ALL ABOUT VACCINE PREVENTABLE DISEASES

POLIO

- Highly contagious disease caused by poliovirus.
- Most infections are asymptomatic or result in nonspecific febrile illness.
- A small portion of patients will experience meningitis and/or paralytic disease.
- The proportion of individuals who experience paralytic disease ranges from 100:1 to 1000:1 or more.
- Viral replication occurs in the oropharynx and the intestinal tract.
- Can be transmitted via the respiratory route or fecal contamination.

POLIO IN THE US AND NORTH DAKOTA

- The last imported case of wild type polio in the US was in 1993.
- Prior to that case the last case was in 1986.
- The last cases of naturally occurring paralytic polio in the US occurred in 1979 among an Amish community.
- The last case of paralytic polio in North Dakota was in 1977.

POLIO IN THE WORLD

- Polio virus has been eradicated from most of the world.
- Two countries currently have ongoing transmission of Wild Type Polio Virus:
  - Afghanistan reported 19 cases of Wild Type Polio in 2015
  - Pakistan reported 23 cases of Wild Type Polio in 2015
- Countries that remain vulnerable to polio include:
  - Cameroon, Equatorial Guinea, Eritrea, Iraq, Nigeria, Somalia, South Sudan, and the Syrian Arab Republic

VACCINATION RECOMMENDATIONS

- IPV or Inactivated polio vaccine is the only polio vaccine available in the United States.
- Routinely recommended at age 2 months, 4 months, 6 through 18 months, and one dose after age 4.
- Unvaccinated individuals traveling to high risk areas should be vaccinated before leaving.
  - 3 doses
  - First two doses given 1-2 months apart.
  - Third dose 6-12 months after the second.
**POLIO TESTING**

- Poliovirus isolation is most likely possible from stool specimens
  - This does not provide proof that polio is causing paralytic poliomyelitis
  - For this isolation of virus from cerebrospinal fluid (CSF) is needed but this is rarely accomplished
  - 2 stool specimens and 2 throat swabs should be obtained 24 hours apart from patient with suspected poliomyelitis as early as possible
  - Specimens should be forwarded to CDC to determine whether the virus is wild or vaccine related

**MEASLES**

- Respiratory disease caused by a virus
  - Symptoms typically begin with fever, runny nose, cough and red watery eyes
  - Koplik Spots may appear two or three days after symptoms begin
  - Rash that covers the body will develop three to five days after symptoms begin
  - Rash usually starts on the face at the hairline as flat red spots
  - Spreads downward to trunk, arms and legs and feet

**KOPLIK SPOTS**

**MEASLES RASH**

**MEASLES TRANSMISSION**

- Spread through the air by breathing, coughing or sneezing
  - Can live for up to 2 hours outside the body
  - Can spread the disease 4 days before rash appears
  - Can result in other complications
    - 1/10 children get ear infection
    - 1/20 children get pneumonia
    - 1/1000 children get encephalitis
    - 1-2/1000 children die
MEASLES IN NORTH DAKOTA

- The last case of measles in North Dakota was in 2011
  - Our first case of measles in over 23 years!
- Adult male in Cass County
- Was exposed to measles while traveling on an airplane
- Spent his infectious period in South Dakota
- His sister later developed measles from their time together in South Dakota
- No other known cases associated

MEASLES IN THE US

- Large number of measles cases last year and in 2014.

VACCINATION RECOMMENDATIONS

- Recommended schedule is one dose of MMR at 12 through 15 months with a second dose at 4 through 6 years.
  - Adults born in 1957 or later with no evidence of immunity should receive 1 dose of MMR.
  - Those previously vaccinated with killed or rubella type vaccine during 1963-1967 should receive another dose.
  - If the adult is in a high risk group, he/she should receive 2 doses separated by at least 28 days.
  - High risk includes:
    - Healthcare personnel (including lab personnel)
    - International travelers
    - Infants 6-11 months may be recommended to receive a dose if traveling
    - Students at post-high school educational institutions
  - People exposed to measles in an outbreak setting

THE VACCINATION SITUATION

- Recommended coverage for MMR Vaccine is 95% to produce herd immunity.
  - According to preliminary data from the 2015-2016 school assessment, the MMR coverage rate for kindergarteners in North Dakota was 90.67%.
  - According the 2014 National Immunization Survey (NIS)... 94.9% of 24 month olds have received a dose of MMR in North Dakota.
    - 91.3% of 13-17 year olds have received 2 doses of MMR in North Dakota.

MEASLES TESTING

- PCR — collect nasopharyngeal swab or urine
  - Collect within 10 days from rash onset —Ideally within 3 days

AND

- IgM antibody —serum
  - Collect as soon as possible and repeat 72 hours after onset if first test is negative
  - IgM is detectable for at least 60 days after rash onset
  - Vaccinated individuals may have a false negative IgM

MUMPS
**MUMPS**

- Disease caused by the mumps virus
- Symptoms include fever, headache, muscle aches, tiredness, loss of appetite and swelling of salivary glands
- Disease is spread by droplets of saliva or mucus
- Occasionally, complications can occur
  - Ear and inner ear complications
  - Orchitis (inflammation of the testicles)
  - Other more rare complications include:
    - Encephalitis or meningitis
    - Oophoritis (inflammation of the ovaries) and/or mastitis
    - Deafness

**MUMPS IN NORTH DAKOTA**

- Before this year, the last confirmed cases of mumps in North Dakota was in 2011
- Three cases linked to an outbreak occurring in the UK
- One probable case in 2013 and 2015
- A few suspected cases each year

**MUMPS IN NORTH DAKOTA (APRIL 2016)**

- Total cases: 33
  - Confirmed: 7
  - Probable: 2
  - Suspect: 24
- County
  - Ward: 18
  - Burleigh: 3
  - Grand Forks: 2
  - Steele: 2
  - Renville: 1
  - McHenry: 1
  - Pierce: 1
  - Cass: 1
  - Sargent: 1
- Vaccination status
  - Received 2 doses of MMR: 9
  - Received 1 dose of MMR: 2
  - Not vaccinated: 7
  - Unknown vaccination status: 15
- Age
  - >60: 6
  - 40-59: 10
  - 25-39: 9
  - 18-24: 5
  - 10-17: 2
  - <10: 1

**MUMPS TESTING**

- **PCR** – collect buccal swab
  - Ideally, collect within three days of parotitis onset, no more than eight days after parotitis onset
  - Low yield if test is collected more than three days after parotitis onset
- **IgM antibody – serum**
  - Collect as soon as possible
  - Antibodies peak about a week after parotitis onset
- False positives and false negatives may result assays may be affected by other infections or complications that also cause parotitis
- False negatives are common in vaccinated persons

**MUMPS IN THE US**

- 643 cases reported as of this year
- 1,010 cases in the US in 2015
- Outbreaks in 2015 on college campuses
- As of March 2016, University of Iowa has had 514 total confirmed cases since July of 2015
- Illinois had reported 533 cases as of March 2016
- Other college campus outbreaks include
  - Indiana
  - New Hampshire
  - North Carolina
  - Kentucky
- Outbreaks have also been reported as a result of overcrowded bars
  - New Jersey

**RUBELLA**
RUBELLA

• A viral illness caused by a togavirus of the genus rubivirus.
• Spread by contact with respiratory secretions of an infected person
• Symptoms include a mild, maculopapular rash, fever, general ill feeling and swelling behind ears or back of neck
• Complications result when a pregnant woman becomes infected
  - These complications can include deafness, cataracts, heart defects, mental retardation, liver damage, and spleen damage
  - 20% likelihood of a birth defect if the woman is infected in early pregnancy

RUBELLA IN THE US AND NORTH DAKOTA

• So far this year, there have been no cases of rubella in the US
• 5 total cases in 2015
• North Dakota had a rubella case in 2008.
• Associated with travel to India
• Before that, hadn’t had a case since 1991

RUBELLA TESTING

• Best results from rubella testing:
  - PCR —collect throat swabs
  - Virus may be detected from 1 week before to 2 weeks after rash onset
  - Maximum viral shedding up to day 4 after rash onset
  - IgM can be detected 4-30 days after onset of illness
  - If negative results on specimen taken before day 5 are obtained, serological testing should be repeated on specimen collected 5 days after rash onset
  - High likelihood of false positives in IgM testing
  - Rheumatoid, factors, cross-reacting IgM, infection with other viruses

MENINGOCOCCAL DISEASE

• Caused by the bacteria Neisseria meningitidis
• The bacteria can result in meningitis, blood stream infection or other invasive infections
• Should be reported as soon as gram negative diplococcal bacteria are identified
• Bacteria can be transmitted via respiratory and throat secretions
  - Secondary cases are rare
  - Antibiotics may be recommended for close contacts of case to prevent secondary cases
  - If chemoprophylaxis is indicated, should be administered as soon as possible, ideally within 24 hours of case identification
  - Health department follows up to identify close contacts

• Symptoms may include fever, headache, nausea, vomiting, stiff neck, petechial rash, photophobia, mental confusion
• Even with antibiotic treatment, 10 to 15 out of 100 people infected with meningococcal disease will die
• About 11 to 19 out of every 100 survivors will have long-term disabilities, such as loss of limbs, deafness, nervous system problems, or brain damage.
MENINGOCOCCAL DISEASE

- North Dakota
  - 0 cases in 2016
  - 0 cases in 2015
- United States
  - 341 cases in 2015

SEROGROUP B OUTBREAKS

- From 2008-2010, a prolonged outbreak of serogroup B on a university campus in Ohio led to 13 cases and one death.
- In 2013, two universities in New Jersey and California experienced serogroup B outbreaks with a combined 13 cases and one death reported.
- In 2015, the University of Oregon experienced a serogroup B outbreak with 7 cases.
- In 2016, Santa Clara University is currently experiencing an outbreak with two cases reported so far.

VACCINATION RECOMMENDATIONS

- Meningococcal conjugate vaccination (MCV4) is routinely recommended at age 11 through 12 with a booster dose at age 16.
- Protects against serogroups A, C, Y and W-135
- One dose required for Middle School Entry.
- MCV4 is also recommended for lab personnel who are routinely exposed to N. meningitidis along with a booster every 5 years
- Also required for students under 21 in order to reside in campus housing at North Dakota Universities.
- Two doses at age 10 or older at least 8 weeks apart or one dose within the last 5 years.

NEW VACCINE APPROVED

- Two serogroup B vaccines have been licensed by the FDA
  - Bexsero® is given as 2 doses, at least 1 month apart.
  - Trumenba® is given as 3 doses, with the second dose 2 months after the first and the third dose 6 months after the first.
- Routinely recommended for 10 and older who are at increased risk for serogroup B meningococcal infections
  - Includes People at risk because of a serogroup B meningococcal disease outbreak, anyone whose spleen is damaged or has been removed, anyone with a rare immune system condition called "persistent complement component deficiency," anyone with certain other diseases that cause weakened immune system, microbiologists who work with N. meningitidis isolates
  - Can be given to anyone 16 to 23 years old
  - At physician's discretion
- Also recommended for lab personnel who are routinely exposed to N. meningitidis

MENINGOCOCCAL TESTING

- Isolation of N. meningitidis from sterile site (PCR or culture)
- Generally blood or CSF
- Collect as soon as possible
- Gram staining is commonly used for presumptive identification

STREPTOCOCCUS PNEUMONIAE
**STREPTOCOCCUS PNEUMONIAE**

- A bacteria that is commonly found in the human respiratory tract.
- May be isolated from the nasopharynx of 5-90% of healthy persons.
- Rates of asymptomatic carriage vary with age, environment and the presence of upper respiratory infections.
- Can sometimes cause severe invasive pneumococcal disease.
- Bacteremia
- Meningitis
- Pneumonia
- Spread through airborne droplets
- Approximately 10% of all patients with invasive pneumococcal disease die of their illness

**PNEUMOCOCCAL DISEASE IN NORTH DAKOTA**

- All cases of invasive pneumococcal disease in children under 5 are investigated.
- 1 case so far this year in children under 5.
- In 2015, North Dakota had 5 cases of invasive pneumococcal disease in children under 5.
- Nationally, the United States had 1,065 cases of invasive pneumococcal disease in children under 5 in 2015.

**PNEUMOCOCCAL VACCINATION**

- PCV13 (Pneumovax13®) vaccine is routinely recommended for children between the ages of 2 months and 5 years.
- Depending on the type of vaccine, children should receive four doses at 2, 4, and 6 months. A booster dose should be given at 12 to 15 months of age.
- PCV13 vaccine is required for childcare attendance.
- Certain individuals with high risk conditions may be recommended to receive PCV13 or PPSV23 (Pneumovax).
- Adults 65 and older are routinely recommended to receive PCV13 and PPSV23 spaced apart by 12 months.

**STREPTOCOCCUS PNUEMONIAE TESTING**

- Culture or PCR from normally sterile site.
- Collect as soon as possible.
- Test isolates from CSF for resistance to penicillin and cefotaxime, ceftriaxone, or meropenem, and vancomycin.

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**PERTUSSIS/WHOOPING COUGH**

- Coughing illness caused by bacteria Bordetella pertussis.
- Symptoms can include cold-like symptoms, coughing fits, posttussive vomiting, whoop, apnea.
- Most severe in infants
- Cough will persist for at least 14 days.
- May result in certain complications.
- The most common complication is pneumonia.
- Infants may also suffer from seizures and encephalopathy.
- Death is rare but does occur. Most deaths are in unvaccinated infants.
PERTUSSIS IN NORTH DAKOTA

- Pertussis cases peak every few years.
  - Some peak years in North Dakota were 2012 (214 cases) and 2004 (757 cases).
- 2 cases so far in 2016.
- In 2013 there were 43 total cases.
  - 27 confirmed.
  - 3 probable.
  - Ages range from under 1 year to 60 and over.

VACCINATION RECOMMENDATIONS

- DTaP vaccination is routinely recommended at ages 2 months, 4, 6, 15 through 18 months with a booster at 4 through 6 years.
- Tdap vaccination is routinely recommended at age 11 through 12 years.
- Tdap is required for seventh grade entry in North Dakota.
- Under vaccinated children over age 7 may be caught up using Tdap followed by Td.
- Adults who have never received a dose of Tdap are recommended to receive a dose.
- Pregnant women are recommended to receive a dose of Tdap during each pregnancy between 27 and 36 weeks gestation.
- Protective antibodies passed to baby.

PERTUSSIS TESTING

- PCR or culture: Collect posterior nasopharyngeal swab.
- Collect within first 2 weeks of cough onset.

CHICKENPOX

- Very contagious disease caused by the varicella-zoster virus (VZV).
  - Causes a blistery rash, itching, tiredness and fever.
  - Can be serious, especially in babies, adults, and people with weakened immune systems.
  - Before the chickenpox vaccine, about 4 million people would get chickenpox each year in the United States.
  - 10,600 people were hospitalized and 100 to 150 died each year.
  - Spreads easily through the air through coughing or sneezing.
  - Can also be spread by touching or breathing in the virus particles that come from chickenpox blisters.
  - A person is contagious 1-2 days before the rash develops until all lesions have formed scabs.
**CHICKENPOX CASES**

- All suspected cases of chickenpox should be confirmed by laboratory testing
  - PCR or culture of skin specimen
- Cases diagnosed without laboratory testing should still be reported to the health department
- Schools and child care facilities are also required to report

**CHICKENPOX VACCINATION**

- Two doses of chickenpox vaccine are routinely recommended for children at 12 months of age and 4-6 years of age
- Two doses are required for school attendance in North Dakota for grades kindergarten through seventh.
  - Grades eighth through eleventh are required to have one dose.
  - Children who have had chickenpox disease previously are exempt from the requirement.
- Less than 5% of individuals will develop a localized or generalized varicella-like rash 5 to 26 days after vaccination
  - Transmission of varicella vaccine virus is extremely rare
  - Moreover, the rash could also be caused by varicella virus; it is difficult to tell the difference.

**CHICKENPOX TESTING**

- Most reliable test: PCR from scabs, vesicular fluid, or cells from the base of a lesion
  - Collect within 2-3 days after rash onset and fresh vesicles
- IgM and IgG antibody tests should not be used to rule out or confirm varicella infection

**DIPHTHERIA**

- Caused by the bacteria Corynebacterium diphtheriae
  - Bacteria can infect the respiratory mucosa, the skin, and other sites of the body (rare)
  - Transmission from person to person via respiratory droplets or direct contact with respiratory secretions
  - Can also be transmitted via discharge from skin lesions or fomites

- Respiratory diphtheria is characterized by a dense, grayish-white pseudomembrane
  - The pseudomembrane adheres to the local tissue of the tonsils, pharynx, or larynx.
- Initial symptoms usually include a sore throat, difficulty swallowing, malaise and a low grade fever.
- Some people may also develop “bull-neck” caused by inflammation of the cervical lymph nodes and surrounding tissue
- Case fatality of respiratory diphtheria is about 10%
- Antitoxin should be administered upon clinical diagnosis
**DIPHTHERIA IN NORTH DAKOTA AND THE UNITED STATES**

- 0 cases in the U.S. in 2015 and 2016
- 0 cases in North Dakota for a very long time
  - The last cases of diphtheria in North Dakota were reported in 1975; six cases were reported that year.

**DIPHTHERIA TESTING**

- Isolation of *C. diphtheriae* by culture and toxigenicity testing
- The Department of Health should be contacted to arrange for laboratory testing
- After isolation, Eliz test to determine production of diphtheria toxin
- PCR is not yet sufficient for laboratory confirmation
- All isolates of *C. diphtheriae* should be sent to CDC

**HEPATITIS A**

- Viral disease transmitted via the Fecal-Oral Route
- Cases in children under 6 years are often asymptomatic (70%)
- Symptoms usually include nausea, vomiting, abdominal discomfort, pale stools, dark urine, jaundice and elevated serum ALT or AST levels.
- The average incubation period is 20-30 days with a range of 15-50 days.
- Often contracted during international travel.
- Exposed individuals may be recommended to receive prophylaxis.
- Individuals between 12 months and 40 years should receive Hepatitis A vaccine.
- Individuals younger than 12 months and older than 40 years should receive Hepatitis A immune globulin.

**HEPATITIS A IN THE US AND NORTH DAKOTA**

- No confirmed cases so far this year
- 6 confirmed cases in 2015.
- 3 cases reported from outside of the US.
- 53 cases reported in the US so far this year.
- 1273 cases reported in the US in 2015.

**VACCINATION RECOMMENDATIONS**

- Hepatitis A vaccine is routinely recommended for children at 12 months of age.
  - Two doses separated by 6 months.
  - Unvaccinated children can be caught up at any time.
- Also recommended for people at high risk:
  - 12 years or older who are traveling to high-risk areas.
  - Men who have sex with men.
  - Users of illegal drugs.
  - Primarily unvaccinated individuals who anticipate having close contact with an international adoptee from a country where hepatitis A is prevalent.
  - People who have blood clotting disorders.
  - People who may have occupational exposure (i.e. lab setting, working with infected primates).
  - People with chronic liver disease.
  - People who wish to be immune to hepatitis A.
HEPATITIS A TESTING

- IgM anti Hepatitis A virus – Collect serum as soon as possible after symptom onset
- Detectable for up to 6 months after symptom onset

HEPATITIS B

- Viral disease caused by the hepatitis B virus
- Transmitted several different ways
  - Sexual Transmission
  - Injection Drug Use
  - Infected mother to baby at birth
- Symptoms can include jaundice, nausea, vomiting, dark urine, abdominal pain, fever, headache and skin rashes.
  - At least 50% of infections are asymptomatic
- Infections can be acute or chronic
  - People who develop chronic infection as infants or young children are usually asymptomatic
  - However, chronic liver disease develops in 2/3rd of these individuals, and approximately 15-25% die prematurely from cirrhosis or liver cancer
  - In 2013, an estimated 19,764 persons in the US were newly infected with HBV
  - An estimated 700,000-1.4 million persons in the United States have chronic hepatitis B virus infection

PERINATAL HEPATITIS B PROGRAM

- Hepatitis B infection in a pregnant woman poses a serious risk to her infant at birth
  - Without postexposure immunoprophylaxis, approximately 40% of infants born to Hepatitis B positive women will develop chronic Hepatitis B infection
  - Infections can be prevented by identifying these women beforehand and ensuring the infant receives a Hepatitis B vaccine and Hepatitis B Immune Globulin (HBlG) within 12 hours of birth
  - The North Dakota Department of Health does this through the Perinatal Hepatitis B Program
  - Also, follow up with the infant to make sure he/she completes the hepatitis series and is tested to determine disease status and immunity status

HEPATITIS B VACCINATION RECOMMENDATIONS

- Hepatitis B vaccine is routinely recommended at birth, 1-2 months and 6-18 months.
- All children 0 through 18 years are recommended to be vaccinated against Hepatitis B if they were not previously vaccinated.
- Adults who at risk for contracting Hepatitis B or who wish to be protected from HBV infection should also be vaccinated with Hepatitis B vaccine.
  - Adults who are considered high risk include sex partners with Hepatitis B positive people, sexually active people in long-term monogamous relationships, men who have sex with men, injection drug users, household contacts of Hep B positive people, health care workers, people with chronic liver disease, people with HIV, unvaccinated adults with diabetes.
  - Health care workers who may be exposed to blood should have immunity confirmed by titers for hepatitis B
HEPATITIS B TESTING
- IgM anti-HBc – Collect serum as soon as possible after symptom onset
- HBsAg – Collect serum
- Anti-HBc — Collect serum 1-2 months after vaccination
  - Tests for acute infection
  - Detectable for 6 months
  - Tests for immunity to hepatitis B

MANDATORY REPORTABLE VACCINE PREVENTABLE DISEASES
- All mandatory reportable diseases should be reported to Disease Control within 7 days
- Certain diseases should be reported immediately
- Reporting can be done by:
  - Calling 1(800)472-2180 or (701)328-2378
  - Reporting online: [https://www.ndhealth.gov/disease/reportcard](https://www.ndhealth.gov/disease/reportcard)
  - Faxing

MANDATORY REPORTABLE VACCINE PREVENTABLE DISEASES
- Pertussis/Whooping Cough*
- Chickenpox
- Meningococcal disease*
- Influenza
- Measles*
- Mumps*
- Rubella*
- Diphtheria*
- Tetanus
- Invasive Streptococcus pneumoniae
- Invasive Haemophilus influenzae
- Hepatitis A
- Hepatitis B
- Polio*

*Report Immediately

QUESTIONS?
- Contact information
  - Lexie Barber:
    - abarber@nd.gov
    - 701-328-2335
  - Immunization Program:
    - 701-328-3386
    - Toll-free: 800-472-2180