

The Epidemiology of Vaccine Preventable Diseases in Missouri

John Bos, MPH

Assistant Chief,

Bureau of Communicable Disease Control and Prevention

Missouri Department of Health and Senior Services

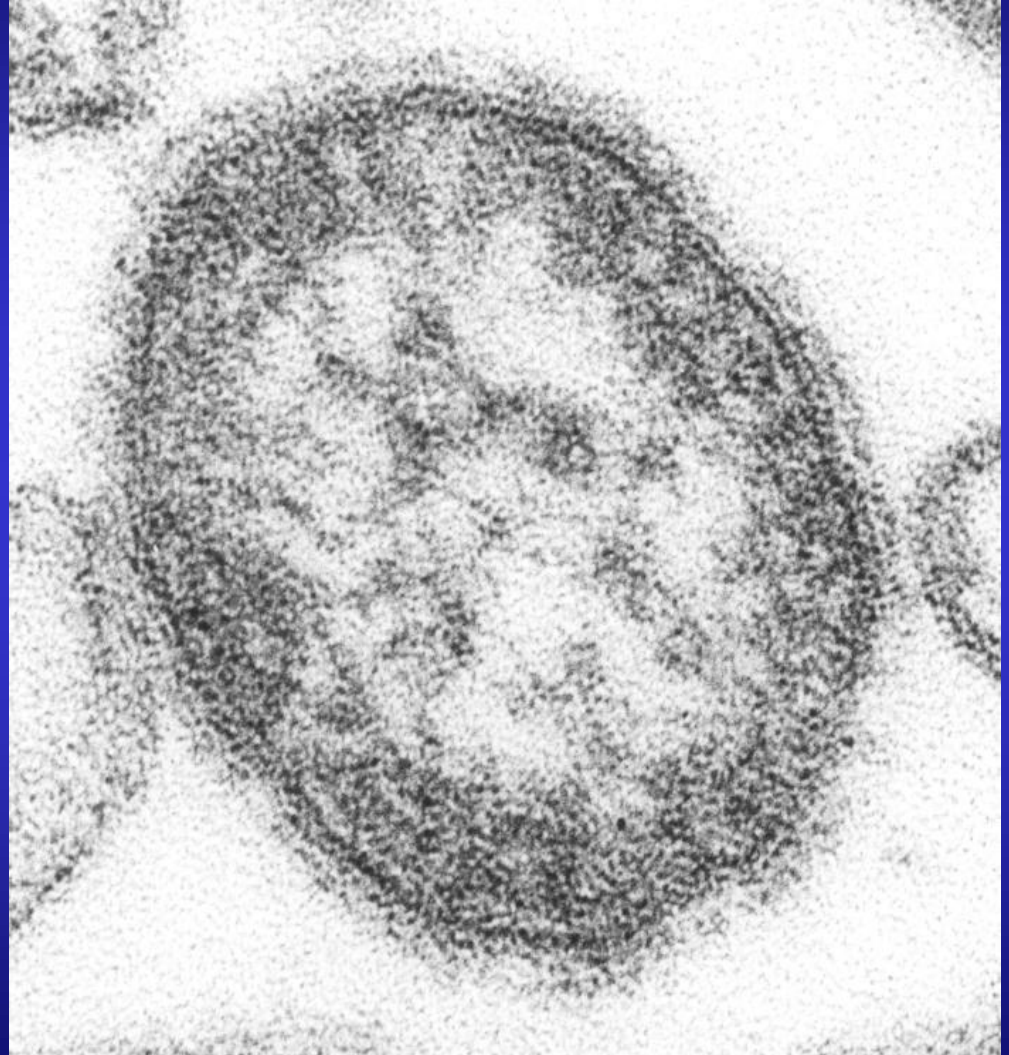
Presentation Objectives

- 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)



CDC/NIP/ Barbara Rice



CDC/ Cynthia S. Goldsmith; William Bellini, Ph.D.

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, laryngotracheobronchitis, and diarrhea
- One out of every 1,000 cases will develop acute encephalitis, which often results in permanent brain damage
- One or two out 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

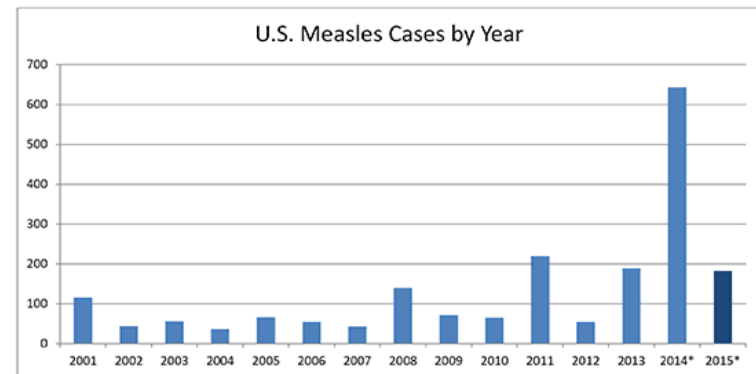
Measles Cases and Outbreaks

189
Cases

reported in 24 states and the District of Columbia: Alaska, Arizona, California, Colorado, Delaware, Florida, Georgia, Illinois, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Jersey, New York, Nevada, Ohio, Oklahoma, Pennsylvania, South Dakota, Texas, Utah, Virginia, Washington

5
Outbreaks

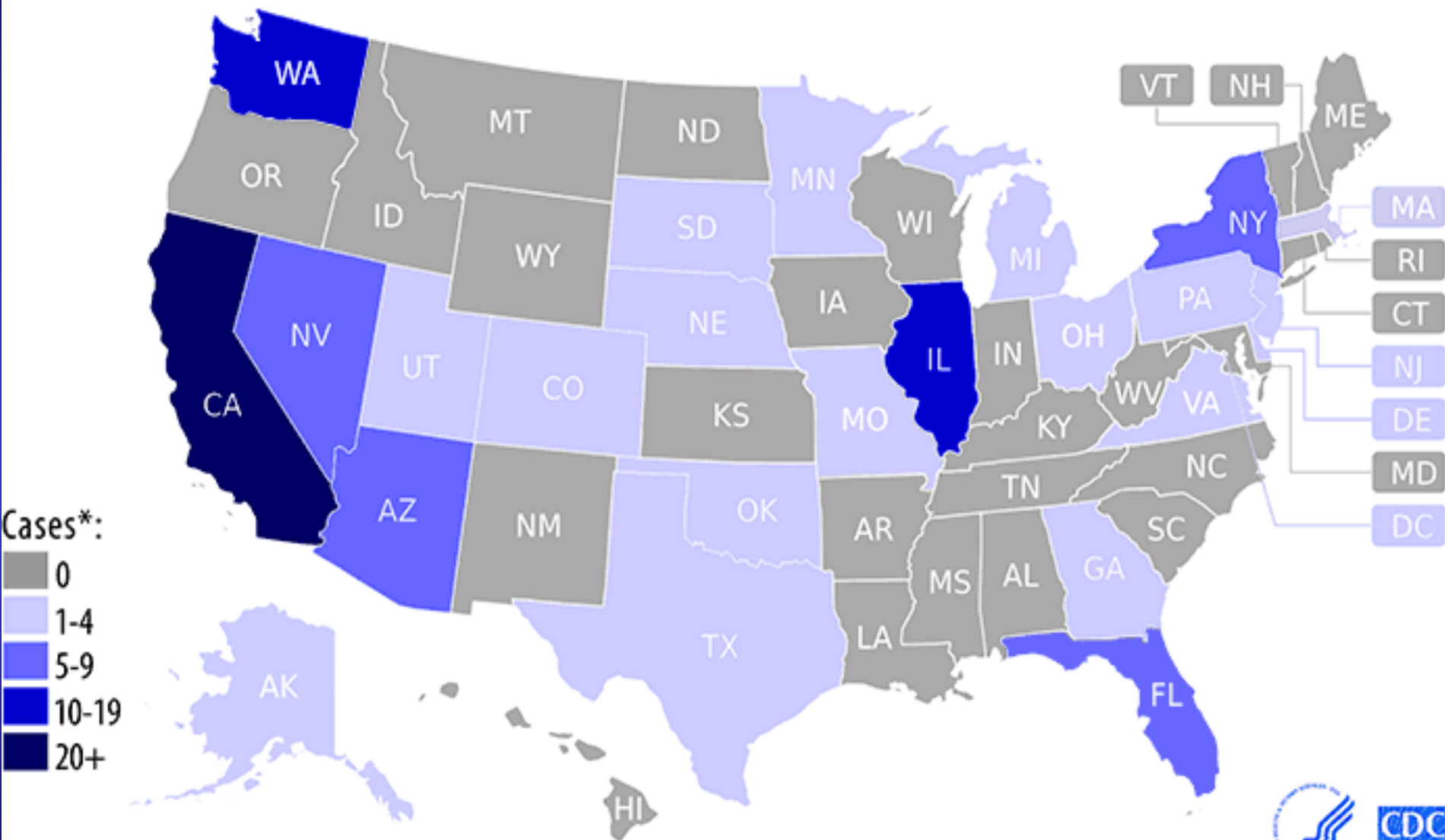
representing 80% of reported cases this year



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



2015 Measles Cases in the U.S.



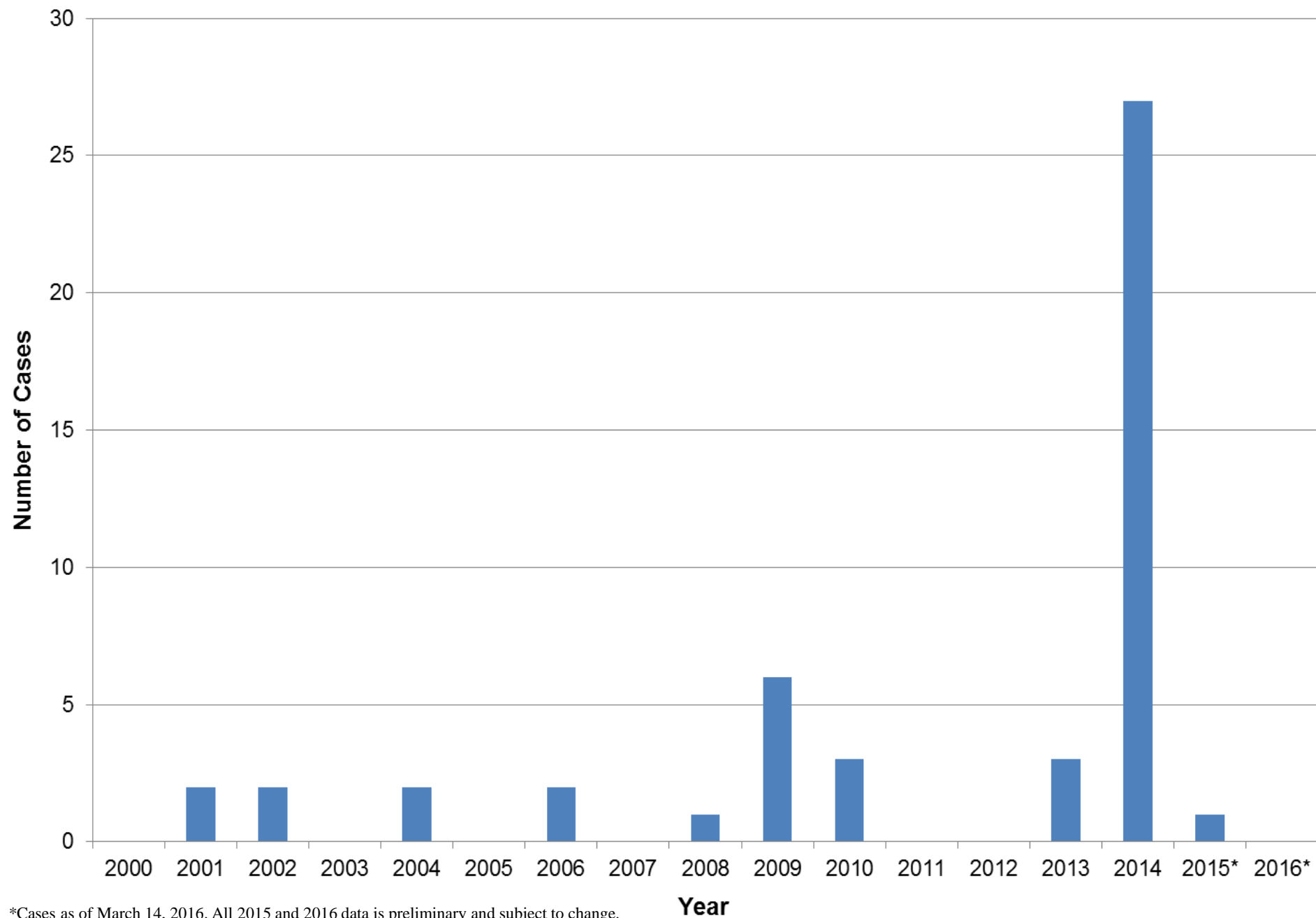
*Provisional data reported to CDC's National Center for Immunization and Respiratory Diseases



Measles Case: Missouri 2015

	Missouri Department of Health & Senior Services
Health Advisory: Measles Case in Missouri June 4, 2015 <small>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</small>	Health Advisory June 4, 2015 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.

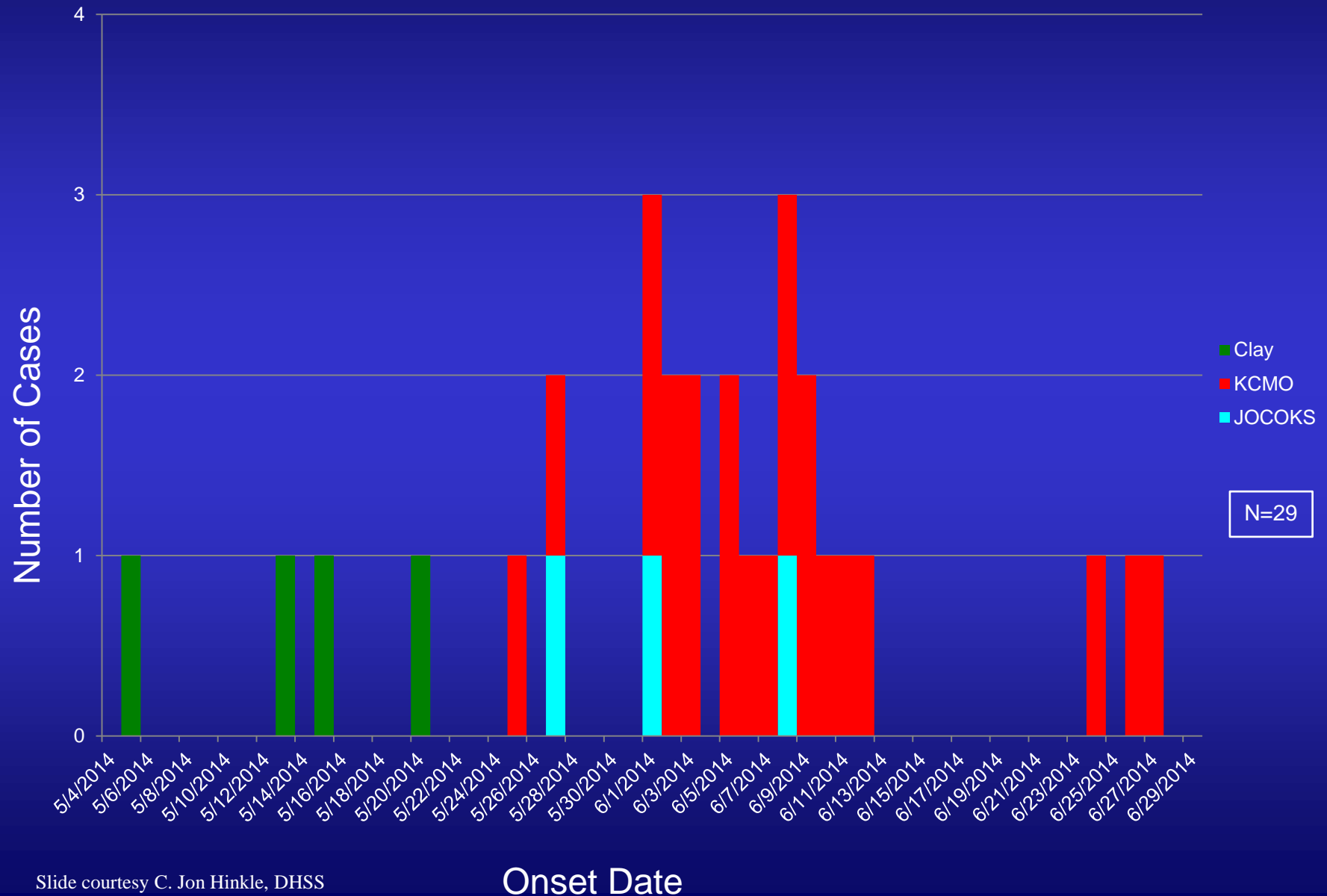
Measles Cases by Year - Missouri, 2000-2016



Measles: Outbreak 2014

- Multi-state (29 cases from the Kansas City Metropolitan Area)
- Age Range: 2 Weeks – 43 Years
 - Median Age: 21.5 Years
 - Average Age: 17.9 Years
- 55% Female
- Demographic factors
 - 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



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

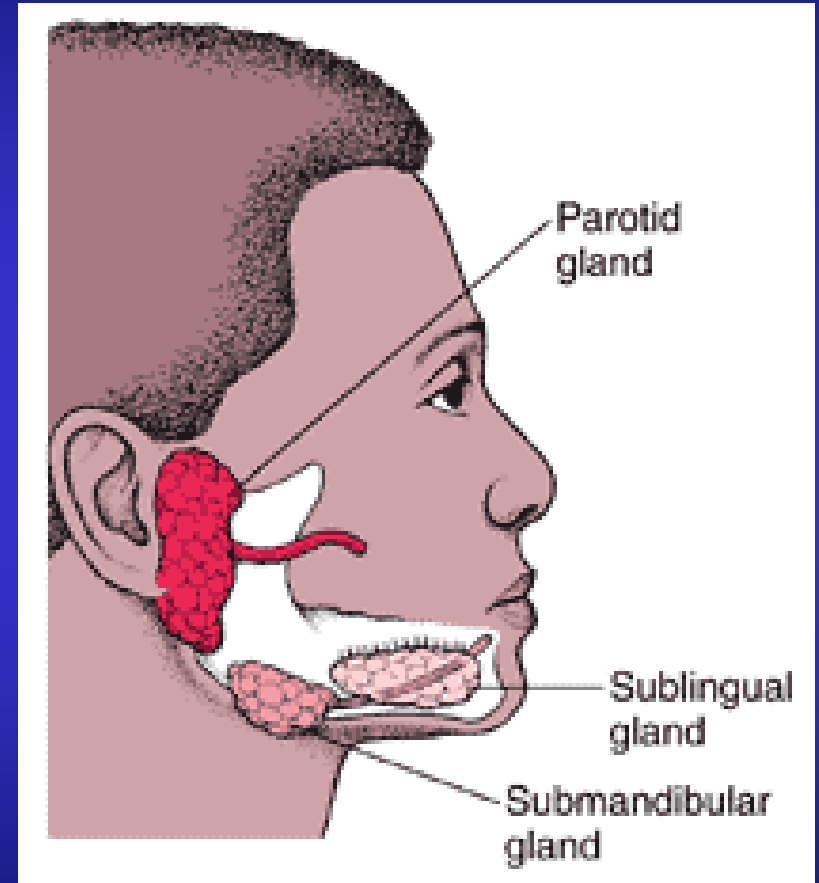
Mumps



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 at least 2 days, but may persist longer than 10 days



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 respiratory secretions or saliva

Mumps: Cases / Outbreaks

- 2011-2013: Several smaller mumps outbreaks on college campuses in California, Virginia, and Maryland
- 2009-2010: Two 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 in the Midwest

United States

Year	Cases
2010	2,612
2011	370
2012	229
2013	584
2014	1,223
2015*	1,057
2016**	250

*Cases as of January 2, 2016. Data is preliminary and subject to change.

**Cases as of March 4, 2016. Data is preliminary and subject to change.

Source: [Morbidity and Mortality Weekly Report \(MMWR\), Notifiable Diseases and Mortality Tables](#)

Mumps Cases: Missouri 2015

Missouri Department of Health & Senior Services

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

Health Advisory
July 24, 2015

FROM: GAIL VASTERLING
DIRECTOR

SUBJECT: Mumps Cases in Central Missouri

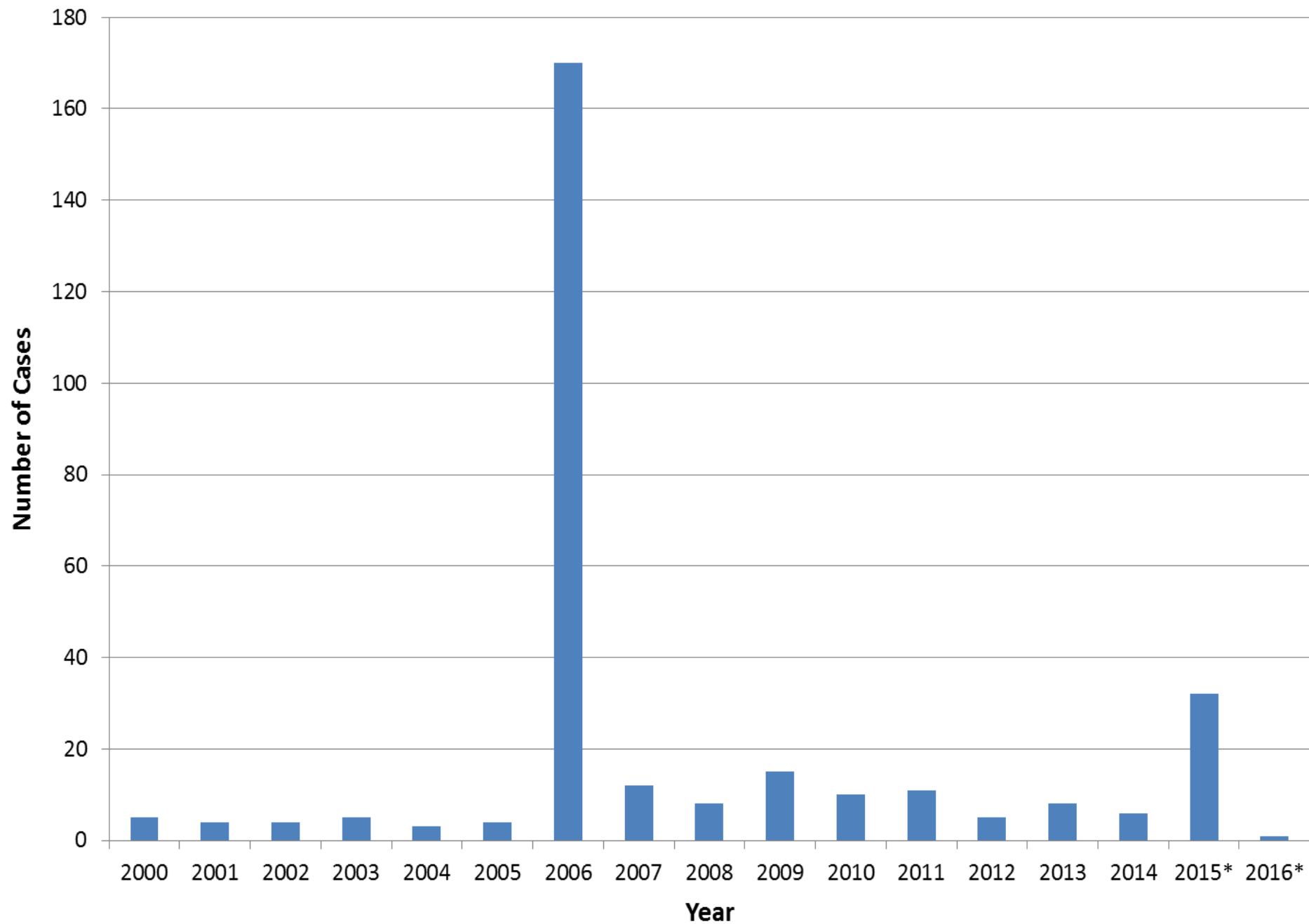
On July 20, 2015, the Columbia/Boone County Department of Public Health and Human Services (CBCDPHHS) and the Missouri Department of Health and Senior Services (DHSS) received a report of suspected mumps cases among persons associated with a large university located in Central Missouri. Seven persons 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

Mumps Cases by Year - Missouri, 2000-2016*



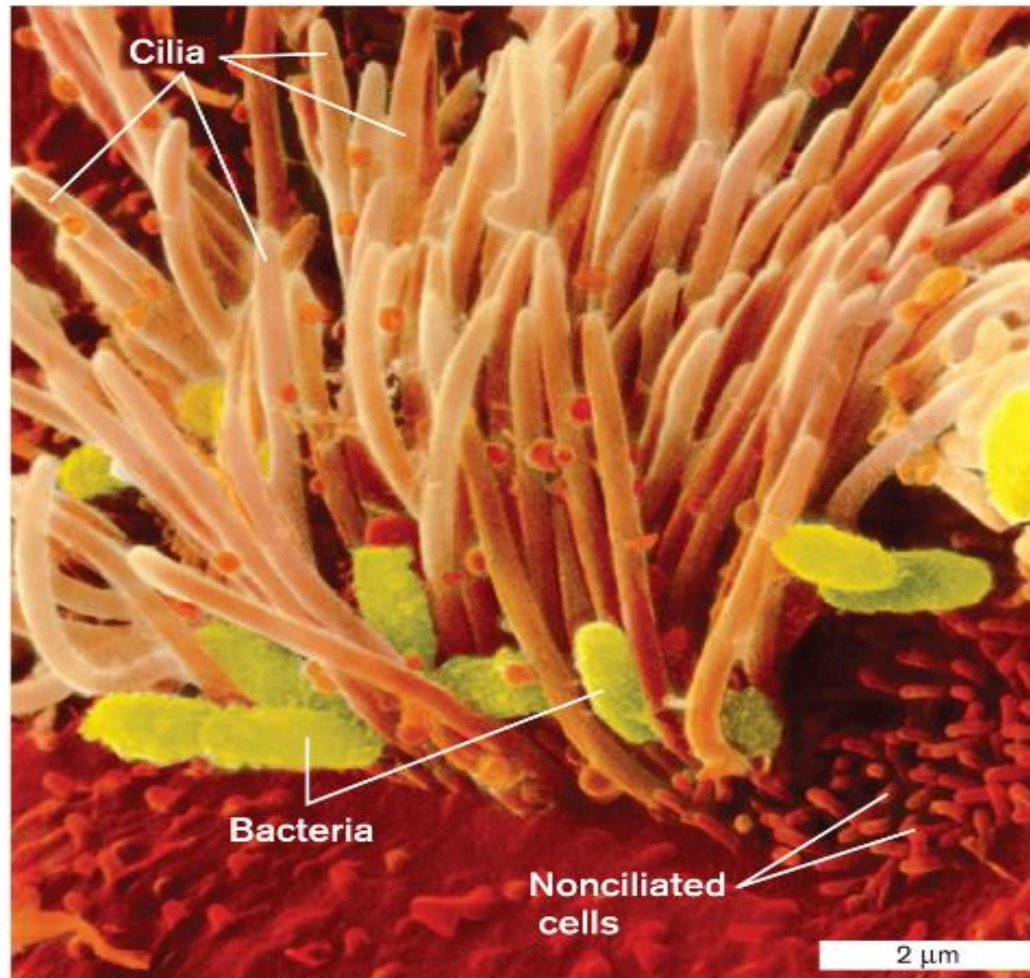
*Cases as of March 14, 2016. All 2015 and 2016 data is preliminary and subject to change.

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



NIBSC/SCIENCE PHOTO LIBRARY

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

Pertussis: Background

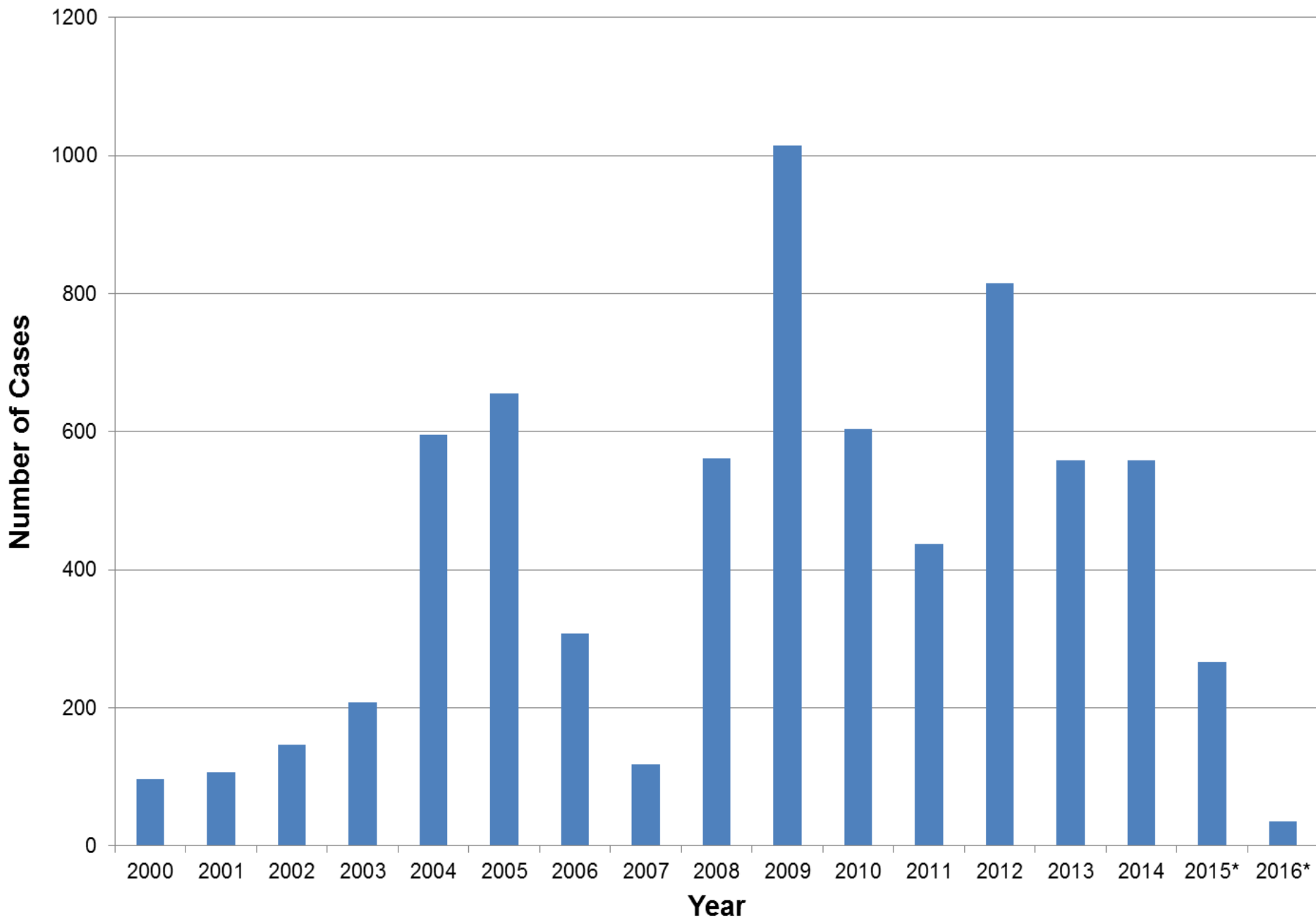
- Incubation period: Average 9-10 days (range 6-20 days)
- Diagnosis: Culture, PCR, serology
- Communicable: three weeks after onset of symptoms or five days following treatment with an appropriate antibiotic
- Transmission: Direct contact with respiratory droplets probably via large droplets

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

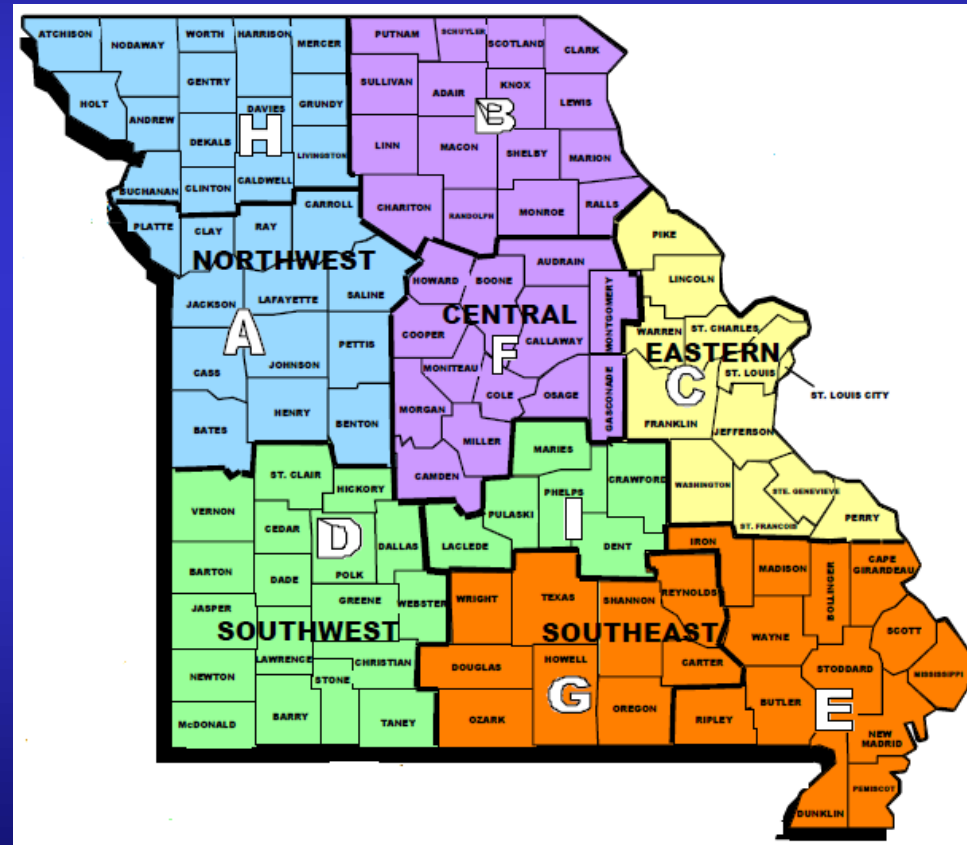
Pertussis Cases by Year - Missouri, 2000-2016*



*Cases as of March 14, 2016. All 2015 and 2016 data is preliminary and subject to change.

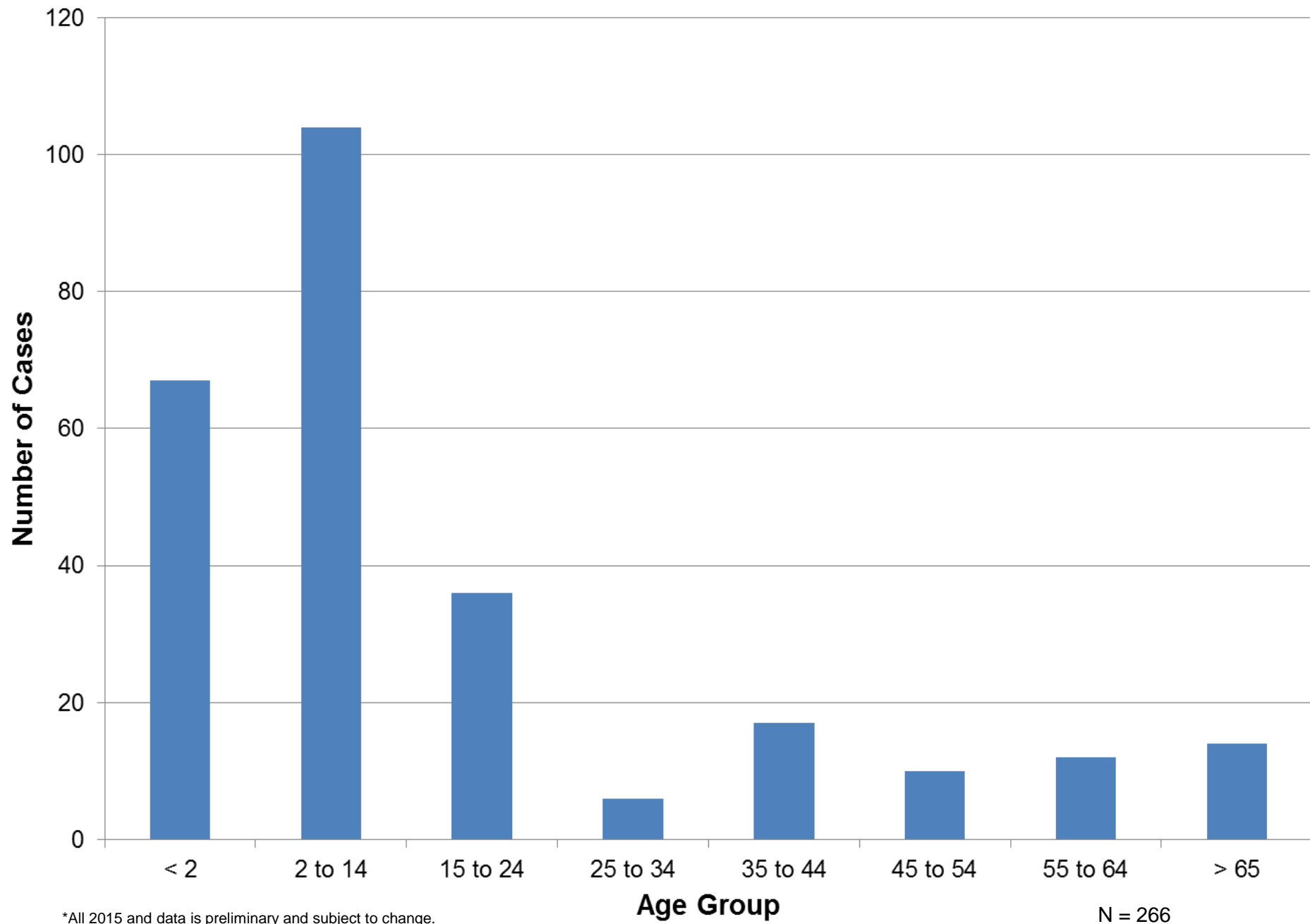
Pertussis: 2015* Cases

- 266 reported cases
- 62 Local Public Health Jurisdictions
- Each district statewide
 - 96 Eastern
 - 61 Northwest
 - 48 Southwest
 - 33 Southeast
 - 28 Central



* 2015 data is preliminary and subject to change.

Pertussis Cases by Age Group - Missouri, 2015*



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

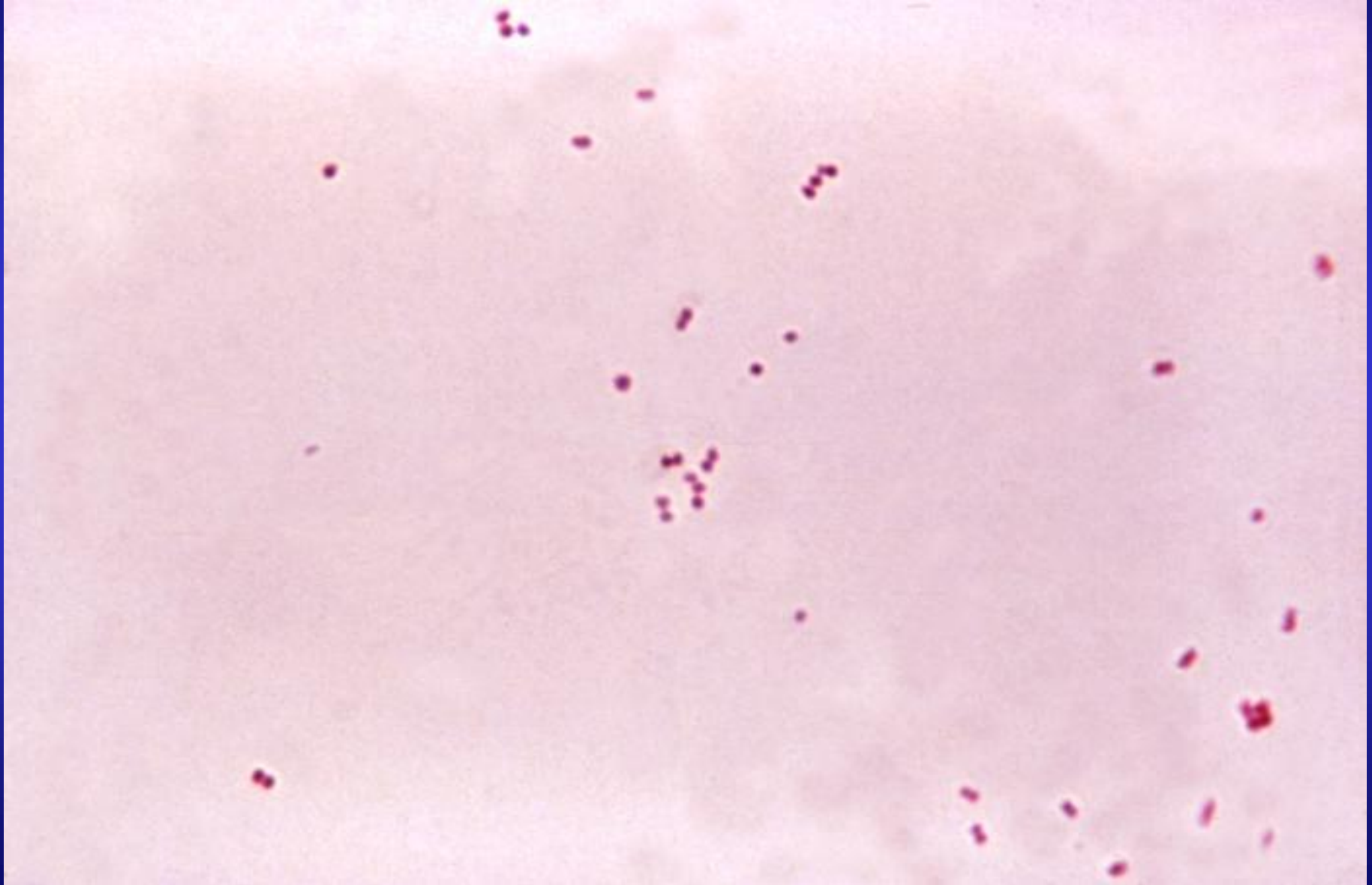


Image courtesy of CDC. <http://www.cdc.gov/meningococcal/about/photos.html>

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

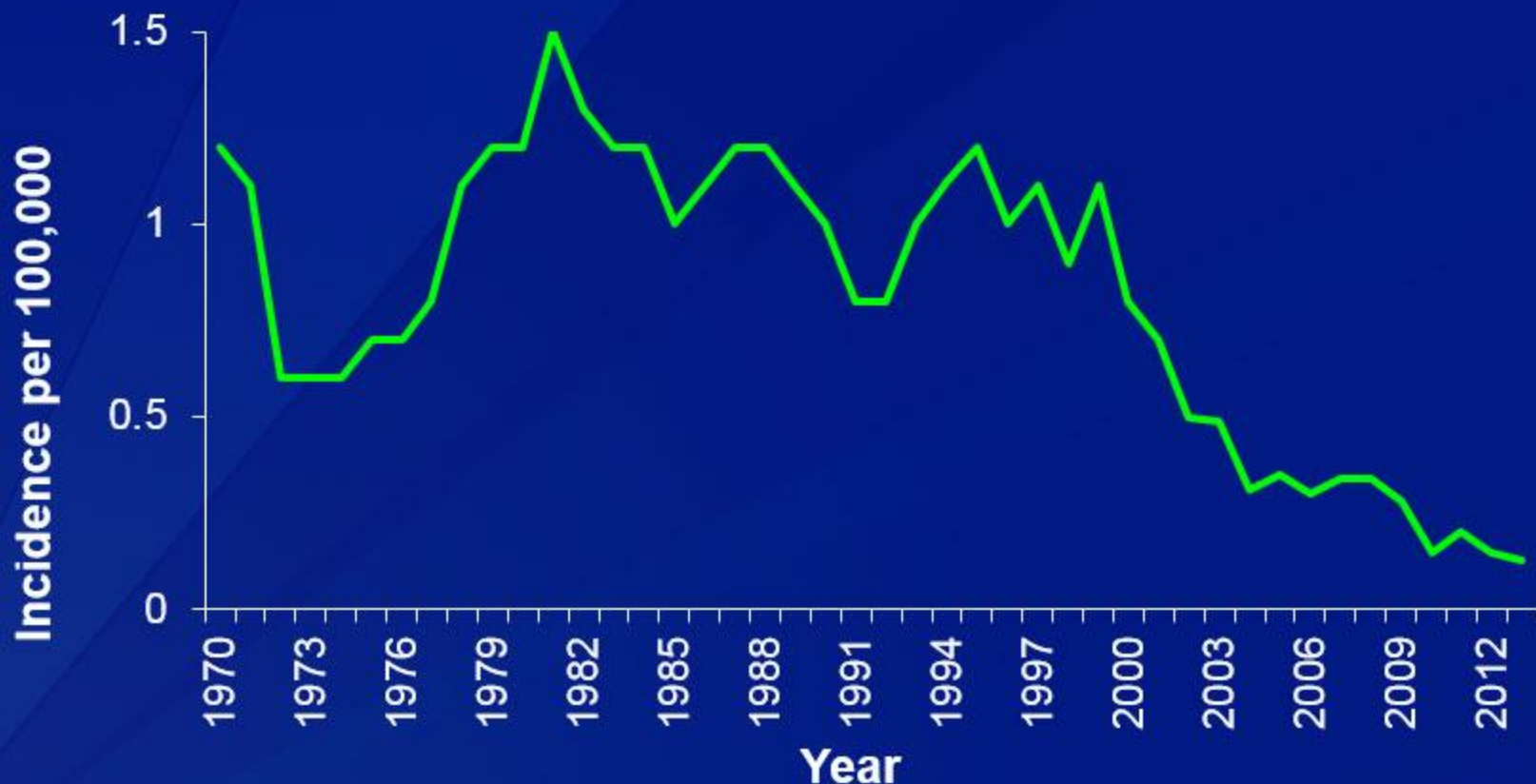
Meningococcal Disease: Background

- 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

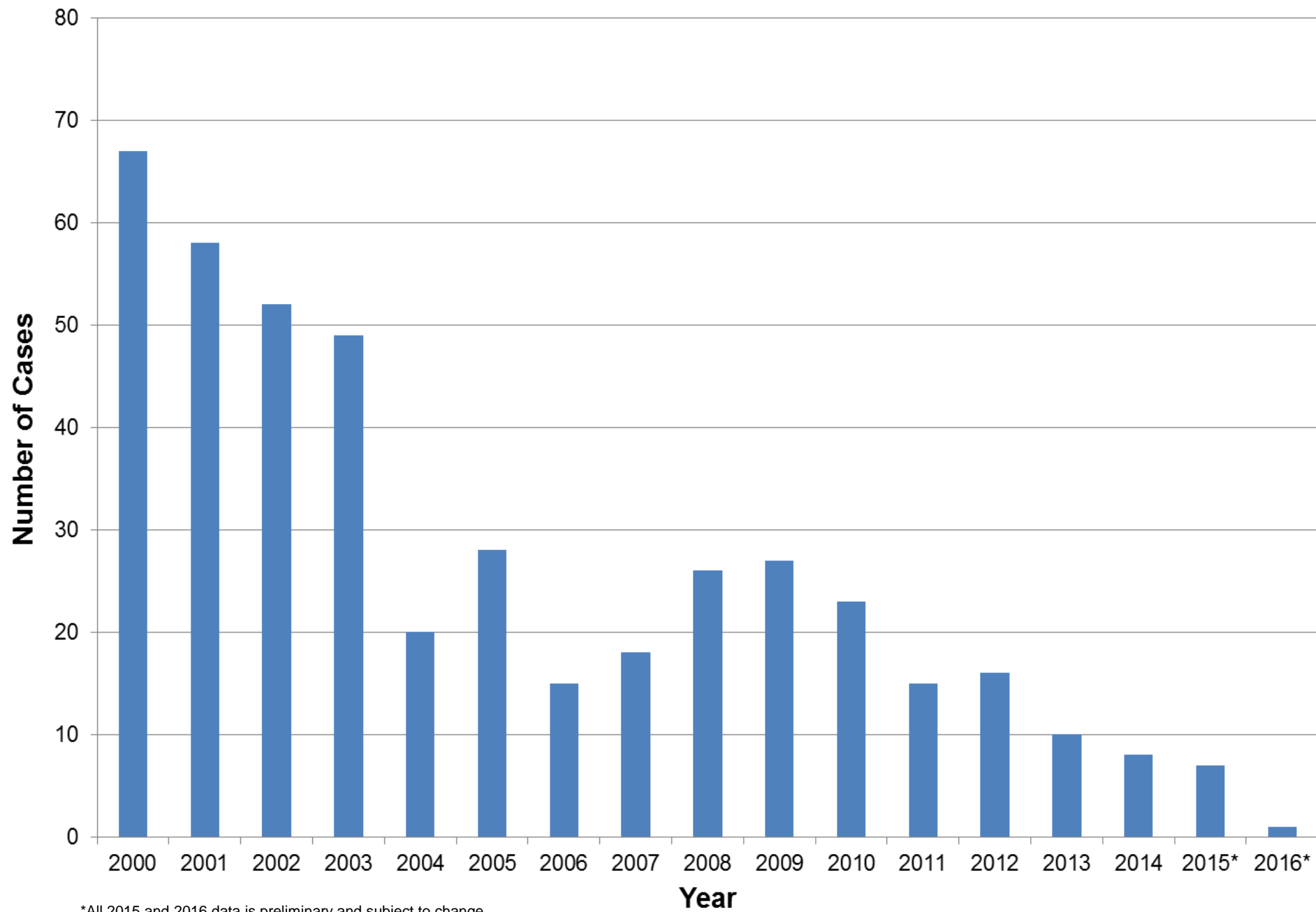
- Transmission: direct contact with respiratory droplets from nose or throat
 - 5-10% of population may be asymptomatic carriers with nasopharyngeal colonization
 - Carrier rates of 25% have been documented in absence of disease
 - Less than 1% colonized will develop invasive disease
 - 98% of cases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

Meningococcal Disease Incidence, United States, 1970-2013



SOURCE: CDC. 1970-1996 National Notifiable Diseases Surveillance System, 1997-2013 Active Bacterial Core surveillance estimated to U.S. population

Meningococcal Disease Cases by Year - Missouri, 2000-2016*

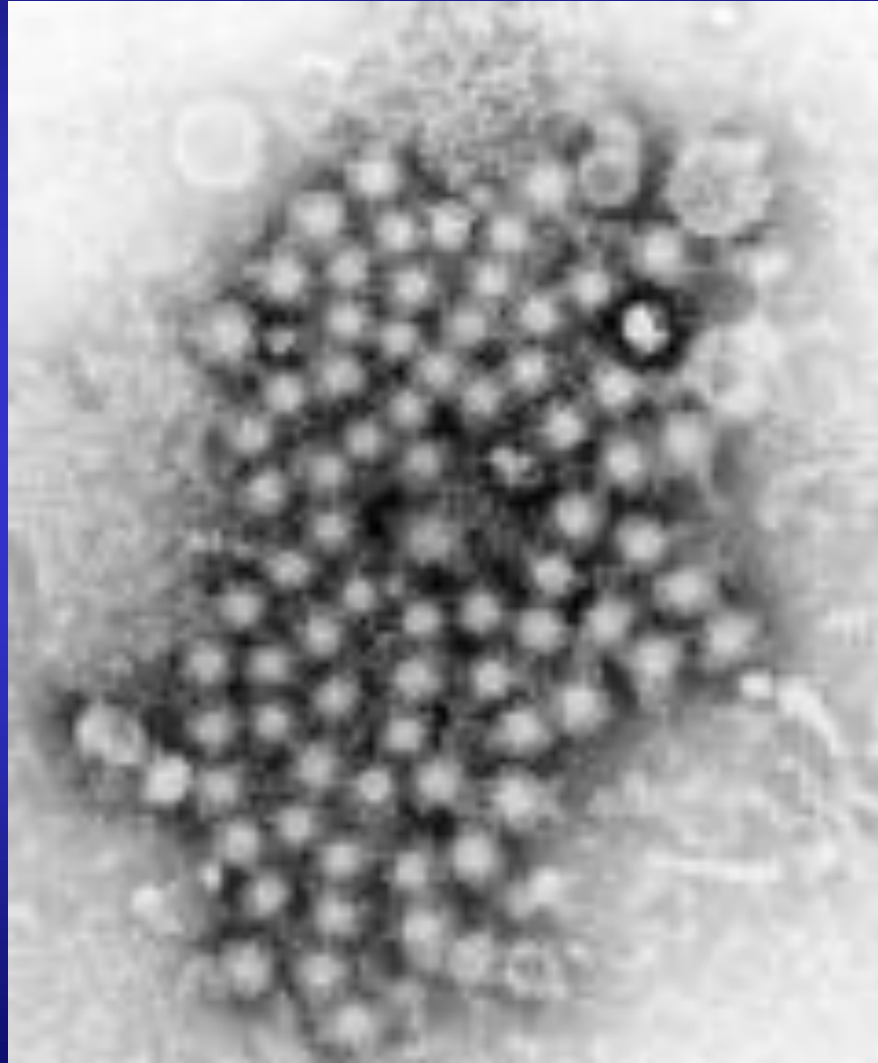


*All 2015 and 2016 data is preliminary and subject to change.

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

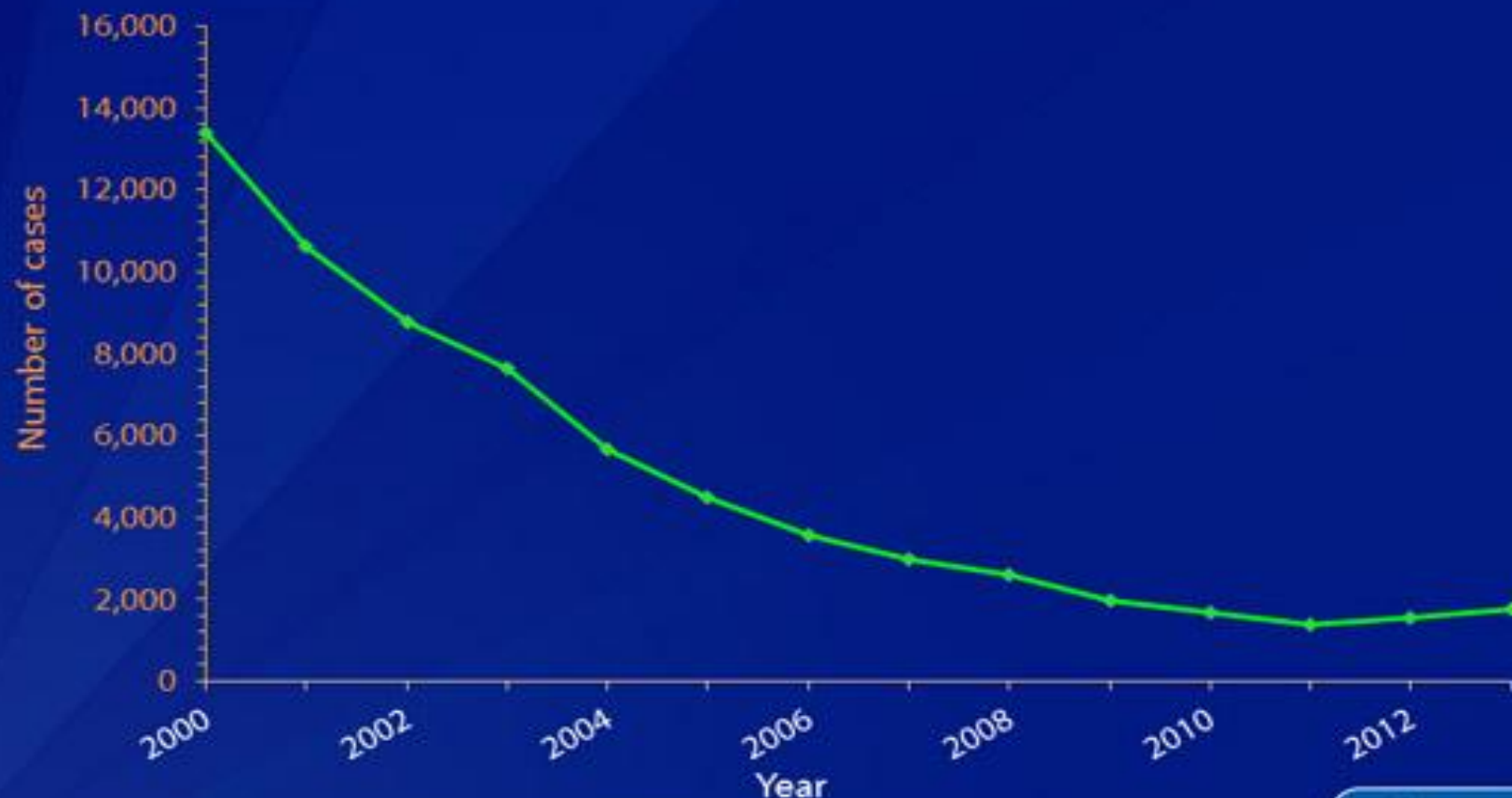
Hepatitis A



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: two weeks before onset to one week after onset of jaundice (two weeks after onset of symptoms in absence of jaundice)
- Transmission: Person-to-person, fecal oral route

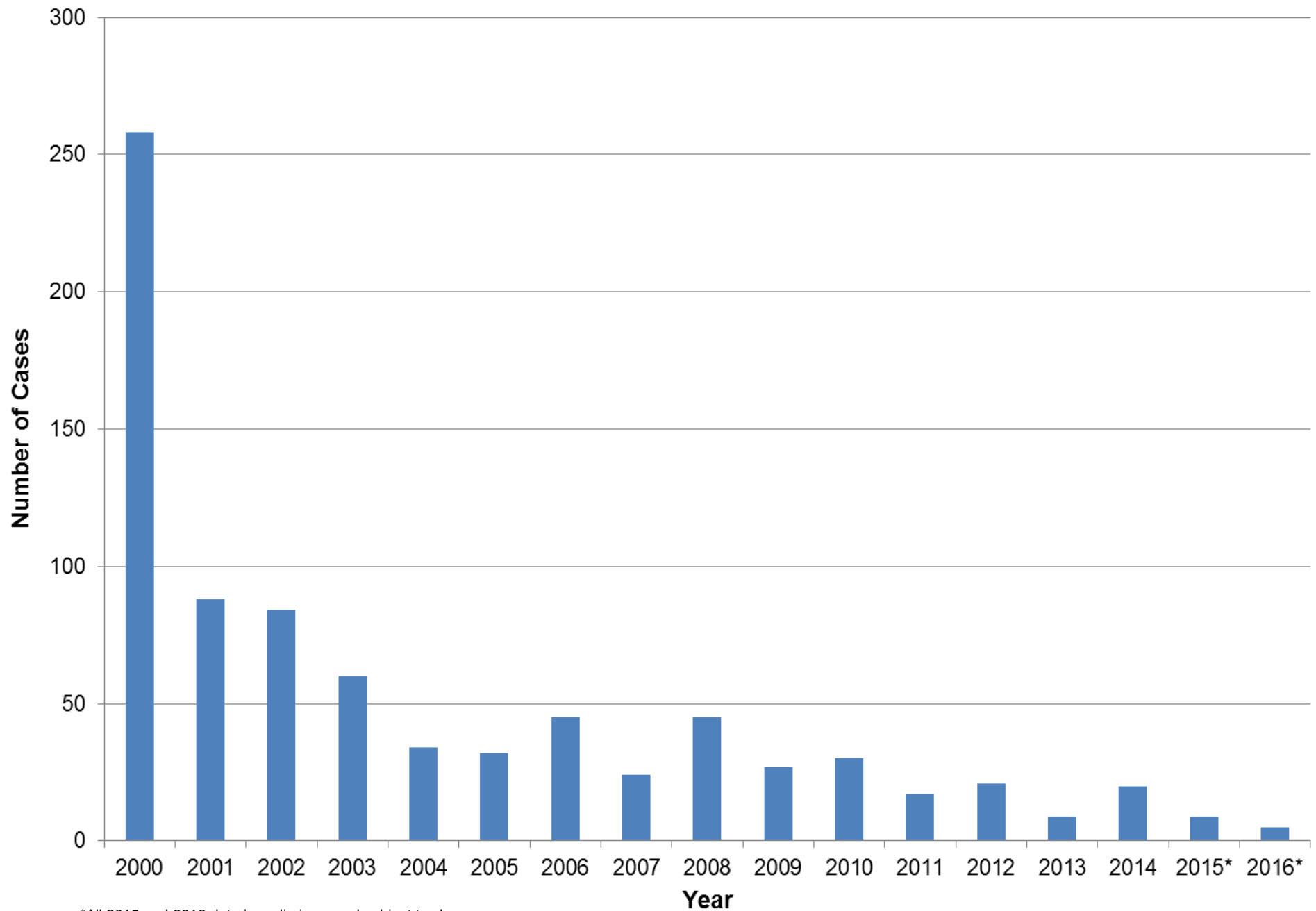
Figure 2.1. Reported number of acute hepatitis A cases — United States, 2000–2013



Source: National Notifiable Diseases Surveillance System (NNDSS)



Hepatitis A Cases by Year - Missouri, 2000-2016*

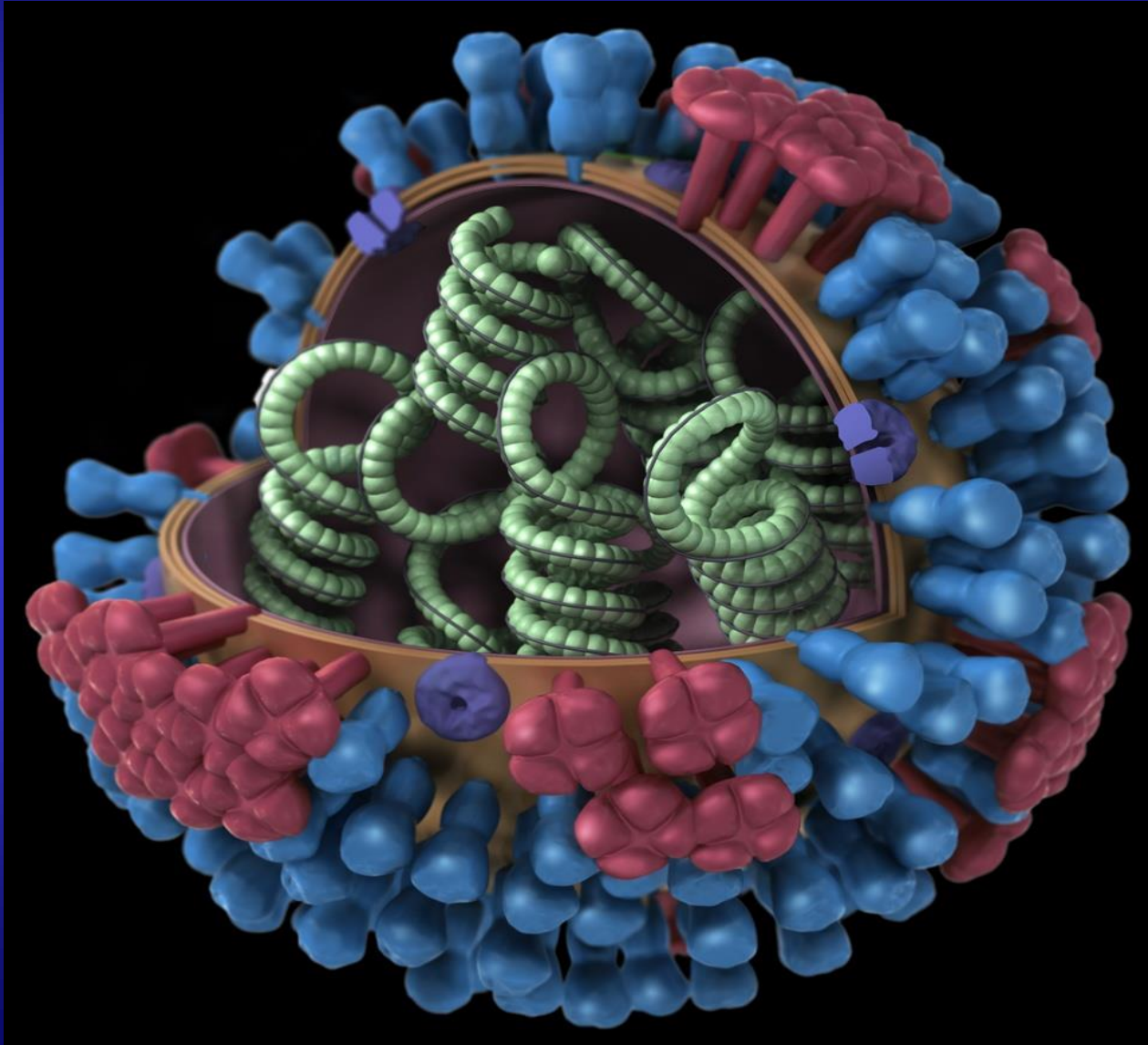


*All 2015 and 2016 data is preliminary and subject to change.

Hepatitis A: Public Health Investigation and Control Measures

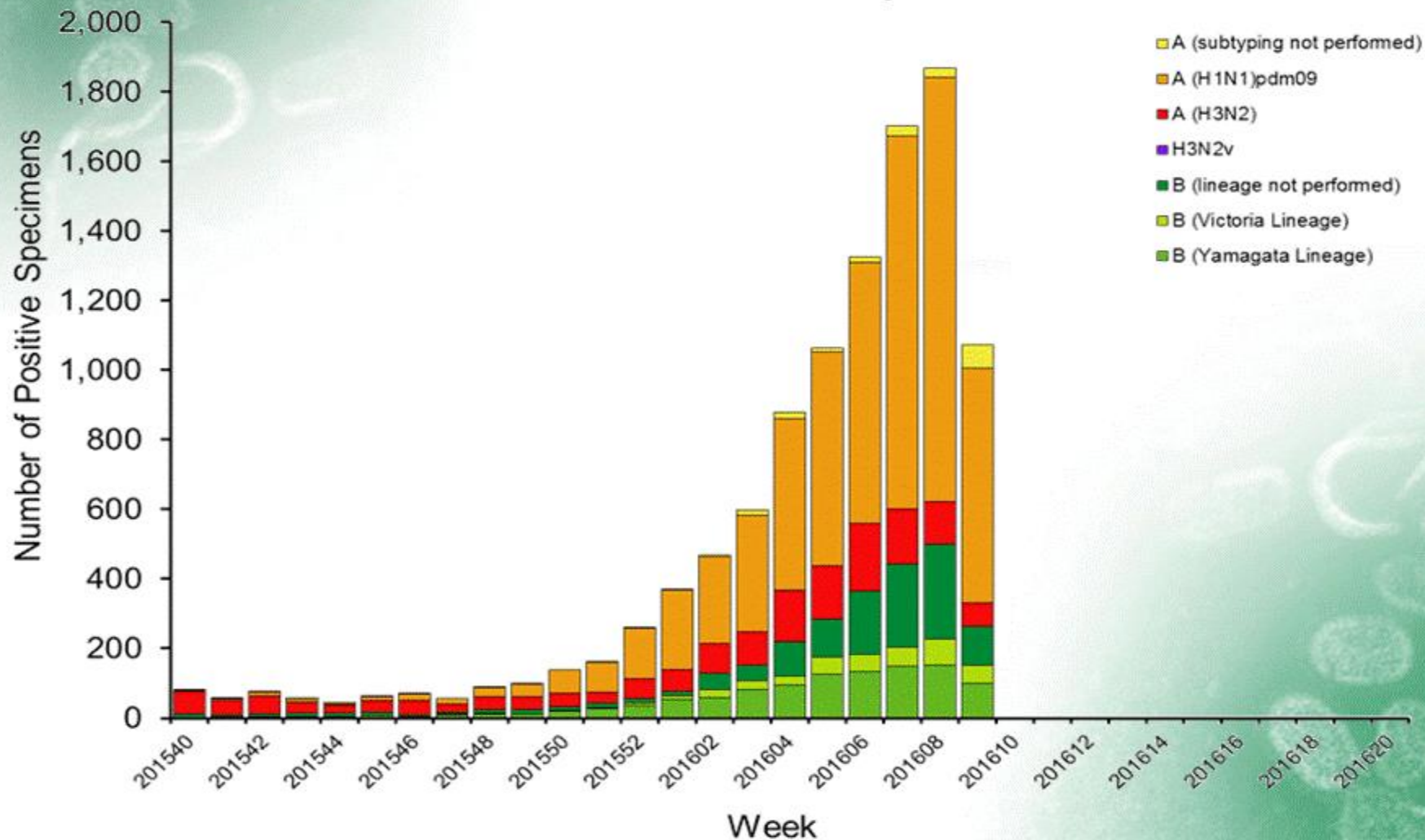
- Confirm the diagnosis
- Identify all close contacts (2 weeks before onset to 1 week after onset of Jaundice or 2 weeks after symptom onset)
- Determine immunity
- Post-exposure prophylaxis of susceptible contacts within 14 days of exposure
 - Hepatitis A vaccine
 - Immunoglobulin for persons > 40 years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

Influenza



A Weekly Influenza Surveillance Report Prepared by the Influenza Division

Influenza Positive Tests Reported to CDC by U.S. Public Health Laboratories, National Summary, 2015-2016 Season

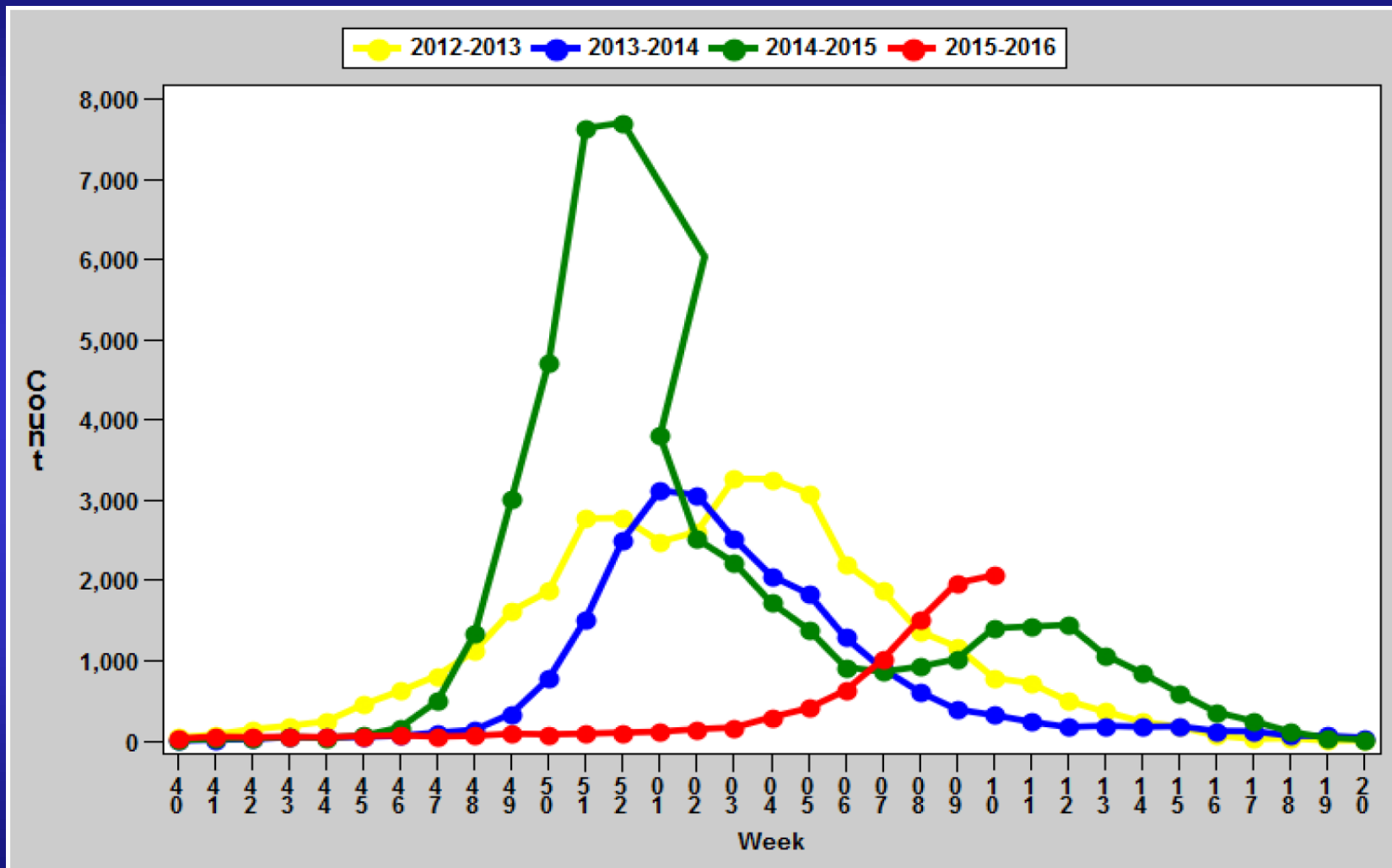


2015 – 2016 Influenza Season - Missouri*

- 9,217 laboratory-positive influenza cases reported
 - 76% Influenza A
 - 21% Influenza B
 - 3% unknown / untyped
- Antigenic characterization
 - Two viruses were antigenically similar to the A/Switzerland/9715293/2013-like (H3N2) virus
 - Two viruses were antigenically similar to the A/California/7/2009-like (H1N1)pdm09 virus
- Both an A/Switzerland/9715293/2013-like virus and an A/California/7/2009-like virus are included in the 2015-2016 Northern Hemisphere vaccine formulation.

* The 2015-2016 influenza season in Missouri began CDC Week 40 (week ending October 10, 2015) and data is through Week 10 (week ending March 12, 2016). Data is preliminary and subject to change.

Number of Laboratory-positive† Influenza Cases by CDC Week, Missouri, 2012-2016*



† 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.

*2015-2016 Season-to-Date through Week 10 (March 12, 2016). 2014-2015 Season had 53 weeks rather than the usual 52. Data Source: Missouri Health Information Surveillance System (WebSurv).

Influenza Weekly Report

- Summary :
<http://health.mo.gov/living/healthcondiseases/communicable/influenza/reports.php>
- 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 2015–2016 Influenza Season¹

Week 10: March 6 – March 12, 2016

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

Summary:

- The estimated influenza activity in Missouri increased to Widespread².
- A season-to-date total of 9,217 laboratory-positive³ influenza cases have been reported in Missouri. The influenza type for reported cases season-to-date includes 76% influenza A, 21% influenza B, and 3% untyped. Influenza A accounted for 79% of reported cases during Week 10 and remains the predominant virus type reported this season. The highest season-to-date rates of reported laboratory-positive influenza cases are among children aged 0–4 years (486 cases per 100,000 population) and children aged 5–14 years (237 cases per 100,000 population). Three laboratory-confirmed influenza cases (two influenza A (H1N1), one influenza B) were reported by the Missouri State Public Health Laboratory (MSPHL) during Week 10.
- The Centers for Disease Control and Prevention (CDC) has antigenically characterized four influenza isolates from Missouri, to date, this influenza season. Two viruses were antigenically similar to the A/Switzerland/9715293/2013-like (H3N2) virus and two viruses were antigenically similar to the A/California/7/2009-like (H1N1)pdm09 virus. Both an A/Switzerland/9715293/2013-like virus and an A/California/7/2009-like virus are included in the 2015–2016 Northern Hemisphere vaccine formulation.
- Influenza-like illness activity was above baseline for both the Missouri Outpatient ILI Surveillance Network (ILINet) and for the hospital emergency room visit chief complaint data reported through ESSENCE during Week 10. The reported percentage of visits for ILI was 3.40% and 2.08% through ILINet and ESSENCE respectively⁴.
- No influenza-associated pediatric deaths have been reported in Missouri, to date, this influenza season. During Week 9, 79 deaths were reported involving Pneumonia and Influenza (P&I) reported to the Bureau of Vital Records, resulting in a season-to-date total of 1,480 P&I associated deaths in Missouri⁵.
- Two influenza or ILI-associated outbreaks have been reported in Missouri, to date, this influenza season. No influenza or ILI-associated school closures have been reported in Missouri, to date, this influenza season.
- Influenza activity remained elevated in the U.S. during Week 9. National influenza surveillance information is prepared by the CDC and is included in the weekly FLUVIEW report, which is available online at <http://www.cdc.gov/flu/weekly/fluactivitysurv.htm>.

¹The 2015–2016 influenza season in Missouri began CDC Week 40 (week ending October 10, 2015) through CDC Week 20 (week ending May 21, 2016).

²Widespread is defined as: Outbreaks of influenza or increases in ILI cases and recent laboratory-confirmed influenza in at least half the regions of the state with recent laboratory evidence of influenza in the state.

³Laboratory-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.

⁴Influenza-like Illness (ILI) is defined by ILINet 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. Influenza-like Illness (ILI) is defined by ESSENCE as Emergency Department chief complaints that contain keywords such as “flu”, “flulike”, “influenza” or “fever” plus “cough” or “fever” plus “sore throat”.

⁵The 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 (2013: 28,639 cases reported)
- 1980's: 20,000 cases of *Haemophilus influenzae* type B primarily in children less than 5 years
 - Despite appropriate antimicrobial therapy 20% hearing impairment or neurologic sequelae and up to 6% will die

Presentation References

- American Academy of Pediatrics. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. *RedBook: 2015 Report of the Committee on Infectious Diseases*. 30th ed.
- 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

Assistant Chief,

Bureau of Communicable Disease Control and Prevention

Missouri Department of Health and Senior Services