Measles

- Single-stranded RNA virus (*Paramyxovirus* family)
- Airborne route: Survive for at least 2 hours in fine droplets
- Incubation period: 7-18 days
- Infectious period: 4 days before and 4 days after rash onset
- Highly contagious: Secondary attack rate is 90% or greater

- Clinical signs and symptoms:
  - Prodome: Fever, cough, coryza, conjunctivitis (3 C’s)
  - Generalized maculopapular rash

- Complications
  - Otitis media, diarrhea, dehydration
  - Pneumonia
  - Measles encephalitis
  - Subacute sclerosing panencephalitis (SSPE)
Measles: Laboratory

- Enzyme immunoassay (EIA):
  - Most commonly used method for detecting measles-specific IgM and IgG antibodies.
  - If IgM is negative within the first 72 hours, repeat testing is recommended

- Specimens for Virus Isolation or RT-PCR Detection:
  - Throat or nasopharyngeal swabs are generally the preferred sample
  - Urine samples may also contain virus
  - Virus isolation is most successful when samples are collected on the first day of rash through 3 days following onset of rash; however, it is possible to detect virus up to day 7 following rash onset.
Measles Epidemiology

• One of the leading causes of death among young children worldwide
• United States: Prior to the introduction of the measles vaccine in 1963¹
  – An estimated 3 to 4 million people in the United States acquired measles each year.
  – Approximately 500,000 of these measles cases were reported annually
    • 500 persons died, 48,000 were hospitalized, and another 1,000 had permanent brain damage from measles encephalitis
  – Highest occurrence of disease among children 5-9 years of age
  – Highest risk of death in children younger than 1 year of age

¹Strebel, P.M., et al., *Measles Vaccine*, in *Vaccines*
Measles Epidemiology, United States, 1962-2010

1963 Vaccine Licensed 1st Dose Recommendation

1989 2nd Dose Recommendation

2000 Elimination Declared

1-dose preschool coverage

2-dose adolescent coverage


Year

Measles Cases

0 50,000 100,000 150,000 200,000 250,000 300,000 350,000


Year

% Measles Vax Coverage

0 10 20 30 40 50 60 70 80 90 100

1989-91 Resurgence

2008 (140)
Vaccine Effectiveness and Vaccine Coverage in the United States

• MMR* vaccine is highly effective
  – One dose vaccine effectiveness for measles is 94-98%
  – Two-dose vaccine effectiveness for measles is 95-100%

• MMR* vaccine coverage is high
  – In 2009,
    • 90% of children 19-35 months of age had received one dose
    • 89.1% of adolescents had evidence of two doses
  – Nationally representative data on MMR* vaccine coverage of U.S. health care personnel are not available.

• During 1999–2004, the rate of measles seropositivity in the U.S. population aged 6-49 years was 95.9% (95% CI, 95.1%–96.5%) indicating high herd immunity.

*Measles, mumps and rubella vaccine
3 McQuillan GM. JID 2007; 196:1459–64
United States MMR Vaccine Recommendations

• Children
  – Routine:
    • 1st dose: 12–15 months
    • 2nd dose: 4–6 years of age
  – Traveling abroad:
    • 6-11 months – 1 dose
    • ≥12 months – 2 doses ≥28 days apart

• Adults:
  – 2 Doses:
    • Including health care personnel, international travelers, university students
  – 1 dose: Others (except during outbreaks)

*Advisory Committee on Immunization Practices, Measles, mumps and rubella vaccine, 1998
Health Care Settings
Measles in Health Care Settings

- A well-described health-care-associated problem
- Symptomatic cases are likely to seek medical care in primary health care facilities, emergency departments or hospital settings due to severity of illness.
- Approximately 33 states do not have laws mandating that all hospital personnel have proof of measles immunity
- Medical settings are a primary site of measles transmission
  - During 2001-2011, 45 reported measles cases were transmitted in U.S. health care facilities accounting for 5% of all reported U.S. measles cases

Measles in Health Care Settings

- 1996, Washington:\(^2\) Health care personnel (HCP) were 19 times more likely to develop measles than other adults.\(^1\)

- 2005, Indiana: A hospital spent >$113,000 responding to a measles outbreak. One HCP was admitted to intensive care unit.\(^3\)

- 2008, Arizona:\(^4\):
  - 7 (50\%) of the cases acquired measles in a health care setting; one was an unvaccinated HCP.
  - 11 (79\%) accessed health care services while infectious; one was masked and isolated.
  - Two hospitals spent $799,136 responding to and containing cases in their facilities.
  - 25\% HCP lacked documentation of measles immunity.
    - 9\% lacked measles IgG antibodies.

- 2001-2011: 13 cases occurred among HCP, 8 (62\%) of whom were unvaccinated or had unknown vaccination status.

ACIP Provisional Recommendations for Measles ‘Evidence of Immunity’ Requirements for Healthcare Personnel*

- June 2009
- All persons who work in health care facilities should have presumptive evidence of immunity to measles.
- Presumptive evidence of immunity for persons who work in health care facilities includes any of the following:
  - Written documentation of vaccination with 2 doses of live measles or MMR vaccine administered at least 28 days apart*
  - Laboratory evidence of immunity**
  - Laboratory confirmation of disease
  - Birth before 1957€β£†

*The first dose of measles-containing vaccine should be administered on or after the first birthday; the second dose should be administered no earlier than 28 days after the first dose.
** Measles immunoglobulin (IgG) in the serum; equivocal results should be considered negative.
€ Most persons born before 1957 are likely to have been infected naturally and may be presumed immune.
β May vary depending on current state or local requirements.
£† For unvaccinated personnel born before 1957 who lack laboratory evidence of measles immunity or laboratory confirmation of disease, health-care facilities should consider vaccinating personnel with two doses of MMR vaccine at the appropriate interval.
† For unvaccinated personnel born before 1957 who lack laboratory evidence of measles immunity or laboratory confirmation of disease, health-care facilities should recommend two doses of MMR vaccine during an outbreak of measles.
United States
January 1 through June 10, 2011
Cumulative Number of Measles Cases Reported, by Month of Rash Onset – United States, January 1, 2001 through June 10, 2011
Distribution of Reported Measles Cases, United States, January 1 – June 10, 2011 (n = 152)

- **Age:** 3 months to 68 years
  - <12 months: 23 (15%)
  - 1-4 years: 30 (20%)
  - 5-19 years: 32 (21%)
  - ≥20 years: 67 (44%)

- Among those ≥12 months, 107 (70%) unvaccinated or unknown vaccination status.

- Import associated: 131 (86%)

- Health care setting exposure: 12 (8%)

- Hospitalizations: 53 (35%)
  - Pneumonia: 9
Measles Hospitalizations, United States, January 1, 2001 through June 10, 2011

*June 10, 2011*
International
Measles Cases Reported to World Health Organization:
Onset Date October 2010 – April 2011

Timor-Leste:
As of 4 May 2011: 234 cases and 4 deaths reported

Data source: surveillance DEF file
Data in HQ as of 11 May 2011

Measles in Europe: 2011

Measles in Europe: France

- As of 19 April, over 7500 cases reported for 1st three months of 2011
- Complications:
  - Encephalitis: 12
  - Guillian-Barré: 1
  - Death: 2 deaths due to pneumonia

http://www.invs.sante.fr/surveillance/rougeole/Point_rougeole_190411.pdf
Summary

• Increase in the number of measles cases in 2011 in United States:
  – Highest since 1996
  – Majority among unvaccinated U.S. travelers
  – High proportion accessing healthcare

• Health care personnel
  – Should have adequate immunity or be up to date with measles vaccination
  – Have awareness of measles among travelers
  – Ensure adequate isolation precautions
  – Active Surveillance in hospitals when measles is reported in the community
  – Inform public health departments immediately

• Maintaining high vaccine coverage is critical to sustaining measles elimination
Acknowledgments

- State and Local health departments
- CDC
  - Division of Viral Diseases

The findings and conclusions are those of the authors and do not necessarily represent the view of the Centers for Disease Control and Prevention.