MEASLES: WHY WAS IT NEVER TRULY ERADICATED?
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Objectives
The learner will be able to
– Outline the current measles outbreak in the US
– Summarize the signs and symptoms of measles
– List the complications of measles
– Discuss individual rights versus societal rights with regard to vaccinations and herd immunity
– Discuss treatment options
– Discuss vaccination options
– Discuss thimerosal

CDC
• From January 1 to January 30, 2015, 102 people from 14 states were reported to have measles.
• Most of these cases are part of a large, ongoing multi-state outbreak linked to an amusement park in California.
History of measles in the U.S.

- Measles was declared eliminated (i.e., interruption of year-round endemic transmission) in the United States in 2000.
- Due to high population immunity achieved by high 2-dose measles vaccine coverage and a highly effective measles vaccine.

What we’re learning...

The current multi-state outbreak underscores
- the ongoing risk of importation of measles,
- the need for high measles vaccine coverage,
- the importance of a prompt and appropriate public health response to measles cases and outbreaks.
The virus

- Caused by a single-stranded, enveloped RNA virus with 1 serotype.
- Classified as a member of the genus morbillivirus in the paramyxoviridae family.
- Humans are the only natural hosts of measles virus.

Transmission

- Highly contagious respiratory infection
- Transmitted by respiratory droplets and direct contact with nasal or throat secretions of infected persons.

Importations of Measles Cases

- From endemic areas of the world continue to occur
- Leads to secondary measles cases and outbreaks in the United States
  - Primarily among unvaccinated persons

Giant cell with intracytoplasmic inclusions.
Measles Epidemiology

- Measles is highly transmissible; almost all non-immune children contract measles if exposed to infection.
- Poorly nourished children and those whose immune systems have been weakened by HIV/AIDS or other diseases are severely at high risk of developing measles complication and death.
- Measles kills more children than any other vaccine-preventable disease.
  - Measles infection has its greatest incidence in children below 2 years of age in the developing countries.

Measles Epidemiology

- The number of reported measles cases in the United States has declined from nearly 900,000 annually in the early 1940s to an average of 83 cases annually from 2001 through 2011.
- As a result of high vaccination coverage and better measles control in the Americas, in 2000, measles was declared eliminated (no disease transmission for at least 12 months) in the United States.
Incubation Period
• Ranges between 7 and 21 days from exposure to onset of fever
• Patients are infectious from about 4 days before developing the rash until 4 days after rash.
• Rash usually appears about 14 days after exposure.

Clinical Presentation
• Symptoms include prodromal fever that can rise as high as 105°F (40.6°C), conjunctivitis, coryza (runny nose), cough, and small spots with white or bluish-white centers on an erythematous base on the buccal mucosa (Koplik spots).
• A characteristic red, blotchy (maculopapular) rash appears on the third to seventh day after the prodromal symptoms appear. The rash begins on the face, becomes generalized, and lasts 4–7 days.

Clinical Presentation
• Common complications include diarrhea (8%), middle ear infection (7%–9%), and pneumonia (1%–6%).
• Encephalitis, which can result in permanent brain damage, occurs in approximately 1 per 1,000–2,000 cases of measles.
Koplik's spots on palate due to pre-eruptive measles on day 3 of the illness.

On the third pre-eruptive day with "Koplik spots" indicative of the beginning onset of measles.

Third day of rash.

A classic day 4 rash with measles.
Clinicians: When to consider “measles”

- Consider measles in patients with a fever, rash, and cough, coryza and conjunctivitis
  - The three “C”s.

- Ask if they are vaccinated against measles and whether they have recently traveled internationally or if there’s measles in the community.

Complications

- Common complications: Otitis media, bronchopneumonia, laryngotraechobronchitis, and diarrhea.

- Rare:
  - Encephalitis (permanent brain damage possible).
  - Death: 1 or 2 out of every 1,000 children who become infected with measles will die from respiratory and neurologic complications.
  - Subacute sclerosing panencephalitis (SSPE)

Who’s at high risk for complications?

- Infants and children aged <5 years
- Adults aged >20 years
- Pregnant women
- People with compromised immune systems, such as from leukemia and HIV infection
Treatment

• Treatment is supportive.

• World Health Organization recommends vitamin A for all children with acute measles, regardless of their country of residence, to reduce the risk of complications.

• Vitamin A is administered once a day for 2 days at the following doses:
  • 50,000 IU for infants aged <6 months
  • 100,000 IU for infants aged 6–11 months
  • 200,000 IU for children aged ≥12 months

Treatment

• An additional (third) age-specific dose of vitamin A should be given 2–4 weeks later to children with clinical signs and symptoms of vitamin A deficiency. Parenteral and oral formulations of vitamin A are available in the United States.
Vaccination

- There are two options for protecting children who are 12 months through 12 years old against measles, mumps, rubella (German measles) and varicella (chickenpox):
  - Getting two shots: the measles, mumps, and rubella (MMR) vaccine AND the varicella vaccine
  - Getting one shot: the measles, mumps, rubella, and varicella (MMRV) vaccine

MMR & MMRV

- Measles vaccine contains live, attenuated measles virus.
  - In the United States, it is available only in combination formulations, such as measles-mumps-rubella (MMR) and measles-mumps-rubella-varicella (MMRV) vaccine.
- MMRV vaccine is licensed for children aged 12 months to 12 years and may be used in place of MMR vaccine if vaccination for measles, mumps, rubella, and varicella is needed.

MMR Vaccine

- Combination measles-mumps-rubella (MMR) vaccine.
  - Can be used for children aged 12 months through 12 years for protection against measles, mumps, rubella.
  - Single-antigen measles vaccine is not available.
- One dose of MMR vaccine is approximately 93% effective at preventing measles;
- Two doses are approximately 97% effective.
  - Almost everyone who does not respond to the measles component of the first dose of MMR vaccine at age 12 months or older will respond to the second dose.
  - Therefore, the second dose of MMR is administered to address primary vaccine failure
**Is the MMR vaccine safe?**

- In use for more than 3 decades in the U.S.
- Reports of serious adverse events following vaccination have been extremely rare.
  - Minor reactions: pain and redness at the injection site, headache, fatigue, rash, or a vague feeling of discomfort.
- The risk of MMR vaccine causing serious harm or death has been extremely small and that being vaccinated is much safer than getting any of the three diseases (measles, mumps and rubella) the vaccine protects against.
- Vaccine safety experts, including experts at CDC and the American Academy of Pediatrics (AAP), agree that MMR vaccine is not responsible for recent increases in the number of children with autism.
  - A 2004 report by the Institute of Medicine (IOM): No link between autism and MMR vaccine, and no link between autism and vaccines that contain thimerosal as a preservative.

**IOM: Immunization Safety Review Committee**

- **Conclusions**
  - that the body of epidemiological evidence favors rejection of a causal relationship between the MMR vaccine and autism.
  - that the body of epidemiological evidence favors rejection of a causal relationship between thimerosal-containing vaccines and autism.
  - that potential biological mechanisms for vaccine-induced autism that have been generated to date are theoretical only.

**The IOM Committee on Vaccines and Adverse Events**

  - An analysis of more than 1,000 research articles concluded that few health problems are caused by or clearly associated with vaccines.
  - Found convincing evidence of 14 health outcomes -- including seizures, inflammation of the brain, and fainting -- that can be caused by certain vaccines, although these outcomes occur rarely.
  - Found indicative though less clear data on associations between specific vaccines and four other effects, such as allergic reactions and temporary joint pain.
  - The evidence shows there are no links between immunization and some serious conditions that have raised concerns, including Type 1 diabetes and autism.
Children

- CDC recommends routine childhood immunization for MMR vaccine starting with the first dose at 12 through 15 months of age
- The second dose at 4 through 6 years of age or at least 28 days following the first dose.

Students at post-high school educational institutions

- Students at post-high school educational institutions without evidence of measles immunity need two doses of MMR vaccine, with the second dose administered no earlier than 28 days after the first dose.

Adults

- People who are born during or after 1957 who do not have evidence of immunity against measles should get at least one dose of MMR vaccine.
International Travelers

- Before travelling internationally,
  - 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, with the second dose administered no earlier than 28 days after the first dose

Post-exposure Prophylaxis

- People exposed to measles who cannot readily show that they have evidence of immunity against measles should be offered post-exposure prophylaxis (PEP) or be excluded from the setting (school, hospital, childcare).

  - MMR vaccine, if administered within 72 hours of initial measles exposure, or immunoglobulin (IG), if administered within six days of exposure, may provide some protection or modify the clinical course of disease.

Why are children not being vaccinated?

- Many parents are concerned that vaccines can cause autism
- This belief originated with a now-discredited 1998 study, which has circulated on the Internet and has been promoted by some celebrities.
Andrew Wakefield

- The British journal that published the study, "The Lancet," retracted it in 2010.
- British medical authorities found the author, Andrew Wakefield, guilty of serious misconduct and stripped him of the ability to practice medicine in 2010 after finding that he had accepted $675,000 from a lawyer who was hoping to sue vaccine makers.

Why is measles becoming more common?

- Between 2001 and 2010, the U.S. reported a median of 60 measles cases a year.
- But that number began to spike when unvaccinated Americans and foreign visitors who traveled abroad became infected and brought the disease to the U.S.
- Americans foregoing measles vaccinations for personal and religious beliefs are increasing the likelihood of infection.

Thimerosal

- A mercury-containing organic compound (an organomercurial).
- Since the 1930s, it has been widely used as a preservative in a number of biological and drug products, including many vaccines, to help prevent potentially life threatening contamination with harmful microbes.
Thimerosal

- In July 1999, the Public Health Service agencies, the American Academy of Pediatrics, and vaccine manufacturers agreed that thimerosal should be reduced or eliminated in vaccines as a precautionary measure.

Thimerosal

- Timeline: Thimerosal in Vaccines 1999-2010
  [http://www.cdc.gov/vaccinesafety/Concerns/thimerosal/thimerosal_timeline.html]

Thimerosal

- September 13, 2010. Results of a CDC study do not support an association between prenatal and infant exposure to vaccines and immunoglobulins that contain thimerosal and an increased risk for autism spectrum disorder (ASD).

- February 1, 2009. Results of an Italian study were reassuring that immunization in infancy with thimerosal-containing vaccines does not decrease neuropsychological performance later in childhood.
Population vs. Individual Rights

- New Jersey Gov. Chris Christie and Kentucky Sen. Rand Paul, both potential Republican candidates, waded into the debate, saying parents should have a say in whether to vaccinate their kids.

- The remarks were not a departure from previously stated positions, but in light of the current measles outbreak, they drew widespread attention -- and criticism.

Population vs. Individual Rights

- A crucial balancing act for public health professionals.

- What is best for the population as a whole?

- How far can we infringe upon individual (in this case, often parents) rights?

Population vs. Individual Rights

- Ben Carson, a neurosurgeon and conservative advocate who is considering a White House run, weighed in on the other side.

- While saying there are "exceptional situations" that should be heard and he strongly believes in individual rights, Carson said, "I also recognize that public health and public safety are extremely important in our society."
Population vs. Individual Rights

• Carson said in a statement: "Certain communicable diseases have been largely eradicated by immunization policies in this country and we should not allow those diseases to return by foregoing safe immunization programs, for philosophical, religious or other reasons when we have the means to eradicate them."

97% Effective

• The measles-mumps-rubella vaccine is 97 percent effective at preventing measles, according to the Centers for Disease Control and Prevention.

• "Choosing not to vaccinate your child could also endanger the health of other children in your community," CDC director Tom Frieden said.

Beyond Disney: Infant Cases

• February 4, 2015: two infants who attend a KinderCare Learning Center in Palatine, Illinois, have tested positive for measles.

• Three more cases have been diagnosed, based on clinical and other criteria, but results are pending, according to a statement from the Cook County Department of Public Health and state officials.
Infant Cases

- The two infants confirmed to have measles have not been vaccinated. Amy Poore-Terrell, spokeswoman for the public health department, says the children were too young to be vaccinated.
- The MMR vaccine is generally not given to children under the age of 1.
- Clearly, infants acquired the virus from someone who was unvaccinated and had measles.

Day Care Response

- Everyone at the day care center was notified about the measles cases. Anyone who has not had the MMR (measles, mumps, rubella) vaccine was told to stay at home and away from others who have not been vaccinated for the next 21 days.
- Infected people are contagious from four days before their rash begins through four days afterward.
- Measles can remain in the air and on surfaces for up to two hours.

How do we prevent more measles cases?

- Vaccination
- Creating herd immunity
What are the roles of public health and health care professionals?

• Educating the public and patients on the truth regarding vaccination.
• Providing information regarding measles
• Stress the benefits of vaccination go beyond the child (or adult) vaccinated.
• More?

References