as of July 19, 2019



*AL, AK, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, IL, IN, KS, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, TN, TX, UT, VA, VT, WA, WI, WV

**Preliminary data reported to CDC. Mumps outbreaks are not reportable.

Reported mumps cases — United States, 2000–2019*



* Case count is preliminary and subject to change.

**Cases as of July 19, 2019. Case count is preliminary and subject to change.

<https://www.cdc.gov/mumps/outbreaks.html>

Suspect Mumps?

- **Health care professionals should be vigilant about mumps:**
 - Consider mumps in patients presenting with fever and parotitis
 - **Promptly isolate patients** for 5 days after the glands begin to swell
 - **Immediately report the suspect mumps case to the health department**
 - Obtain specimens for testing from patients with suspected mumps, including a blood specimen and a buccal or oral swab specimen, which confirms the diagnosis

- **Health care personnel should have documented evidence of immunity**
 - Refer to “Immunization of Health-Care Personnel: Recommendations of the Advisory Committee on Immunization Practices”
(www.cdc.gov/mmwr/pdf/rr/rr6007.pdf)

Rubella

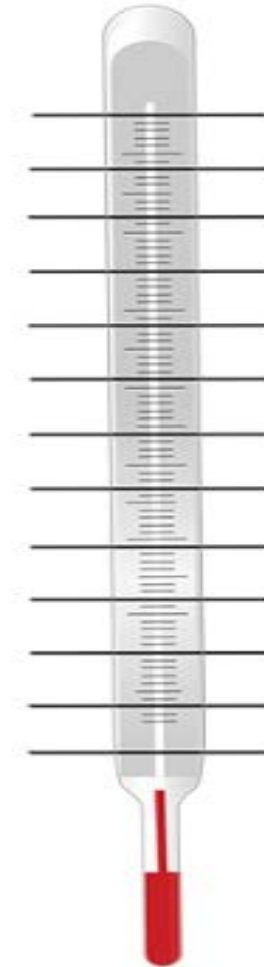
Congenital Rubella Syndrome (CRS) and Birth Defects



www.cdc.gov/globalhealth/immunization/infographic/stop_rubella.htm
www.cdc.gov/vaccines/pubs/surv-manual/chpt14-rubella.html
www.cdc.gov/rubella/index.html

Thanks to vaccines,
the **Americas** were declared
rubella free in 2015

Years	Cases
1996	10,066
2000	5,790
2001	1,707
2002	1,331
2003	898
2004	121
2005	12
2006	1
2007	0
2008	0
2009	6
2010	3
2015	0



Acceptable Presumptive Evidence of Immunity

Routine	Students (College/ Post High School)	Health Care Personnel	International Travelers
(1) Documented age-appropriate vaccination with live measles-, mumps-, and rubella-virus-containing vaccines, or	(1) Documented doses of live measles and mumps virus-containing vaccines; dose of rubella-virus-containing vaccine, or	(1) Documented doses of live measles and mumps virus-containing vaccines; dose of rubella-virus-containing vaccine, or	(1) Documented age-appropriate vaccination with live measles-, mumps-, and rubella-virus-containing vaccines, or
(2) Laboratory evidence of immunity, or	(2) Laboratory evidence of immunity, or	(2) Laboratory evidence of immunity, or	(2) Laboratory evidence of immunity, or
(3) Laboratory confirmation of disease	(3) Laboratory confirmation of disease	(3) Laboratory confirmation of disease	(3) Laboratory confirmation of disease
(4) Born before 1957 (except rubella for women of childbearing age who could become pregnant)	(4) Born before 1957 (except rubella for women of childbearing age who could become pregnant)	(4) Born before 1957 (except rubella for women of childbearing age who could become pregnant)	(4) Born before 1957 (except rubella for women of childbearing age who could become pregnant)

Measles, Mumps, Rubella Serologic Testing

- **Serologic screening before vaccination is not necessary unless the health care facility considers it cost-effective**
- **Postvaccination serologic testing to verify immunity is not recommended**
 - Documented, age-appropriate vaccination supersedes the results of subsequent serologic testing
 - MMR vaccination for persons with 2 documented doses of measles- or mumps-containing vaccine or 1 dose of rubella-containing vaccine with a negative or equivocal measles titer is not recommended
 - Exception for women of childbearing age

2

Vaccine

MMR Vaccine

- **MMR (combination vaccine) licensed in 1971**
- **Highly effective**
- **Safe (over 50 years of use)**
 - Low risk of febrile seizures in children 12 to 23 months (1 in 3,000 doses)
 - Temporary pain/stiffness in joints (teens or adult women)
 - Temporary low platelet count (1 in 30,000 doses)

MMR Vaccine

- **Composition** **Live, attenuated viruses**
- **Efficacy** **Measles: 95% at 12 months; 98% at 15 months**
Mumps: 88% (range: 31%–95%) (2 doses)
Rubella: 95% or more (1 dose)
- **Schedule** **2 doses given subcutaneously**

MMRV Vaccine

- **Composition** **Live, attenuated measles, mumps, rubella, and varicella vaccines**
7 to 8 times as much vaccine virus as monovalent varicella vaccine
- **Efficacy** **Inferred from that of MMR vaccine and varicella vaccine on the basis of noninferior immunogenicity**
- **Schedule** **2 doses given subcutaneously**

MMR Recommendations for Children and Adolescents (Birth through 18 Years)

- **First dose at 12–15 months of age**
 - Minimum age is 12 months
 - Doses given before 12 months of age are not counted as valid
 - Infants as young as 6 months should receive MMR before international travel*
 - Revaccinate at 12 months of age or older
- **Second dose at 4–6 years of age**
 - May be administered before age 4 years (observe 4-week minimum interval)
 - Intended to produce measles and/or mumps immunity in persons who failed to respond to the first dose
 - People who received 2 doses of MMR vaccine as children according to the U.S. vaccination schedule are considered protected for life

MMRV Vaccine

- **First dose at 12–47 months of age**
 - Minimum age is 12 months
 - Can be given as MMR and VAR separately or MMRV
- **Second dose at 15 months–12 years of age**
 - MMRV generally preferred
 - May be given any time before 13th birthday at least 3 months (minimum interval) after the first dose
 - Not approved for use in persons 13 years of age and older

Adult Schedule

■ Routine administration

Vaccine	19-21 years	22-26 years	27-49 years	50-64 years	≥65 years
Measles, mumps, rubella (MMR)	1 or 2 doses depending on indication (if born in 1957 or later)				

■ Medical Indications

Vaccine	Pregnancy	Immuno-compromised (excluding HIV infection)	HIV infection CD4 count		Asplenia, complement deficiencies	End-stage renal disease, on hemodialysis	Heart or lung disease, alcoholism ¹	Chronic liver disease	Diabetes	Health care personnel ²	Men who have sex with men
			<200	≥200							
MMR	CONTRAINDICATED		1 or 2 doses depending on indication								

ACIP Immunization Recommendations: Adults

- **Adults born in 1957 or later without acceptable evidence of immunity to measles, mumps, or rubella should receive 1 dose of MMR**
- **A routine second dose of MMR vaccine at least 28 days after the first dose is recommended for adults who are:**
 - College and post-high-school students
 - Working in medical facilities
 - International travelers
- **Adults born before 1957 are generally presumed immune to measles, mumps, and rubella**

MMR Recommendations: Adults

- **Adults without acceptable evidence of immunity to measles, mumps, or rubella who work in a health care facility should receive 2 doses of MMR**
 - Personnel born before 1957 without acceptable evidence of immunity to measles, mumps, or rubella should be considered for vaccination with 2 doses of MMR for measles or mumps, or 1 dose for rubella

3

**Clinical
Considerations**

MMR Revaccination Indications

- Vaccinated before the first birthday
- Vaccinated with inactivated (killed) measles vaccine (KMV) or measles vaccine of unknown type from 1963 through 1967
- Vaccinated with immune globulin (IG) in addition to a further attenuated strain or vaccine of unknown type (revaccination not necessary if IG given with Edmonston B vaccine)
- Vaccinated before 1979 with either inactivated mumps vaccine or mumps vaccine of unknown type who are at high risk for mumps infection (e.g., work in a health care facility) should be considered for revaccination with 2 doses of MMR

Mumps: January 2018 ACIP Recommendation

Morbidity and Mortality Weekly Report

Recommendation of the Advisory Committee on Immunization Practices for Use of a Third Dose of Mumps Virus–Containing Vaccine in Persons at Increased Risk for Mumps During an Outbreak

Mona Martin, MD¹; Maril Marlow, PhD¹; Kelly L. Moore, MD^{2,3}; Manisha Patel, MD¹

A substantial increase in the number of mumps outbreaks and outbreak-associated cases has occurred in the United States since late 2015 (1,2). To address this public health problem, the Advisory Committee on Immunization Practices (ACIP) reviewed the available evidence and determined that a third dose of measles, mumps, rubella (MMR) vaccine is safe and effective at preventing mumps. During its October 2017 meeting, ACIP recommended a third dose of a mumps virus–containing vaccine* for persons previously vaccinated with 2 doses who are identified by public health authorities as being part of a group or population at increased risk for acquiring mumps because of an outbreak. The purpose of the recommendation is to improve protection of persons in outbreak settings against mumps disease and mumps-related complications. This recommendation supplements the existing ACIP recommendations for mumps vaccination (3).

In 1977, ACIP recommended 1 dose of mumps vaccine for all children aged ≥12 months (4). In response to multiple measles outbreaks in the late 1980s, in 1989 ACIP recom-

Despite this recommendation, mumps outbreaks continued to be reported throughout the United States, particularly in settings where persons have close, prolonged contact (e.g., universities and close-knit communities). To assist state and local health departments in responding to mumps outbreaks, CDC issued guidance on use of a third dose of MMR vaccine in the 2012 *Manual for the Surveillance of Vaccine-Preventable Diseases*.[†] The guidance was based on limited data and provided criteria for health departments regarding when to consider use of a third dose in specifically identified target populations. Additional evidence on effectiveness and safety of the third dose of MMR vaccine recently became available and was presented to ACIP during 2017. This report summarizes the evidence considered by ACIP regarding use of a third dose of a mumps virus–containing vaccine during outbreaks and provides the recommendation for its use among persons who are at increased risk for acquiring mumps because of an outbreak.

Methods

<https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mmr.html>

*Off-label recommendation

International Travel

- Infants 6 through 11 months of age should receive **one** dose of MMR vaccine
- Children 12 months of age or older should have documentation of **two** doses of MMR vaccine
- Teenagers and adults born during or after 1957 without evidence of immunity against measles should have documentation of **two** doses of MMR vaccine
- **Ask patients about plans for international travel as part of your routine screening process**

Health Care Personnel: MMR Vaccination and Serologic Testing

- HCP with 2 documented, appropriately spaced doses of MMR are not recommended to be serologically tested for immunity
- IF they are tested and results are negative or equivocal for measles, mumps, and/or rubella, NO additional MMR doses are recommended
- Do NOT test persons with documented history of MMR vaccination

HCP Born Before 1957

- 2 doses of MMR vaccine should be considered for unvaccinated HCP born before 1957 who do not have laboratory evidence of disease or immunity to measles and/or mumps
- 1 dose of MMR vaccine should be considered for HCP with no laboratory evidence of disease or immunity to rubella

HCP and Outbreaks

- Health care facilities should recommend 2 doses of MMR vaccine at the appropriate interval for unvaccinated health care personnel regardless of birth year who lack laboratory evidence of measles or mumps immunity or laboratory confirmation of disease
- A third dose of MMR can be administered to adults who previously received 2 or more doses of mumps-containing vaccine and are identified by public health authority to be at increased risk for mumps in an outbreak

What Do You Think?

- **If a health care worker develops a rash and low-grade fever after MMR vaccination, is s/he infectious?**
- Approximately 5 to 15% of susceptible people who receive MMR vaccine will develop a low-grade fever and/or mild rash 7 to 12 days after vaccination. However, the person is not infectious, and no special precautions (such as exclusion from work) need to be taken.

MMR and MMRV Administration

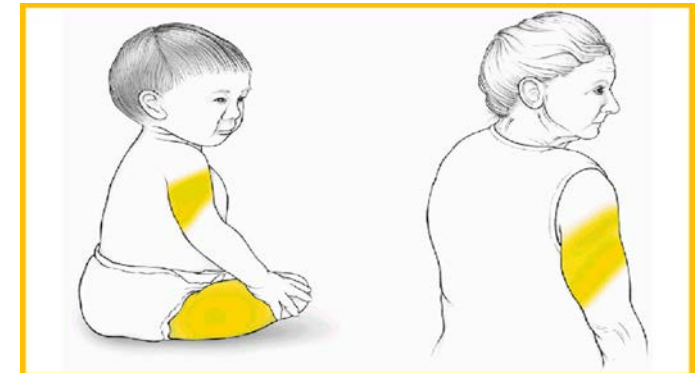
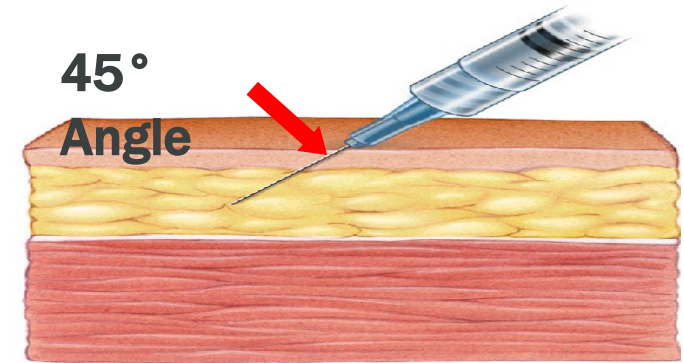
■ Preparation

- MMR-containing vaccines must be reconstituted BEFORE administering
- Use ONLY the diluent supplied by the manufacturer

■ Route: Subcutaneous injection

- Needle gauge: 23–25 gauge
- Needle length: 5/8 inch

■ Site: Upper outer triceps of the arm or the thigh



MMR and MMRV Administration Errors

- **Wrong diluent used to reconstitute vaccine**
 - Dose does NOT count and should be repeated ASAP
- **Wrong route**
 - Administered intramuscularly instead of subcutaneously
- **MMRV administered after the age of 12 years**
 - Dose counts if the minimum interval has been met
- **Always remember – store vaccine according to the manufacturer’s recommendations and use a new needle and syringe for each patient**

Measles, Mumps, Rubella Postexposure Prophylaxis

- If given within 72 hours of exposure, MMR vaccine might protect or modify clinical course of measles (preferable to IG for persons >12 months if given within 72 hours of exposure)
- If administered within 6 days of exposure, IG can prevent or modify measles in persons who are nonimmune
 - Not indicated for persons who have received 1 dose of measles-containing vaccine at age ≥ 12 months, unless they are severely immunocompromised
- Postexposure MMR vaccination or IG not shown to prevent or alter the clinical severity of rubella or mumps and is not recommended

MMR and MMRV Contraindications and Precautions

- History of anaphylactic reaction to neomycin
- History of severe allergic reaction to any component of the vaccine
- Pregnancy
- Moderate or severe acute illness
- Recent blood product
- Personal or family (i.e., sibling or parent) history of seizures of any etiology
 - Should be vaccinated with separate MMR and varicella vaccines, not MMRV

MMR Vaccine Contraindications and Precautions

■ Immunosuppression

- HIV
 - Prevaccination HIV testing not recommended
 - MMR recommended for persons who do not have evidence of current severe immunosuppression
 - Revaccination recommended for persons with perinatal HIV infection who were vaccinated before establishment of effective antiretroviral therapy (ART) with 2 appropriately spaced doses of MMR vaccine once effective ART has been established
 - MMRV not for use in persons with HIV infection
- Low-dose steroids – vaccinate anytime
- Leukemia in remission without chemotherapy for 3 months – vaccinate
- Hematopoietic cell transplant (HCT) recipient who is immunocompetent

Tuberculin Skin Testing (TST)* or Tuberculosis Interferon-Gamma Release-Assay (IGRA) and MMR or MMRV Vaccines

- Apply TST or IGRA at same visit as MMR or MMRV
- Delay TST or IGRA at least 4 weeks (28 days) if MMR or MMRV given first
- Apply TST first and administer MMR or MMRV when skin test read (least favored option because receipt of MMR or MMRV is delayed)



Administering the TB skin test

*Previously called PPD

MMR Vaccine Adverse Reactions

- Fever 5%–15% (measles)
- Rash, pruritis, purpura 5% (measles)
- Thrombocytopenia 1/30,000–40,000 doses (measles)
- Lymphadenopathy Rare (rash, pruritis, purpura)
- Allergic reactions Rare
- Parotitis Rare (mumps)
- Hearing loss Rare (mumps)

MMRV Vaccine Adverse Reactions

- **Similar to MMR**
- **Higher risk for fever and febrile seizures 5–12 days after the first dose among children 12–23 months of age**
 - 1 additional febrile seizure occurred 5–12 days after vaccination per 2,300–2,600 children compared with children who received first dose as MMR and varicella vaccine separately
- **Fever of 102°F or higher**
 - 22% of MMRV recipients
 - 15% with separate injections
- **Increased risk of febrile seizures has not been observed following use of MMRV as the second dose in the MMR and varicella series**

MMR Vaccine Safety

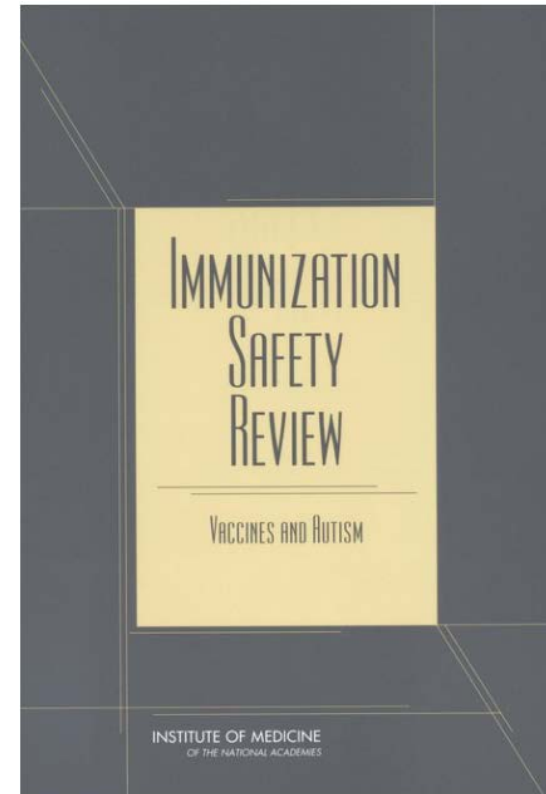
 Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People™

Vaccine Safety



[Vaccine safety information: https://www.cdc.gov/vaccinesafety/index.html](https://www.cdc.gov/vaccinesafety/index.html)
www.nap.edu/catalog/10997/immunization-safety-review-vaccines-and-autism
www.cdc.gov/measles/cases-outbreaks.html

“The committee concludes that the evidence favors rejection of a causal relationship between MMR vaccine and autism.” Institute of Medicine, 2004



MMR Storage and Handling

- **Store in the refrigerator between 2°C and 8°C (36°F and 46°F)**
 - May also be stored in the freezer
 - Protect vaccine from light by keeping in the original packaging with the lid closed
- **Store diluent at room temperature or refrigerate**
- **Discard if not used within 8 hours after reconstitution**
 - Do not fill syringe with reconstituted vaccine until ready to administer

MMR (M-M-R II)

Ages: 12 months and older

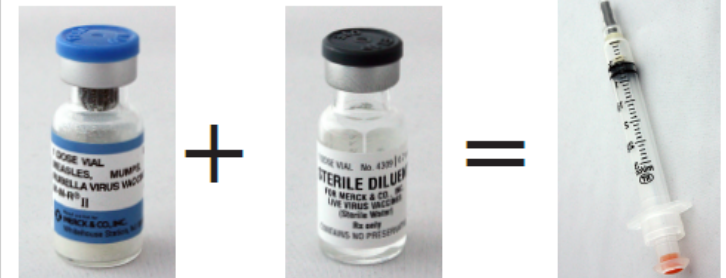
Use for: Any dose in the series

Route: Subcutaneous (subcut) injection

Reconstitute MMR powder ONLY with manufacturer-supplied sterile water diluent

Beyond Use Time: If not used immediately after reconstitution, store in vaccine vial in dark place at 2°C to 8°C (36°F to 46°F) and discard if not used within 8 hours.

MMR (M-M-R II)



Lyophilized MMR component + **Manufacturer's sterile water diluent** = **M-M-R II vaccine**

Beyond Use Time: If not used immediately after reconstitution, store in vaccine vial in dark place at 2°C to 8°C (36°F to 46°F) and discard if not used within 8 hours.

MMRV Storage and Handling

- Store in the freezer between -50°C and -15°C (-58°F and +5°F)
 - Do NOT use dry ice
 - Protect vaccine from light
 - Vaccine may be stored at refrigerator temperature (2°C and 8°C or between 36°F and 46°F) for up to 72 continuous hours after removal from freezer
- Store diluent at room temperature or refrigerate
- If not used immediately, the reconstituted vaccine may be stored at room temperature, protected from light, for up to 30 minutes
 - Do not freeze reconstituted vaccine
- Discard if not used within 30 minutes after reconstitution
 - Do not fill syringe with reconstituted vaccine until ready to administer

MMRV (ProQuad)

Ages: 12 months through 12 years

Use for: Any dose in the series

Route: Subcutaneous (subcut) injection

Reconstitute MMRV powder ONLY with manufacturer-supplied sterile water diluent

Beyond Use Time: Discard reconstituted vaccine if not used within 30 minutes.

MMRV (ProQuad)



Lyophilized MMRV component

+



Manufacturer's sterile water diluent

=



ProQuad vaccine

Beyond Use Time: Discard reconstituted vaccine if not used within 30 minutes.

What Do You Think?

- A nursing student had MMR titers done before he started school. His titers came back negative. He has 2 documented doses of MMR after 1 year of age, separated by more than 4 weeks. How many doses of MMR should we administer?
 - One
 - Two
 - None