Measles, Mumps, and Rubella

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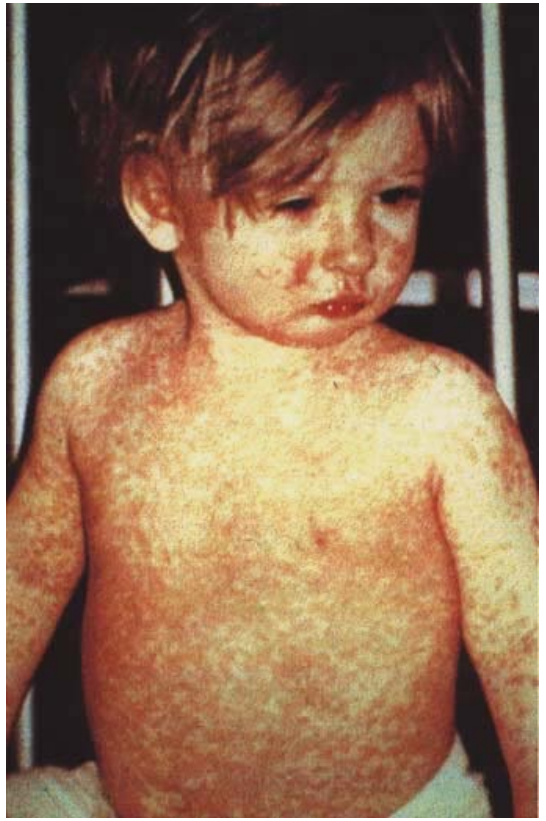
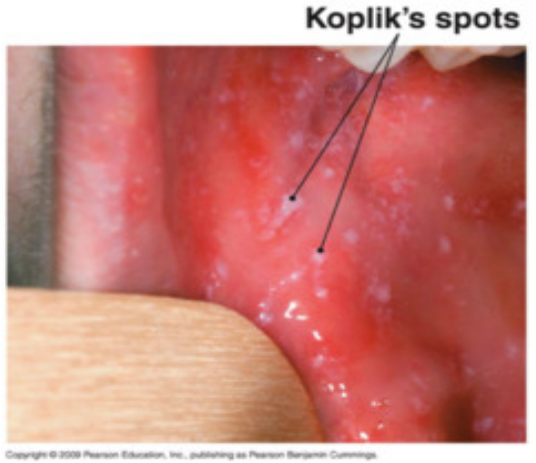
MEASLES, MUMPS, AND RUBELLA DISEASES

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

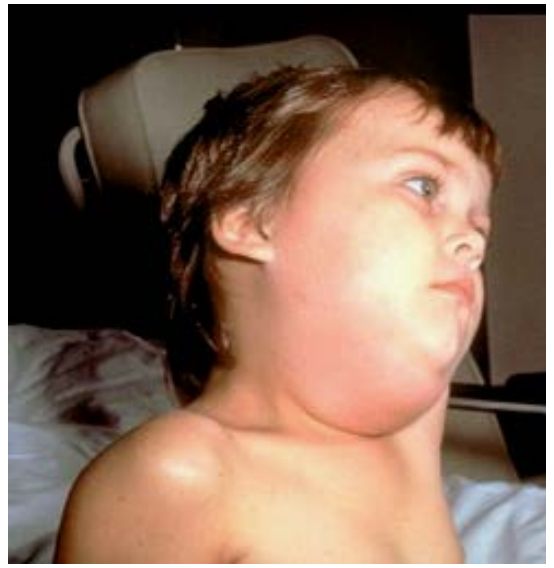
- Diarrhea: 8%
- Otitis media: 7%
- Pneumonia: 6%
- Encephalitis: 0.1%
- Seizures: 0.6%–0.7%
- Death: 0.2%

- Groups at high risk for severe illness and complications:
  - Infants and children younger than 5 years
  - Adults older than 20 years
  - Pregnant women
  - People with compromised immune systems

Based on 1985-1992 surveillance data
http://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/active/measles/en/

Mumps

- **Paramyxovirus**
  - Nasopharynx and regional lymph nodes are primary sites of infection, then can spread to meninges and glands (salivary, pancreas, testes, ovaries)
- **Incubation period is 12–25 days**
- **Infectious period: Greatest around time of parotitis onset**
- **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**

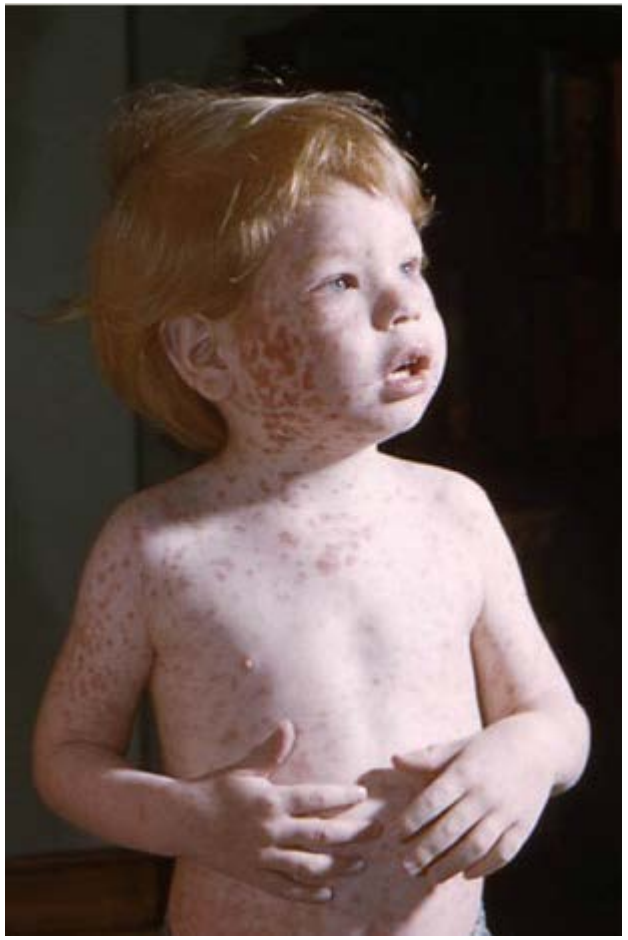


Mumps Complications

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)**
- **Infectious period is 7 days before to up to 7 days after rash onset**
- **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**

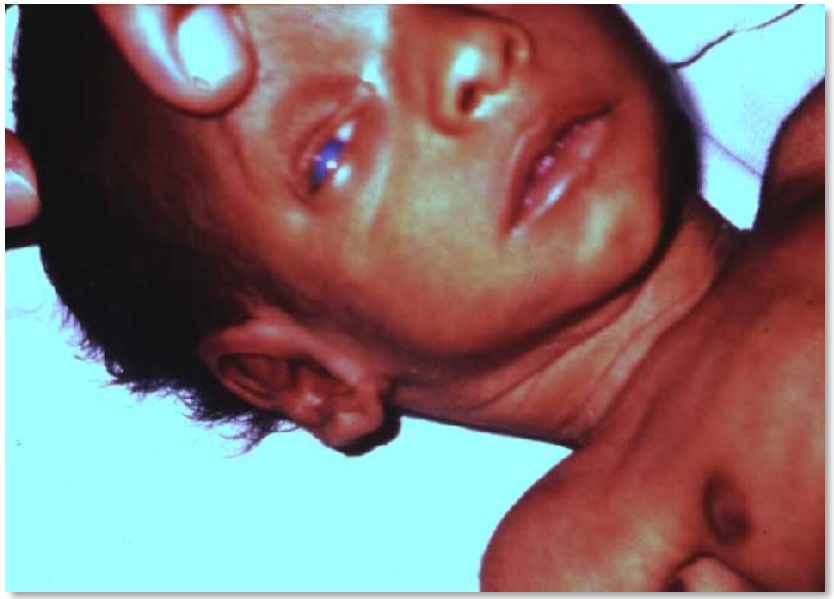


Rubella Complications

- Arthralgia or arthritis: 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

Congenital Rubella Syndrome (CRS)

- **Rubella infection may affect fetal organs**
  - Hearing impairment
  - Cataracts
  - Heart defects
  - Intellectual disabilities
  - Liver and spleen damage
  - Low birth weight
  - Skin rash and birth
- **May lead to fetal death or preterm delivery**
- **Severity of damage to fetus depends on gestational age**
- **Up to 85% of infants affected if infected during first trimester**



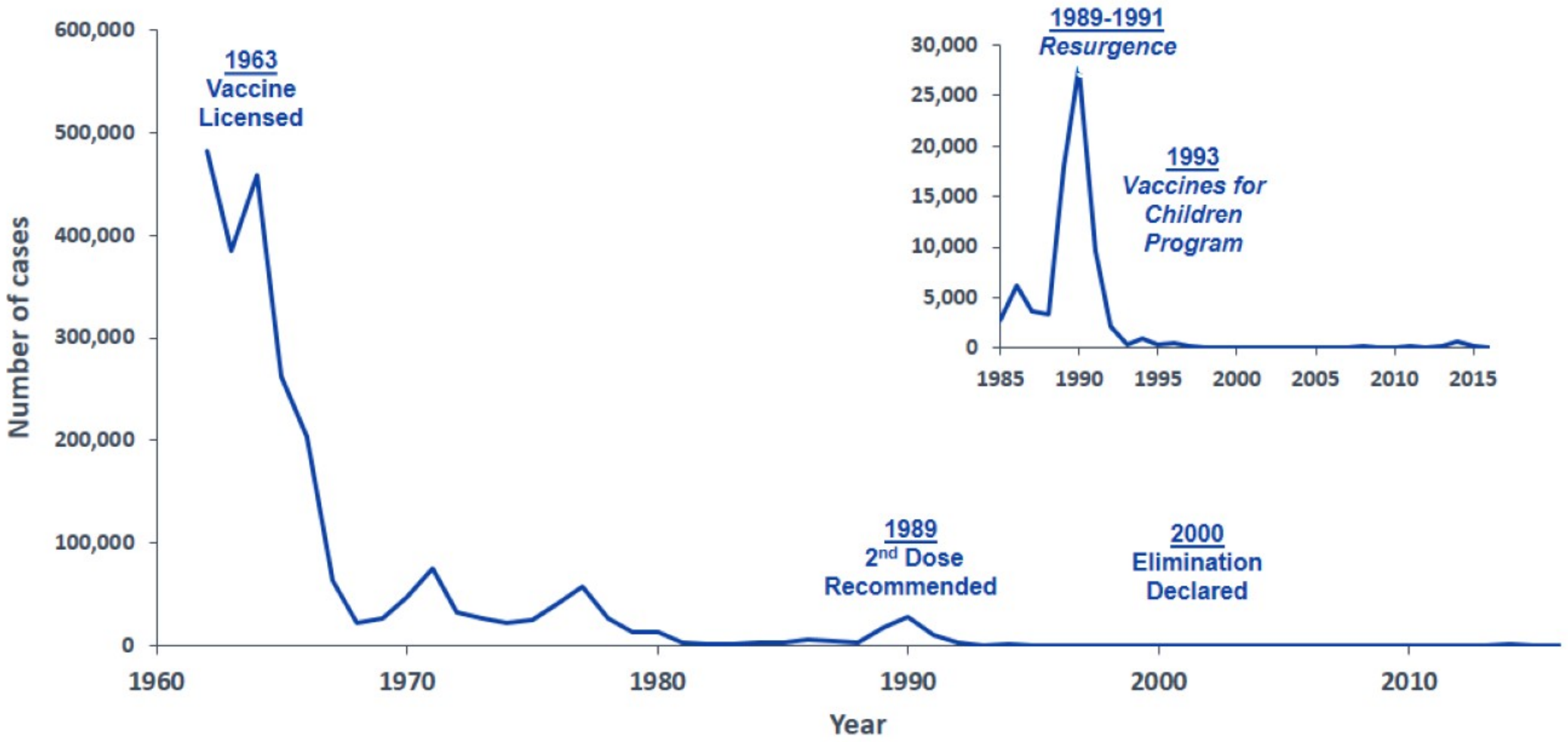
https://www.cdc.gov/rubella/pregnancy.html

Epidemiology

	Measles	Mumps	Rubella
Reservoir	Human	Human	Human
Transmission	Respiratory, airborne	Airborne, direct contact with droplet nuclei or saliva	Respiratory, subclinical cases may transmit
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 up to 7 days after rash onset

MEASLES, MUMPS, AND RUBELLA BURDEN OF DISEASE IN THE UNITED STATES

Measles Cases, United States, 1962-2016*



*2016 data is preliminary and subject to change

Measles Cases by Year Since 2010

Year	Cases
2010	63
2011	220
2012	55
2013	187
2014	667
2015	188
2016	86
2017*	118
2018**	107

- **The majority of people who got measles were unvaccinated**
- **Measles is still common in many parts of the world, including some countries in Europe, Asia, the Pacific, and Africa**
- **Travelers with measles continue to bring the disease into the U.S.**

*Preliminary cases as of 12/30/2017
**Preliminary cases as of 07/14/2018

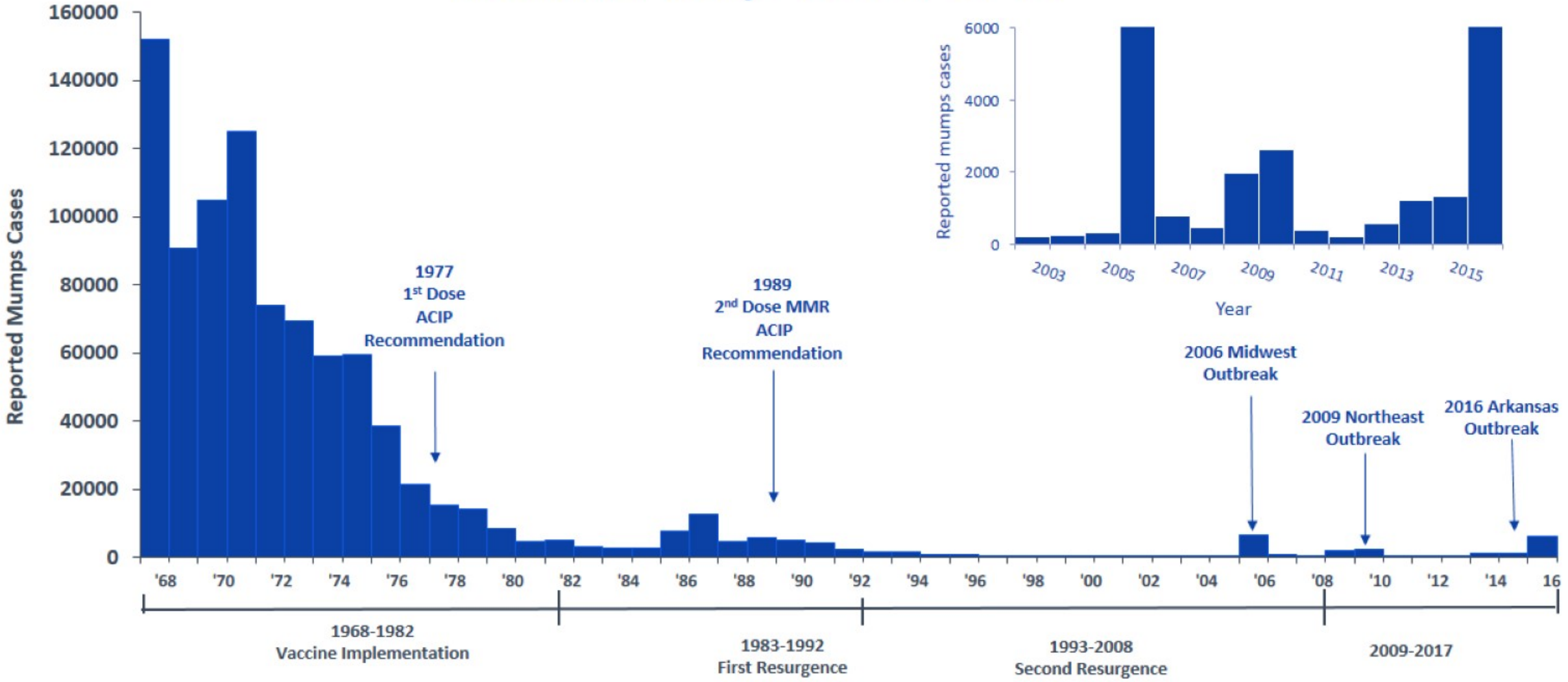
https://www.cdc.gov/measles/cases-outbreaks.html

Measles Guidance for Health Care Personnel

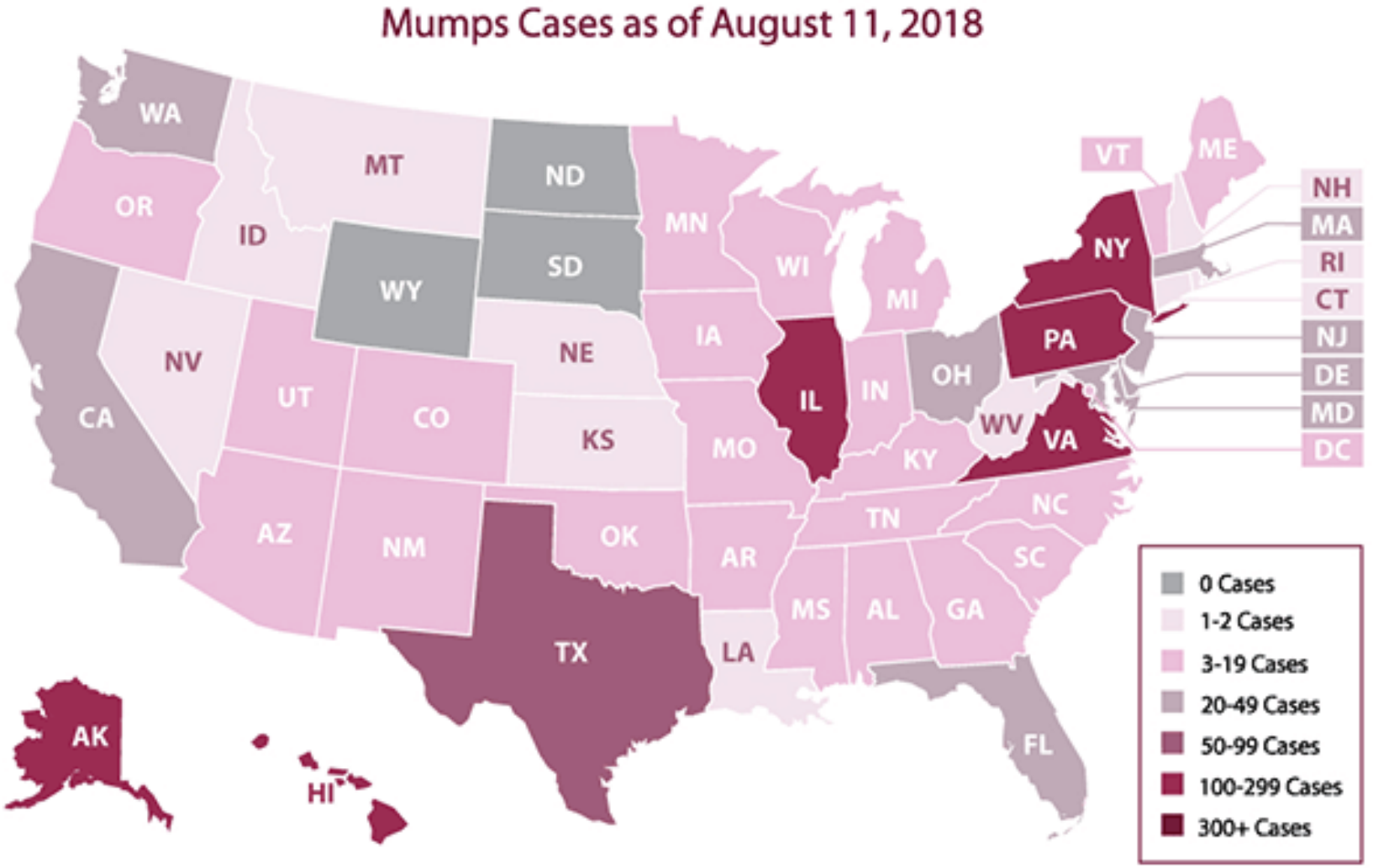
- **Be vigilant about measles**
- **Ensure EVERYONE is up to date on MMR vaccination**
  - Staff and patients: Children, adolescents, and adults
- **Consider measles in patients with febrile rash illness and clinically compatible measles symptoms (cough, coryza, and conjunctivitis)**
- **Ask patients 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**

www.cdc.gov/measles/hcp/index.html

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



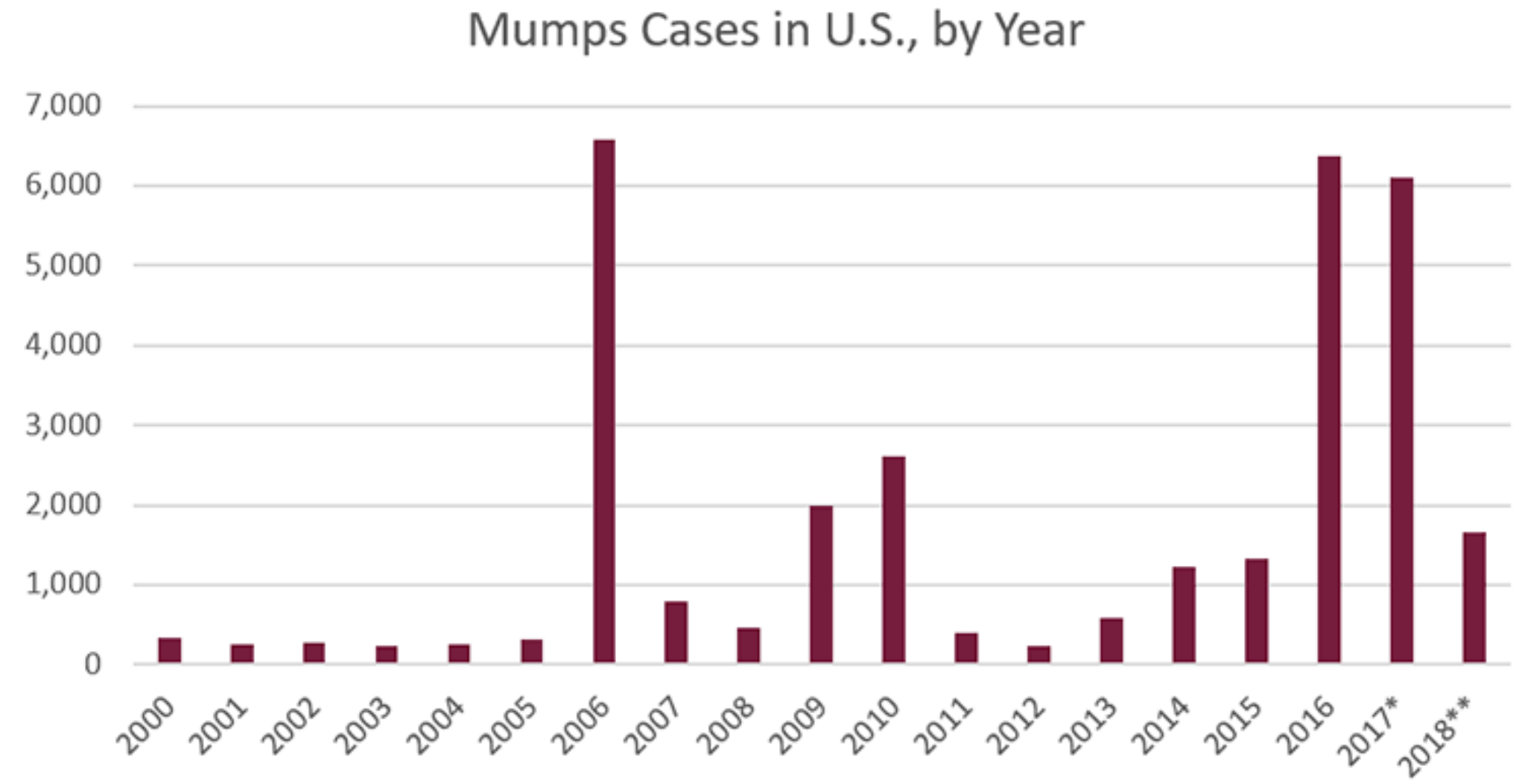
Source: National Notifiable Disease Surveillance System (passive surveillance); 2016 data is preliminary and subject to change



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

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

www.cdc.gov/mumps/outbreaks.html



* Case count is preliminary and subject to change.

**Cases as of August 11, 2018. Case count is preliminary and subject to change.

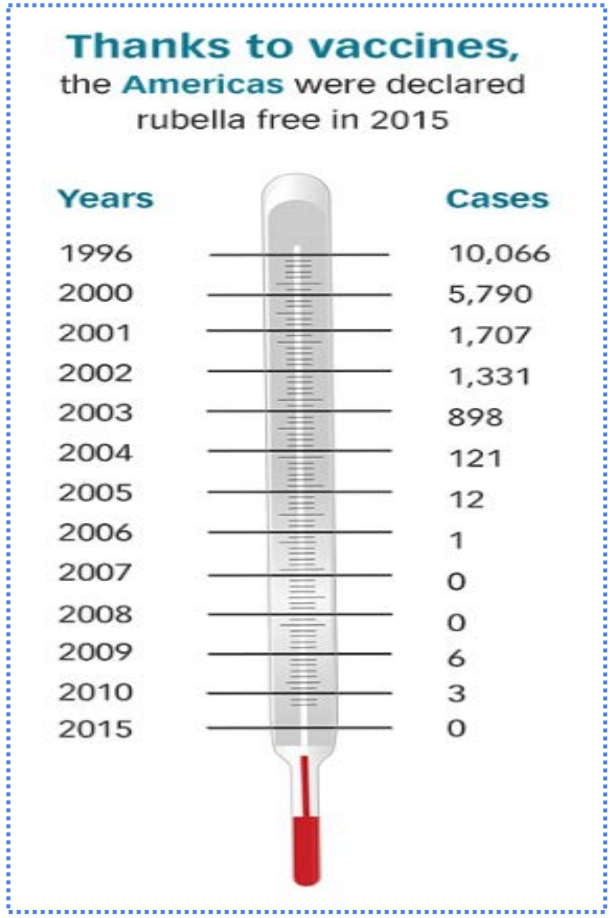
Source: Morbidity and Mortality Weekly Report (MMWR), Notifiable Diseases and Mortality Tables

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

Mumps Guidance for Health Care Personnel

- **Be vigilant:**
  - Patients with fever and inflammation of the salivary glands
  - Isolate suspect cases
  - Report suspect cases to health department
  - Obtain specimens for testing
- **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)

Number of Rubella and Congenital Rubella Syndrome (CRS) Cases by Year



United States		
Year	Rubella	CRS
2010	5	0
2011	4	0
2012	9	3
2013	9	1
2014	6	0
2015	5	1
2016	1	0
2017	5	2

www.cdc.gov/mmwr/volumes/66/wr/mm6630md.htm?s_cid=mm6630md_w
http://apps.who.int/immunization_monitoring/globalsummary/incidences?c=USA
www.cdc.gov/globalhealth/immunization/infographic/stop_rubella.htm

MEASLES, MUMPS, AND RUBELLA EVIDENCE OF IMMUNITY

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. These persons should be considered to have presumptive evidence of immunity
  - Exception: Women of childbearing age with 1 or 2 documented doses of rubella-containing vaccine and rubella-specific IgG levels that are not clearly positive should receive 1 additional dose of MMR vaccine (maximum of 3 doses) and do not need retesting

www.cdc.gov/mmwr/pdf/rr/rr6204.pdf

MEASLES-, MUMPS-, AND RUBELLA-CONTAINING VACCINES

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

MEASLES-, MUMPS-, AND RUBELLA-CONTAINING VACCINES
VACCINATION SCHEDULES
AND
RECOMMENDATIONS FOR USE

www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mmr.html

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, provided at least 4 weeks (minimum interval) have elapsed since the first dose (example: international travel)
  - Intended to produce measles and/or mumps immunity in persons who failed to respond to the first dose and may boost antibody titers in some persons who responded to the first dose

*ACIP off-label recommendation www.cdc.gov/mmwr/pdf/rr/rr6204.pdf

MMRV Vaccine

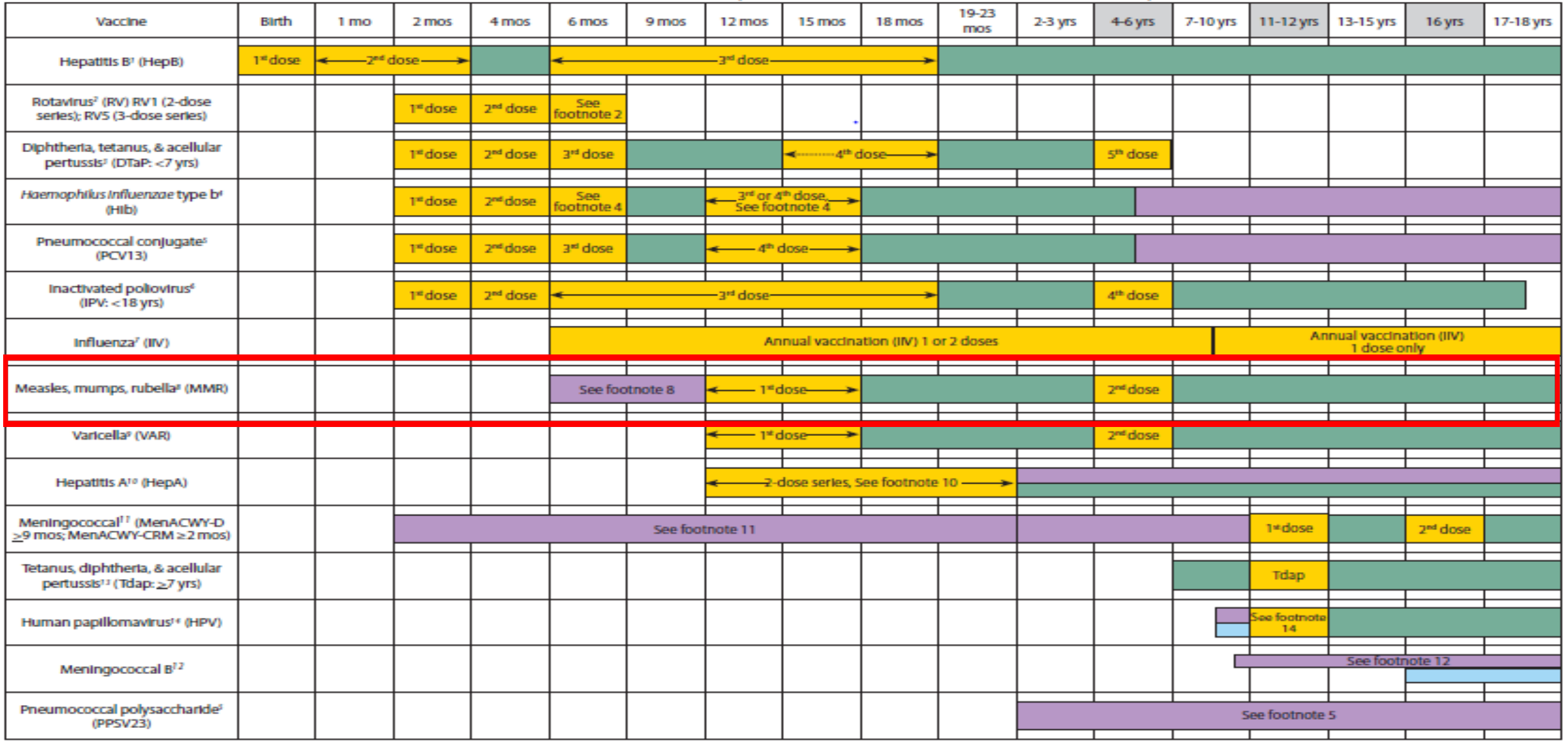
- **First dose at 12–47 months of age**
  - Minimum age is 12 months
  - MMR and VAR separately vs. MMRV
    - Providers considering MMRV for the first dose should discuss benefits/risks of both options with parents or caregivers
    - Unless parent or caregiver expresses preference for MMRV, CDC recommends MMR and VAR be given separately
    - If first dose given at 48 months–12 years of age, MMRV is generally preferred
- **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 of varicella-containing vaccine
  - Not approved for use in persons 13 years of age and older

www.cdc.gov/mmwr/pdf/rr/rr5903.pdf

Figure 1. Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger—United States, 2018.

(FOR THOSE WHO FALL BEHIND OR START LATE, SEE THE CATCH-UP SCHEDULE [FIGURE 2]).

These recommendations must be read with the footnotes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are shaded in gray.



Range of recommended ages for all children

Range of recommended ages for catch-up immunization

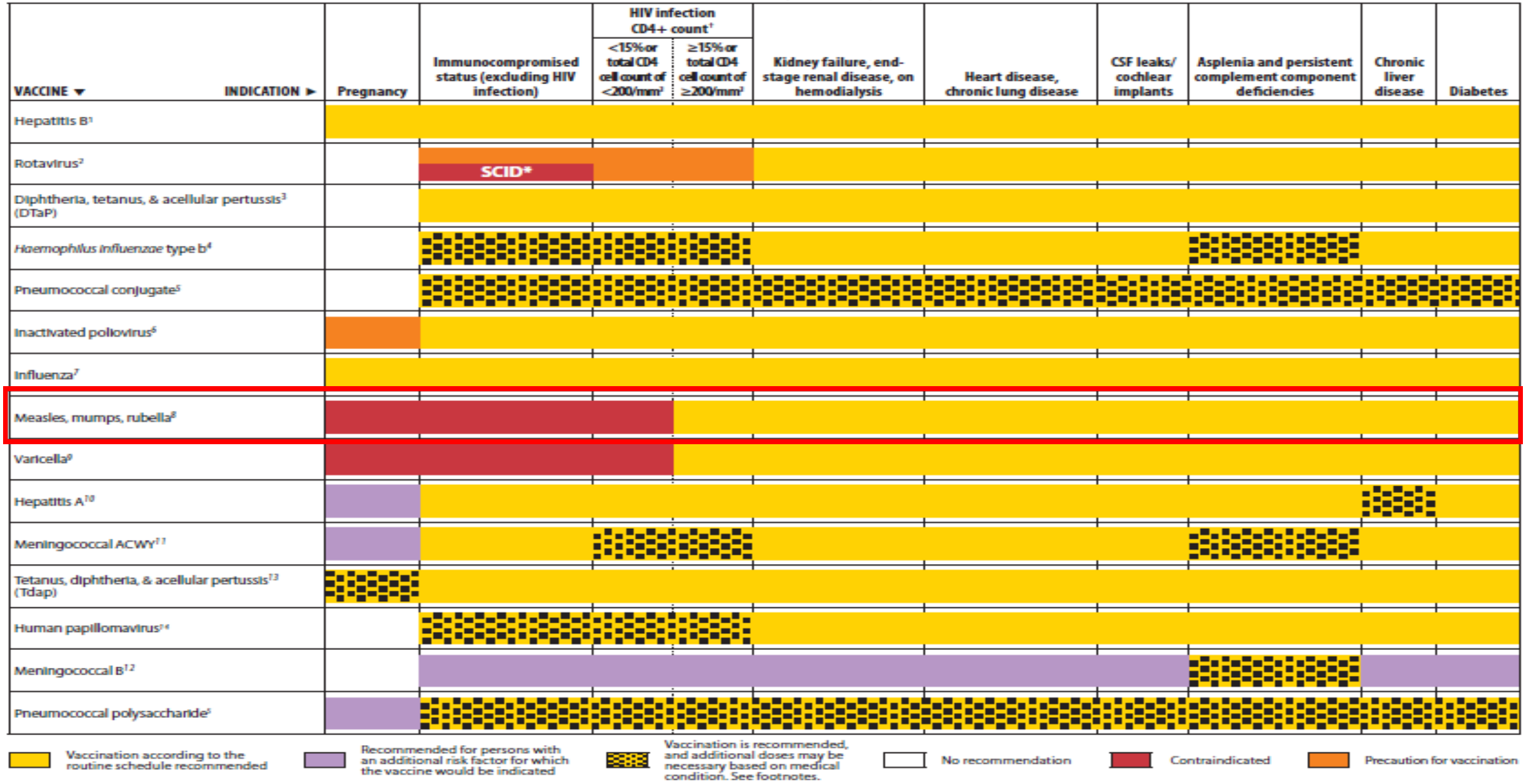
Range of recommended ages for certain high-risk groups

Range of recommended ages for non-high-risk groups that may receive vaccine, subject to individual clinical decision making

No recommendation

NOTE: The above recommendations must be read along with the footnotes of this schedule.

Figure 3. Vaccines that might be indicated for children and adolescents aged 18 years or younger based on medical indications



*Severe Combined Immunodeficiency
†For additional information regarding HIV laboratory parameters and use of live vaccines; see the General Best Practice Guidelines for Immunization "Altered Immunocompetence" at: www.cdc.gov/vaccines/hcp/acip-recs/general-recs/immunocompetence.html; and Table 4-1 (footnote D) at: www.cdc.gov/vaccines/hcp/acip-recs/general-recs/contraindications.html.

NOTE: The above recommendations must be read along with the footnotes of this schedule.

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 unless they have a medical contraindication to the vaccine (e.g., pregnancy or severe immunodeficiency)**
  - Pregnant women without evidence of immunity to rubella should receive 1 dose of MMR upon completion or termination of pregnancy and before discharge from the health care facility
- **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 (except rubella for women of childbearing age who could become pregnant)**

Figure 1. Recommended immunization schedule for adults aged 19 years or older by age group, United States, 2018

This figure should be reviewed with the accompanying footnotes. This figure and the footnotes describe indications for which vaccines, if not previously administered, should be administered unless noted otherwise.

Vaccine	19–21 years	22–26 years	27–49 years	50–64 years	≥65 years
Influenza[1]	1 dose annually				
Tdap[2] or Td[2]	1 dose Tdap, then Td booster every 10 yrs				
MMR[3]	1 or 2 doses depending on indication (if born in 1957 or later)				
VAR[4]	2 doses				
RZV[5] (preferred)				2 doses RZV (preferred)	
or				or	
ZVL[5]				1 dose ZVL	
HPV–Female[6]	2 or 3 doses depending on age at series initiation				
HPV–Male[6]	2 or 3 doses depending on age at series initiation				
PCV13[7]	1 dose				
PPSV23[7]	1 or 2 doses depending on indication				1 dose
HepA[8]	2 or 3 doses depending on vaccine				
HepB[9]	3 doses				
MenACWY[10]	1 or 2 doses depending on indication, then booster every 5 yrs if risk remains				
MenB[10]	2 or 3 doses depending on vaccine				
Hib[11]	1 or 3 doses depending on indication				

Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection

Recommended for adults with other indications

No recommendation

Figure 2. Recommended Immunization schedule for adults aged 19 years or older by medical condition and other indications, United States, 2018

This figure should be reviewed with the accompanying footnotes. This figure and the footnotes describe indications for which vaccines, if not previously administered, should be administered unless noted otherwise.

Vaccine	Pregnancy[1-6]	Immuno-compromised (excluding HIV infection)[3-7,11]	HIV infection CD4+ count (cells/µL)[3-7,9-10]		Asplenia, complement deficiencies[7,10,11]	End-stage renal disease, on hemodialysis[7,9]	Heart or lung disease, alcoholism[7]	Chronic liver disease[7-9]	Diabetes[7,9]	Health care personnel[3,4,9]	Men who have sex with men[6,8,9]
			<200	≥200							
Influenza[1]	1 dose annually										
Tdap[2] or Td[2]	1 dose Tdap each pregnancy	1 dose Tdap, then Td booster every 10 yrs									
MMR[3]	contraindicated				1 or 2 doses depending on indication						
VAR[4]	contraindicated				2 doses						
RZV[5] (preferred)					2 doses RZV at age ≥50 yrs (preferred)						
or					or						
ZVL[5]	contraindicated				1 dose ZVL at age ≥60 yrs						
HPV–Female[6]		3 doses through age 26 yrs			2 or 3 doses through age 26 yrs						
HPV–Male[6]		3 doses through age 26 yrs			2 or 3 doses through age 21 yrs						2 or 3 doses through age 26 yrs
PCV13[7]		1 dose									
PPSV23[7]		1, 2, or 3 doses depending on indication									
HepA[8]		2 or 3 doses depending on vaccine									
HepB[9]		3 doses									
MenACWY[10]		1 or 2 doses depending on indication , then booster every 5 yrs if risk remains									
MenB[10]		2 or 3 doses depending on vaccine									
Hib[11]		3 doses HSCT recipients only			1 dose						

Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection

Recommended for adults with other indications

Contraindicated

No recommendation

MMR Recommendations: Health Care Personnel (HCP)

- **HCP without acceptable evidence of immunity to measles, mumps, or rubella should receive 2 doses of MMR**
  - HCP 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
- **HCP with 2 documented, appropriately spaced doses of MMR are not recommended to be serologically tested for immunity; they are considered immune**
  - IF they are tested and results are negative or equivocal for measles, mumps, and/or rubella, NO additional MMR doses are recommended

Mumps: New 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 Marin, MD[1]; Muriel Marlow, PhD[1]; Kelly L. Moore, MD[2,3]; Manisha Patel, MD[1]

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 recommended a routine 2-dose schedule of measles-containing vaccine (*5*). 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

*ACIP off-label recommendation

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

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

Measles 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**

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

MMR and MMRV Contraindications and Precautions

- **History of anaphylactic reaction to neomycin**
- **History of severe allergic reaction to any component of the vaccine**
- **Pregnancy**
  - Ask if pregnant or likely to become so in next 4 weeks*
  - Exclude those who say "yes“
  - For others, explain theoretical risks and then vaccinate
- **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)

*ACIP off-label recommendation; vaccine package insert states 3 months

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 – vaccinate 24 months posttransplant
  - Family history of congenital or hereditary immunodeficiency

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

- Apply TST or draw 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)

*Previously called PPD

MMR Vaccine Adverse Reactions

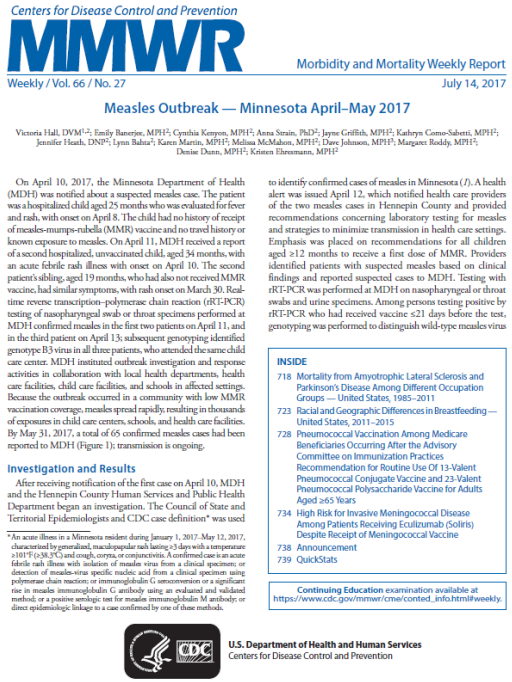
Fever	5%–15% (measles)
Rash, pruritis, purpura	5% (measles)
Thrombocytopenia	1/30,000–40,000 doses (measles)
Lymphadenopathy	Rare (rash, pruritis, purpura)
Allergic reactions	Rare
Parotitis	Rare (mumps)
Deafness	Rare (mumps)
Encephalopathy	<1/1,000,000 doses (measles)

MMR Vaccine and Arthropathy

- **Acute joint symptoms**
  - 25% of susceptible women (rubella)
- **Frank arthritis-like signs and symptoms**
  - 10% of susceptible women (rubella)
- **Chronic or persistent symptoms**
  - Rare
- **Population-based studies have not confirmed association**

MMR Vaccine and Autism

From April to the end of May 2017, 65 confirmed cases of measles were reported to the Minnesota Department of Health.



Centers for Disease Control and Prevention

MMWR

Morbidity and Mortality Weekly Report

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Measles Outbreak — Minnesota April–May 2017

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On April 10, 2017, the Minnesota Department of Health (MDH) was notified about a suspected measles case. The patient was a hospitalized child aged 25 months who was evaluated for fever and rash, with onset on April 8. The child had no history of receipt of measles-mumps-rubella (MMR) vaccine and no travel history or known exposure to measles. On April 11, MDH received a report of a second hospitalized, unvaccinated child, aged 34 months, with an acute febrile rash illness with onset on April 10. The second patient's sibling, aged 19 months, who had also not received MMR vaccine, had similar symptoms, with rash onset on March 30. Real-time reverse transcription–polymerase chain reaction (rRT-PCR) testing of nasopharyngeal swab or throat specimens performed at MDH confirmed measles in the first two patients on April 11, and in the third patient on April 13; subsequent genotyping identified genotype B3 virus in all three patients, who attended the same child care center. MDH instituted outbreak investigation and response activities in collaboration with local health departments, health care facilities, child care facilities, and schools in affected settings. Because the outbreak occurred in a community with low MMR vaccination coverage, measles spread rapidly, resulting in thousands of exposures in child care centers, schools, and health care facilities. By May 31, 2017, a total of 65 confirmed measles cases had been reported to MDH (Figure 1); transmission is ongoing.

Investigation and Results

After receiving notification of the first case on April 10, MDH and the Hennepin County Human Services and Public Health Department began an investigation. The Council of State and Territorial Epidemiologists and CDC case definition* was used to identify confirmed cases of measles in Minnesota (*1*). A health alert was issued April 12, which notified health care providers of the two measles cases in Hennepin County and provided recommendations concerning laboratory testing for measles and strategies to minimize transmission in health care settings. Emphasis was placed on recommendations for all children aged ≥12 months to receive a first dose of MMR. Providers identified patients with suspected measles based on clinical findings and reported suspected cases to MDH. Testing with rRT-PCR was performed at MDH on nasopharyngeal or throat swabs and urine specimens. Among persons testing positive by rRT-PCR who had received vaccine ≤21 days before the test, genotyping was performed to distinguish wild-type measles virus

*An acute illness in a Minnesota resident during January 1, 2017–May 12, 2017, characterized by generalized, maculopapular rash lasting ≥3 days with a temperature ≥101°F (≥38.3°C) and cough, coryza, or conjunctivitis. A confirmed case is an acute febrile rash illness with isolation of measles virus from a clinical specimen; or detection of measles-virus specific nucleic acid from a clinical specimen using polymerase chain reaction; or immunoglobulin G seroconversion or a significant rise in measles immunoglobulin G antibody using an evaluated and validated method; or a positive serologic test for measles immunoglobulin M antibody; or direct epidemiologic linkage to a case confirmed by one of these methods.

INSIDE

Continuing Education examination available at https://www.cdc.gov/mmwr/cme/conted_info.html#weekly.

U.S. Department of Health and Human Services
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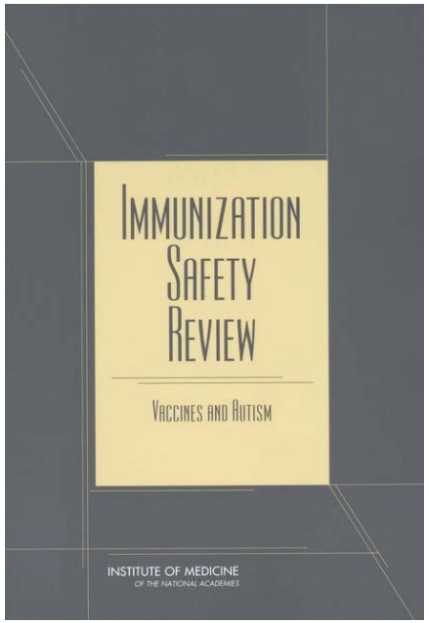
"The committee concludes that the evidence favors rejection of a causal relationship between MMR vaccine and autism." Institute of Medicine, 2004



www.cdc.gov/mmwr/volumes/66/wr/mm6627a1.htm?s_cid=mm6627a1_w
www.nap.edu/catalog/10997/immunization-safety-review-vaccines-and-autism

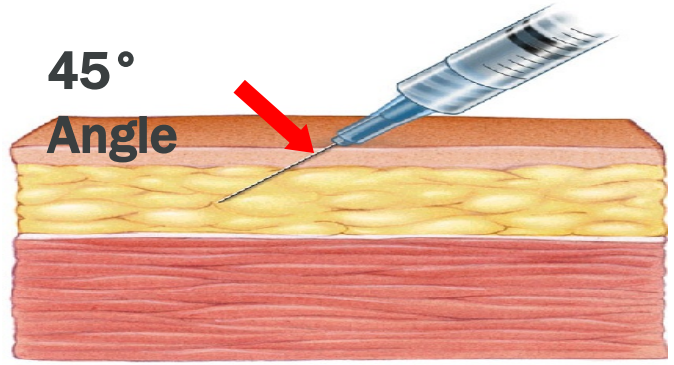
MMRV Vaccine Adverse Reactions

- **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**

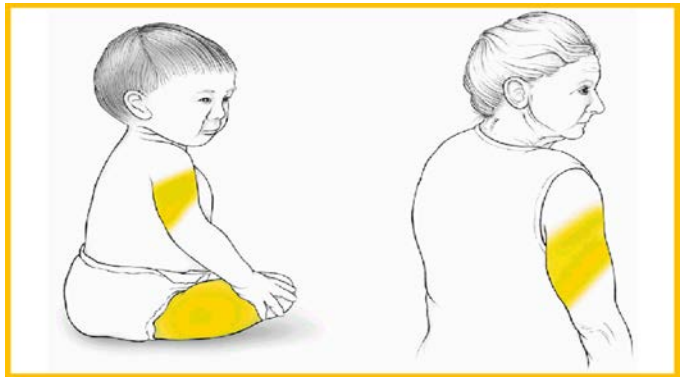
VACCINE ADMINISTRATION

MMR and MMRV Administration

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



- **Route: Subcutaneous (Subcut) injection**
  - Needle gauge: 23–25 gauge
  - Needle length: 5/8 inch



- **Site: Upper outer triceps of the arm or the thigh**

MMRV and MMRV Administration Errors

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

MMR AND MMRV STORAGE AND HANDLING

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**
- **Discard if not used within 30 minutes after reconstitution**
  - Do not freeze reconstituted vaccine
  - Do not fill syringe with reconstituted vaccine until ready to administer

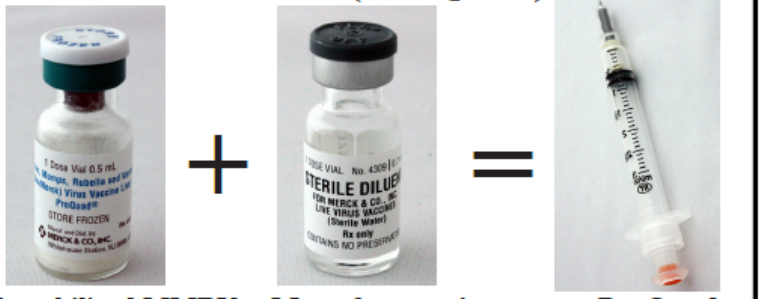
MMRV (ProQuad)

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.

Thanks!

Up next: CE information and Q&A session