The Epidemiology of Vaccine Preventable Diseases in Missouri

John Bos, MPH
Interim Chief,
Bureau of Communicable Disease Control and Prevention
Missouri Department of Health and Senior Services
Presentation Objectives

• Provide an overview of select vaccine preventable diseases in Missouri.

• Describe the epidemiology, surveillance, investigation, and control measures for select vaccine preventable diseases.
Measles (Rubeola)
Measles: Background

- **Agent:** Measles virus
- **Symptoms:** Fever, malaise, cough, coryza, and conjunctivitis, Koplik spots, and maculopapular rash
  - Rash spreads from head to trunk to extremities
- **Diagnosis:** Serology (IgM) and reverse transcription polymerase chain reaction (RT-PCR)
  - Serum sample and throat swab or nasopharyngeal swab
- **Incubation period:** 7 – 21 days (14 days to rash onset)
- **Communicable:** 4 days before to 4 days after rash appears
- **Transmission:** Infectious droplets or airborne spread
Measles: Complications

• Common: Otitis media, bronchopneumonia, laryngotraceobronchitis, and diarrhea

• 1 of every 1,000 cases will develop acute encephalitis, which often results in permanent brain damage

• 1-2 of every 1,000 children infected will die from respiratory and neurologic complications

• Subacute sclerosing panencephalitis (SSPE) is a rare, but fatal degenerative disease of central nervous system
  – Behavioral and intellectual deterioration and seizures that develop 7 to 10 years after infection
Measles: Cases and Outbreaks 2015*

- A large, multi-state measles outbreak linked to an amusement park in California
- The virus type in this outbreak was (B3)
- No source was identified

* All 2015 data is preliminary.
2015 Measles Cases in the U.S.
January 1 to September 18, 2015

Cases*:
- 0
- 1-4
- 5-9
- 10-19
- 20+

*Provisional data reported to CDC's National Center for Immunization and Respiratory Diseases

Slide courtesy CDC: http://www.cdc.gov/measles/cases-outbreaks.html
Measles Case: Missouri 2015

Health Advisory:

Measles Case in Missouri

FROM: GAIL VASTERLING
DIRECTOR

SUBJECT: Measles Case in Missouri

On May 31, 2015, the Missouri Department of Health and Senior Services (DHSS) received a report of a possible case of measles in Branson, Missouri involving a foreign traveler. The individual presented to the Cox Medical Center Branson Emergency Department on Sunday, May 31, 2015, with reported symptoms consistent with measles and a possible exposure to measles prior to arrival in the United States. The individual was promptly isolated from the public on May 31, and remained in isolation until no longer infectious to others. The initial serological test for measles was negative; however, measles virus was subsequently identified through molecular detection by RT-PCR on June 3, 2015.

June 4, 2015

This document will be updated as new information becomes available. The current version can always be viewed at http://www.health.mo.gov

The Missouri Department of Health & Senior Services (DHSS) is now using 4 types of documents to provide
Measles Cases by Year- Missouri, 2000-2015*

Number of Cases

Year


*Cases as of September 26, 2015. All 2015 data is preliminary.
Measles: Outbreak 2014

- Multi-state (29 cases from KC Metro)
- Age Range: 2 Weeks – 43 Years
  - Median Age: 21.5 Years
  - Average Age: 17.9 Years
- 55% Female
- Demographic factors
  - Micronesian
  - Vaccine history limited, lacking documentation
  - Children not vaccinated until school entry
  - Large, multigenerational households
  - Close, active social network
Outbreak Associated Measles Cases by Local Jurisdiction and Date of Onset, May-June, 2014

Number of Cases

Onset Date

Slide courtesy C. Jon Hinkle, DHSS

N=29
Measles: Public Health Investigation and Control Measures

- Confirm the diagnosis
- Identify contacts (4 days before to 4 days after onset of rash)
- Determine immunity of close contacts
- Post-exposure prophylaxis of susceptible contacts
  - MMR vaccine within 72 hours of exposure
  - Immunoglobulin within 6 days of exposure
- Active surveillance of contacts for symptoms of measles
Mumps

Image courtesy of CDC.
Mumps: Background

- Agent: Mumps virus
- Symptoms: Prodrome - myalgia, anorexia, malaise, fever and headache
- Swelling and tenderness in salivary glands, usually parotid
  - Unilateral or bilateral
  - Lasts 7-10 days in unvaccinated
Mumps: Background

- Incubation period: 16-18 days (range 12-25 days)
- Diagnosis: Serology (IgM) and RT-PCR
  - Serum sample and buccal swab
  - Results can be challenging to interpret
- Communicable: 2 days before to 5 days after onset of parotitis. Inapparent infections can be communicable.
- Transmission: Droplet spread and direct contact to saliva
Mumps: Cases / Outbreaks

- 2011-2013: Several smaller mumps outbreaks on colleges in California, Virginia, and Maryland
- 2009-2010: 2 large outbreaks
  - 3,000 mostly high school-aged students who were part of a close-knit religious community, New York City
  - 500 mostly school-aged children, in the U.S. Territory of Guam
- 2006 – over 6,500 cases mostly college-aged students Midwest

### United States

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*Cases as of September 18, 2015

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

Mumps Cases in Central Missouri

July 24, 2015

This document will be updated as new information becomes available. The current version can always be viewed at http://www.health.mo.gov

The Missouri Department of Health & Senior Services (DHSS) is now using 4 types of documents to provide important information to medical and public health professionals, and to

Missouri Department of Health & Senior Services

Health Advisory
July 24, 2015

FROM: GAIL VASTERLING
DIRECTOR

SUBJECT: Mumps Cases in Central Missouri

On July 20, 2015, the Columbia/Boone County Department of Public Health and Human Services (CBCDPHHS) and the Missouri Department of Health and Senior Services (DHSS) received a report of suspected mumps cases among persons associated with a large university located in Central Missouri. Seven persons were reported to have presented to health care providers with parotitis (swelling of one or both salivary glands) with onset dates ranging from July 13-17, 2015. On July 22, 2015, mumps virus was confirmed for 5 of those ill persons through molecular detection by RT-PCR.

The purpose of this DHSS Health Advisory is to alert health care providers of the possible outbreak of mumps in Missouri, and to provide guidance on clinical and laboratory diagnosis, and measures to control infection transmission.

Background

Mumps is an acute viral infection caused by the mumps virus, a member of the family

http://www.health.mo.gov
Mumps Cases by Year - Missouri, 2000-2015*

*Cases as of September 26, 2015. All 2015 data is preliminary.
Mumps: Public Health Investigation and Control Measures

- Confirm the diagnosis
- Identify contacts (2 days before to 5 days after onset of parotitis)
- Determine immunity of close contacts
- Vaccinate susceptible contacts (unless contraindicated)
  - Vaccinate to prevent infection following future exposures
  - Vaccine and Immune globulin (IG) are not effective as post exposure prophylaxis
- Active surveillance of contacts for symptoms of mumps
Pertussis

*B. pertussis* colonizing the trachea

- **Cilia**
- **Bacteria**
- **Nonciliated cells**
Pertussis: Background

• **Agent:** *Bordetella pertussis*

• **Symptoms:**
  
  – Catarrhal: coryza, low-grade fever, mild cough
  
  – Paroxysmal: paroxysmal cough, difficulty breathing (whoop), cyanosis, vomiting, exhaustion
  
  – Convalescent: less persistent paroxysmal cough, paroxysms can recur with subsequent respiratory infections for many months
  
  – In infants, apnea may be the only symptom
Pertussis: Background - Complications

- Infants: 50% of infants less than 12 months of age are hospitalized. Complications among hospitalized infants include:
  - 61% apnea
  - 23% pneumonia
  - 1.1% seizures
  - 1% die
  - 0.3% will have encephalopathy (as a result of hypoxia from coughing or possibly from toxin)
  - Anorexia, dehydration, difficulty sleeping, epistaxis, hernias, otitis media, and urinary incontinence, refractory pulmonary hypertension, pneumothorax, rectal prolapse, and subdural hematomas
Pertussis: Complications

- Adolescents and adults: typical less severe in, especially if vaccinated
  - 0.8% of adolescents and 3% of adults hospitalized
  - 2% pneumonia
  - 33% weight loss
  - 28% urinary incontinence
  - 6% syncope
  - 4% rib fractures from severe coughing
  - Anorexia, dehydration, epistaxis, hernias, and otitis media, encephalopathy as a result of hypoxia from coughing or possibly from toxin, pneumothorax, rectal prolapse, subdural hematomas, and seizures

Source: http://www.cdc.gov/pertussis/clinical/complications.html
Pertussis: Background

- Incubation period: Average 9-10 days (range 6-20 days)
- Diagnosis: Culture, PCR, serology
- Communicable: 3 weeks after onset of symptoms or 5 days following treatment with an appropriate antibiotic
- Transmission: Direct contact with respiratory droplets probably via large droplets
Reported NNDSS pertussis cases: 1922-2014

SOURCE: CDC, National Notifiable Diseases Surveillance System and Supplemental Pertussis Surveillance System and 1922-1949, passive reports to the Public Health Service
Pertussis Cases by Year - Missouri, 2000-2015*

*Cases as of September 26, 2015. All 2015 data is preliminary.
Pertussis: 2015* Cases

- 197 reported cases
- 48 Local Public Health Jurisdictions
- Each district statewide
  - 74 Eastern
  - 41 Northwest
  - 36 Southwest
  - 26 Southeast
  - 20 Central
Pertussis Cases by Age Group and Gender – Missouri, 2015*

*Cases as of September 26, 2015. All 2015 data is preliminary.
Pertussis: Antibiotic Prophylaxis

• All household contacts (even if vaccinated) within 21 days of onset in index patient.

• Other exposed persons at high risk of severe illness or those with close contact of a person at high risk of severe illness.
  – Infants and women in their third trimester of pregnancy.
  – All persons with pre-existing health conditions that may be exacerbated by a pertussis infection (for example, but not limited to immunocompromised persons and patients with moderate to severe medically treated asthma).

• All contacts in high risk settings that include infants aged <12 months or women in the third trimester of pregnancy. These include, but are not limited to neonatal intensive care units, childcare settings, and maternity wards.
Pertussis: Why the Increase?

- Increased awareness and improved recognition of pertussis among clinicians
- Greater access to and use of laboratory diagnostics, especially polymerase chain reaction (PCR) testing
- Increased surveillance and reporting of pertussis to public health departments
- Waning immunity from vaccines
- Changes in *Bordetella pertussis* at the genetic level
  - Research is underway to determine if any of the recent changes may be related to the increase in disease.
Meningococcal Disease

Image courtesy of CDC. http://www.cdc.gov/meningococcal/about/photos.html
Meningococcal Disease: Background

- **Agent:** *Neisseria meningitidis*
  - Serogroups A, B, C, W, X, Y
  - Serogroups B, C, and Y cause the majority of disease in the U.S

- **Symptoms:**
  - Meningitis
    - Fever, headache, and stiff neck, nausea, vomiting, photophobia, and altered mental status
    - Newborns and infants: fever, headache, and neck stiffness may be absent or difficult to notice. The infant may appear to be slow or inactive, irritable, vomiting or feeding poorly.
  - Meningococcal sepsis: fever, petechial or purpuric rash, hypotension, shock, acute adrenal hemorrhage, and multi organ failure
Meningococcal Disease: Background

• Can be treated with appropriate antibiotics
  – Started as soon as possible when suspected
• Despite treatment
  – 10 to 15 out of 100 cases die
  – 11 to 19 out of every 100 survivors will have long-term disabilities: Loss of limb(s), deafness, nervous system problems, or brain damage
Meningococcal Disease: Background

- Diagnosis:
  - Culture of blood or cerebrospinal fluid
  - PCR-based assays
- Incubation period: 3-4 days (range 2-10 days)
- Communicable: 24 hours after treatment with appropriate antibiotic
Meningococcal Disease: Transmission

- Transmission: direct contact with respiratory droplets from nose or throat
  - 5-10% of population may be asymptomatic carriers with nasopharyngeal colonization
  - Carrier rates of 25% have been documented in absence of disease
  - Less than 1% colonized will develop invasive disease
  - 98% of cases are sporadic and meningococcal outbreaks account for less than 2% of reported cases in the U.S.
Meningococcal Disease Incidence, United States, 1970-2013

Meningococcal Disease Cases by Year - Missouri, 2000-2015*

Number of Cases

Year


*Cases as of September 26, 2015. All 2015 data is preliminary.
Meningococcal Disease: Control Measures

• Confirm the diagnosis

• Identify high-risk contacts (7 days before onset to 24 hours after treatment with an effective antibiotic)
  – Household or household-like contacts
  – Direct exposure to cases oral/nasal secretions
  – Mouth-to-mouth resuscitation, unprotected contact during endotracheal intubation
  – Passengers on plane seated directly next to case for flight lasting more than 8 hours

• Chemoprophylaxis of high-risk contacts (ideally with 24 hours, little value greater than 2 weeks after exposure)

• Surveillance for additional cases
Hepatitis A

Image courtesy of CDC. http://www.cdc.gov/vaccines/vpd-vac/hepa/photos.htm
Hepatitis A: Background

- **Agent**: Hepatitis A virus
- **Symptoms**: Abrupt onset of fever, malaise, anorexia, nausea, abdominal discomfort followed in a few days by jaundice
  - 70% of infections in children less than 6 years of age are asymptomatic
- **Diagnosis**: Hepatitis IgM
- **Incubation period**: average 28-30 days, range 15-50 days
- **Communicable**: 2 weeks before onset to 1 week after onset of jaundice (2 weeks after onset of symptoms in absence of jaundice)
- **Transmission**: Person-to-person, fecal oral route
Figure 2.1. Reported number of acute hepatitis A cases — United States, 2000–2013

Source: National Notifiable Diseases Surveillance System (NNDSS)
Hepatitis A Cases by Year - Missouri, 2000-2015*

*Cases as of September 26, 2015. All 2015 data is preliminary.
Hepatitis A: Public Health Investigation and Control Measures

- Confirm the diagnosis
- Identify all close contacts (2 weeks before onset to 1 week after onset of Jaundice or 2 weeks after symptom onset)
- Determine immunity
- Post-exposure prophylaxis of susceptible contacts within 14 days of exposure
  - Hepatitis A vaccine
  - Immunoglobulin for persons > 40 years of age or immunocompromised
- Active surveillance of contacts for symptoms
Hepatitis A Food Handler

- Food handler worked during period of communicability Springfield-Greene County, May 2014
- Minimum of 5,000 persons potentially exposed
- 3,467 persons received prophylaxis (3,457 vaccine, approximately 10 persons IG)
- 832 persons received second dose of vaccine given by Springfield-Greene County Health Department
- No secondary cases reported
Influenza
2014 – 2015* Influenza Season - Missouri

- 54,316 laboratory-positive influenza cases reported
  - 77% Influenza A
  - 20% Influenza B
  - 3% unknown / untyped
- Influenza A H3N2 (drifted)
  - Influenza A/Switzerland/9715293/2013 related to, but antigenically and genetically distinguishable, from A/Texas/50/2012 vaccine virus
  - 80.7% of the influenza A (H3N2) viruses characterized from U.S. laboratories from October 1, 2014 – May 16, 2015
Number of Laboratory-positive† Influenza Cases by CDC Week, Missouri, 2011-2015*

† Laboratory-positive Influenza includes the following test methods: rapid influenza diagnostic tests (antigen), reverse transcriptase polymerase chain reaction (RT-PCR) and other molecular assays, immunofluorescence antibody staining (Direct (DFA) or Indirect (IFA)), or viral culture.

*2014-2015 Season-to-Date through the week ending May 23, 2015 (Week 20). Data Source: Missouri Health Information Surveillance System (WebSurv).
Health Advisory:
Influenza in Missouri, 2014

December 24, 2014

This document will be updated as new information becomes available. The current version can always be viewed at http://www.health.mo.gov

The Missouri Department of Health & Senior Services (DHSS) is now using 4 types of documents to provide important information to medical and public health professionals, and to other interested persons:

FROM: GAIL VASTERLING
DIRECTOR

SUBJECT: Influenza in Missouri, 2014

This Missouri Department of Health and Senior Services (DHSS) Health Advisory summarizes 2014-2015 influenza season activity in Missouri through December 13, 2014, and highlights the availability of influenza surveillance for the state.

As of December 13, 2014, the estimated influenza activity level in Missouri is characterized as “Widespread.” A total of 7,498 laboratory-positive influenza cases have been reported statewide since the beginning of the 2014-2015 season. Influenza A has accounted for 93% of reported cases; influenza B, 6%; and influenza unknown or untyped, 1%. Laboratory surveillance data suggests influenza A (H3) is likely causing the majority of influenza cases in the state. All 11 of the laboratory-confirmed influenza cases reported by the Missouri State Public Health Laboratory (MSPHL) during Week 50 were influenza A (H3). Influenza-like illness (ILI) activity is also above baseline for both the Missouri Outpatient ILI Surveillance Network (ILI Net) and hospital emergency department influenza-like illness (ILI) activity surveillance through ESSENCE. These surveillance systems of activity for both influenza and influenza-like illness (ILI) are currently reporting activity levels above baseline, with influenza seen in both the outpatient and hospital emergency department setting.

The DHSS continues to monitor the influenza season, with updated information available on the DHSS Influenza Information page at http://www.health.mo.gov/influenza.
Influenza Weekly Report

• Summary

• Surveillance data
  – Interactive maps
    • Reported Laboratory -positive Influenza Cases by Influenza Type by County, Report Week
    • Reported Laboratory -positive Influenza Cases by Influenza Type by County, Season-to-Date
    • Percentage of Laboratory-positive Influenza Cases Reported to be Influenza Type A
  – Data tables and graphs

• Links to CDC and other sources of influenza data
Missouri Weekly Influenza Surveillance Report
2014-2015 Influenza Season

Week 20: May 17 – May 23, 2015

All data are preliminary and may change as more reports are received.

Summary:

- The estimated influenza activity in Missouri is Sporadic.\(^3\)
- A season-to-date total of 54,316 laboratory-positive\(^2\) influenza cases have been reported in Missouri. Influenza A remains the predominant type reported this season. Influenza B viruses accounted for 100% of the reported cases during Week 20. There were no laboratory-confirmed influenza cases reported by the Missouri State Public Health Laboratory (MSPHL) during Week 20.
- The Centers for Disease Control and Prevention (CDC) has antigenically characterized 21 influenza isolates so far this influenza season from Missouri: five A (H3N2) A/Texas/50/2012-like, seven A H3N2 viruses antigenically similar to the A/Switzerland/9715293/2013, four B/Massachusetts/02/2012-like, and five B/Brussels/60/2008-like. Influenza A/Texas/50/2012-like and B/Massachusetts/02/2012-like are included in the 2014-2015 influenza vaccine for the Northern Hemisphere. B/Brussels/60/2008-like is included in the 2014-2015 Northern Hemisphere quadrivalent influenza vaccine. Influenza A/Switzerland/9715293/2013 is related to, but antigenically and genetically distinguishable, from A/Texas/50/2012 vaccine virus and accounts for 80.7% of the influenza A (H3N2) viruses characterized from U.S. laboratories from October 1, 2014 – May 16, 2015. [http://www.cdc.gov/flu/weekly/](http://www.cdc.gov/flu/weekly/)
- Influenza-like illness activity is below baseline for both the Missouri Outpatient ILI Surveillance Network (ILINet) and the hospital emergency room visit chief complaint data reported through ESSENCE. The reported percentage of visits for ILI was 0.92% and 0.7% through ILINet and ESSENCE respectively\(^4\).
- The highest rate of laboratory-positive influenza cases were among children aged 0-4 years (2 cases per 100,000 population). One influenza-associated pediatric death has been reported in Missouri to date, this influenza season. Deaths involving Pneumonia and Influenza (P&I) reported to the Bureau of Vital Records increased to 70 deaths during Week 19, resulting in a season-to-date total of 2,937 P&I associated deaths in Missouri\(^5\).
- No outbreaks of influenza or ILI were reported during Week 20 in Missouri. No ILI-associated school closures were reported during Week 20.
- National influenza activity and surveillance information is prepared by the CDC. The information including a weekly report (FLUVIEW) is available online at [http://www.cdc.gov/flu/weekly/fluactivitysurv.htm](http://www.cdc.gov/flu/weekly/fluactivitysurv.htm).

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\(^1\)The 2014-2015 influenza season in Missouri began CDC Week 40 (Week ending October 4, 2014) through CDC Week 20 (week ending May 23, 2015).

\(^2\)Sporadic is defined as: influenza-like illness activity has not increased and there are isolated lab-confirmed cases or a lab-confirmed outbreak in a single institution in the state.

\(^3\)Laboratory-positive influenza includes the following test methods: rapid influenza diagnostic tests (antigen), reverse transcriptase polymerase chain reaction (RT-PCR) and other molecular assays, immunofluorescence antibody staining (Direct (DFA) or Indirect (IFA)), or viral culture.

\(^4\)Influenza-like Illness (ILI) is defined as fever (temperature of 100°F [37.8°C] or greater) and a cough and/or a sore throat without a known cause other than influenza.

\(^5\)The P&I data are available one week later. The P&I data for the CDC Week provided is the most current data available.
Expect Murphy's Law to be in Full Effect

“An observation: anything that can go wrong will go wrong” Merriam-Webster Dictionary
What If We Stopped Vaccinating?

• 1921: 15,000 in U.S. died from diphtheria (1 case reported since 2004)
• 1964-65: Rubella (German measles) epidemic in infected 12½ million U.S.
  – 20,000 cases of congenital rubella syndrome
  – 2,000 babies died,
  – 11,000 miscarriages
• Before 1963: 500,000 cases and 500 death annually from measles
• 1940’s: greater than 200,000 cases of pertussis reported annually (2008-2011: annual average 3,132 cases infants and 16 deaths)
• 1980’s: 20,000 cases of *Haemophilus influenzae* type B primarily in children less than 5 years
  – Despite appropriate antimicrobial therapy 30% hearing impairment or neurologic sequelae and up to 6% will die
Presentation References


• American Public Health Association Control of Communicable Diseases Manual. 20th ed.

• Centers for Disease Control website: www.cdc.gov

• Epidemiology and Prevention of Vaccine-Preventable Diseases: The Pink Book 13 ed. 2015

• DHSS Communicable Disease Investigation Reference Manual

• DHSS Data and Statistical Reports
Thank You!

John Bos, MPH
Interim Chief,
Bureau of Communicable Disease Control and Prevention
Missouri Department of Health and Senior Services