Measles, Mumps, and Rubella

September 2018

Chapters 13, 15 and 20

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%
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
- Prodrome is nonspecific
  - Myalgia
  - Anorexia
  - Malaise
- Parotitis in 9%–94%, typically occurs within 16–18 days
- Prevaccine era: 15%–27% of infections were asymptomatic

Mumps Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orchitis</td>
<td>12%–66% in postpubertal males (prevaccine)</td>
</tr>
<tr>
<td></td>
<td>3%–10% (postvaccine)</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>3.5% (prevaccine)</td>
</tr>
<tr>
<td>Unilateral deafness</td>
<td>1/20,000 (prevaccine)</td>
</tr>
<tr>
<td>Death</td>
<td>2/10,000 from 1966–1971</td>
</tr>
</tbody>
</table>

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

- 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

Rubella Complications

- Rubella infection may affect fetal organs, causing:
  - Deafness
  - 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

<table>
<thead>
<tr>
<th></th>
<th>Measles</th>
<th>Mumps</th>
<th>Rubella</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir</td>
<td>Human</td>
<td>Human</td>
<td>Human</td>
</tr>
<tr>
<td>Transmission</td>
<td>Respiratory</td>
<td>Airborne</td>
<td>Respiratory</td>
</tr>
<tr>
<td>Temporal Pattern</td>
<td>Peaks in late</td>
<td>Peaks in late</td>
<td>Peaks in late</td>
</tr>
<tr>
<td></td>
<td>winter/spring</td>
<td>winter/spring</td>
<td>winter/spring</td>
</tr>
<tr>
<td>Communicability</td>
<td>4 days before to</td>
<td>Several days</td>
<td>7 days before to</td>
</tr>
<tr>
<td></td>
<td>4 days after rash</td>
<td>before and after</td>
<td>5–7 days after</td>
</tr>
<tr>
<td></td>
<td>onset</td>
<td>onset of parotitis</td>
<td>rash onset</td>
</tr>
</tbody>
</table>
Measles Cases by Year Since 2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Reported Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>63</td>
</tr>
<tr>
<td>2011</td>
<td>220</td>
</tr>
<tr>
<td>2012</td>
<td>55</td>
</tr>
<tr>
<td>2013</td>
<td>187</td>
</tr>
<tr>
<td>2014</td>
<td>667</td>
</tr>
<tr>
<td>2015</td>
<td>188</td>
</tr>
<tr>
<td>2016</td>
<td>86</td>
</tr>
<tr>
<td>2017*</td>
<td>118</td>
</tr>
<tr>
<td>2018**</td>
<td>107</td>
</tr>
</tbody>
</table>

*Preliminary cases as of 12/31/2017
**Preliminary cases as of 07/14/2018

- 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.

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 travel to communities frequented by international travelers
  - History of measles in the community
- Promptly isolate patients with suspected measles

www.cdc.gov/measles/cases-outbreaks.html
www.cdc.gov/measles/hcp/index.html
U.S. Mumps Cases as of August 11, 2018

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, RI, SC, TN, TX, UT, VA, VT, WI, WV, and WY

**Preliminary data reported to CDC.** Mumps outbreaks are not reportable.
Mumps Cases in U.S., by Year

Suspect Mumps?
- Health care professionals should be vigilant about mumps:
  - Consider mumps in patients presenting with fever and inflammation of the salivary glands
  - Promptly isolate patients with suspected mumps 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 to mumps according to the Advisory Committee on Immunization Practices
  - 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/mumps/outbreaks.html
http://apps.who.int/immunization_monitoring/globalsummary/incidences?c=USA
www.cdc.gov/globalhealth/immunization/infographic/stop_rubella.htm
Acceptable Presumptive Evidence of Immunity

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

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 (Subcut)
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 (Subcut)
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
  - 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
    - 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
  - Not approved for use in persons 13 years of age and older

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: New ACIP Recommendation

Mumps 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 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
  - 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

MMR Vaccine Contraindications and Precautions

- Immunosuppression
  - HIV
    - Prevacination 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 the same visit as MMR or MMRV.
- Delay TST or IGRA by at least 4 weeks (28 days) if MMR or MMRV is 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 Autism**

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

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

MMRV Storage and Handling

- Store in the refrigerator between -20°C and -15°C (−4°F and −5°F)
  - Do not use dry ice
  - 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