

VACCINE PREVENTABLE DISEASES

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DISEASE CONTROL 101 CONFERENCE
DECEMBER 3, 2015



VACCINE HISTORY

In the United States alone, the CDC estimates that between 1994-2013, vaccinations prevented

- 322 million illnesses
- 21 million hospitalizations
- 732,000 premature deaths from VPDs

TABLE. Estimated number of illnesses, hospitalizations, and deaths prevented by routine childhood immunization for selected vaccine-preventable diseases among children born during the Vaccines for Children era — United States, 1994–2013

Vaccine-preventable disease*	Illnesses	Hospitalizations	Deaths
Diphtheria	5,673	5,673	303.3
Hepatitis B	9	9	0.5
Pertussis	34,486	2,691	26.3
Haemophilus influenzae type B	801	330	15.7
Polio	6,244	830	64.4
Measles	75,748	6,377	315.3
Mumps	42,764	5,261	62.2
Rubella	36,545	134	6.3
Congenital rubella syndrome	12	12	1.3
Hepatitis B	4,207	423	18.7
Hepatitis A	60,445	174	15.2
Pneumococcal-related disease†	26,376	923	18.0
Rotavirus	13,368	327	6.1
Total	322,089	21,093	732.7

*Illnesses were considered as preventing disease for both children born in all years during 1994–2013 except for the following, who were only in use for part of the 20-year period: hepatitis B, 1996–2013; rotavirus and 13-valent pneumococcal conjugate vaccines, 2007–2013; and rubella, 2007–2013. †Includes invasive pneumococcal disease, otitis media, and conjunctivitis.



OVERVIEW

- Measles
- Mumps
- Pertussis
- Meningococcal Disease
- Rubella
- Haemophilus influenzae* type B
- Streptococcus pneumoniae*
- Chickenpox
- Influenza



MEASLES



MEASLES

- **Respiratory disease caused by a virus**
 - Usually grows in cells at the back of the throat and lungs
- **Symptoms typically begin with fever, runny nose, cough and red watery eyes**
 - 3 C's: Cough, Coryza and Conjunctivitis
 - 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**
 - 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



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MEASLES TRANSMISSION

- **Spread through the air by breathing, coughing or sneezing**
 - Extremely contagious
 - Can live for up to 2 hours outside the body
 - Cases can spread the disease 4 days before rash appears
- **Can result in other complications.**
 - 1/10 children get an ear infection
 - 1/20 children get pneumonia
 - 1/1000 children get encephalitis
 - 1-2/1000 children die



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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**

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MEASLES IN THE US

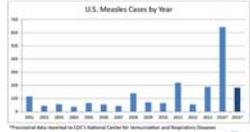
Large number of measles cases this year and last year.

Measles Cases and Outbreaks

January 1 to November 13, 2015*

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



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 unknown 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
 - 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.**
- **North Dakota's 2014-2015 Kindergarten vaccination rates for MMR vaccine were the 7th worst in the nation.**
 - 89.78% of North Dakota kindergartners up to date with MMR vaccine
- **According to 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.



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**
 - The most common complication is orchitis (inflammation of the testicles.)
 - Other more rare complications include
 - Encephalitis or meningitis
 - Oophoritis (inflammation of the ovaries) and/or mastitis
 - Deafness



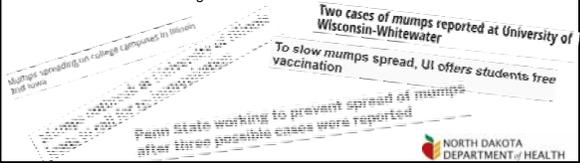
MUMPS IN NORTH DAKOTA

- **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**
- **A few suspect cases each year**



MUMPS IN THE US

- **708 cases in the US so far this year**
- **Outbreaks this year on college campuses**
 - University of Illinois at Urbana-Champaign
 - 69 cases of mumps
 - University of Iowa
 - Over 100 cases since beginning of school year
 - School holding mass vaccination clinics for students



PERTUSSIS



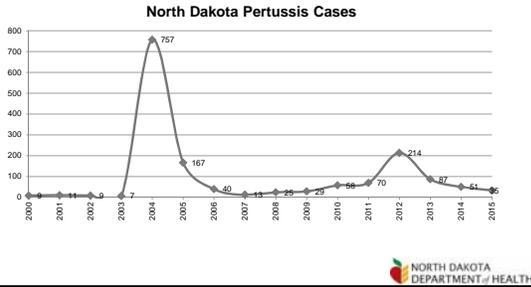
PERTUSSIS/WHOOPING COUGH

- **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

35 cases so far in 2015.

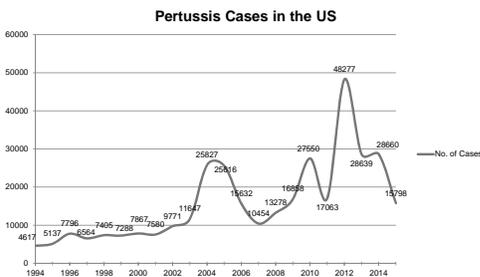


PERTUSSIS IN NORTH DAKOTA

- The number of pertussis cases peak every few years
 - Some peak years in North Dakota were 2012 (214 cases) and 2004 (757 cases)
- In 2015 there have been 35 total cases so far
 - 32 confirmed
 - 3 probable
 - Ages range from under 1 year to 60 and over
 - Majority of most recent cases from Morton County where a small outbreak occurred



PERTUSSIS IN THE US



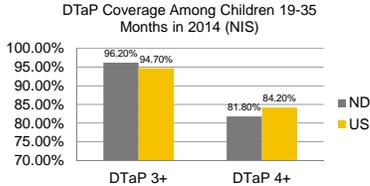
VACCINATION RECOMMENDATIONS

- 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 can 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



THE VACCINATION SITUATION

- According to the 2014 NIS 96.2% of 24 month year olds have received 3+ doses of DTaP in North Dakota.
- Only 81.8% of 24 month year olds have received 4+ doses of DTaP in North Dakota



THE VACCINATION SITUATION

- According to the 2014 NIS, 92.1% of adolescents received at least one dose of Tdap in North Dakota
 - National coverage rate was 87.6%.
- Adult Tdap vaccination coverage was collected in 2012 via the National Health Interview Survey (NHIS)
 - 14.2% of adults over 19 years were vaccinated with Tdap
 - 25.9% Adults living with a child under 1 year were vaccinated with Tdap
 - 8.0% of adults over age 65 were vaccinated with Tdap



MENINGOCOCCAL DISEASE



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



MENINGOCOCCAL DISEASE

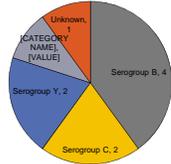
- **Symptoms may include fever, headache, nausea, vomiting, stiff neck, petechial rash, photophobia, mental confusion**
 - Even with antibiotic treatment, 10 to 15 out of 100 people infected with meningococcal disease will die.
 - About 11 to 19 out of every 100 survivors will have long-term disabilities,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



MENINGOCOCCAL DISEASE IN NORTH DAKOTA

- 0 cases in 2015
- 2 cases in 2014

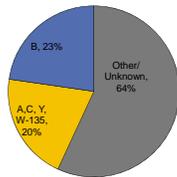
North Dakota Meningococcal Disease Serogroups 2009-2014



MENINGOCOCCAL DISEASE IN THE US

- 304 cases in 2015 so far
- 397 cases in 2014

2015 Distribution of Meningococcal Serogroups n=304



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.



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.**
- **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. or
 - 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 taking a drug called eculizumab (also called Soliris®), microbiologists who routinely work with *N. meningitidis* isolates
 - Can be given to anyone 16 to 23 years old
 - At physician's discretion



THE VACCINATION SITUATION

- **According to the 2014 National Immunization Survey:**
 - North Dakota's coverage rate for adolescents aged 13-17 years for 1 or more doses of MenACWY was **91.8(±3.3)%**
 - The United States' coverage rate for adolescents aged 13-17 years for 1 or more doses of MenACWY was **79.3(±1.1)%**



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 5 cases of Rubella in the US

North Dakota had a rubella case in 2008.

- Associated with travel to India
- Before that, hadn't had a case since 1991




Haemophilus influenzae type B



Haemophilus influenzae type B

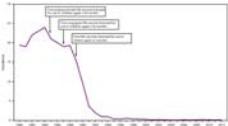
- Invasive HIB disease is caused by the bacteria *Haemophilus influenzae* type B.
 - Can cause pneumonia, bacteremia, meningitis and several other invasive infections
 - Young infants and toddlers are the major reservoir for HIB as they carry the bacteria in their upper respiratory tract
 - It is spread via the respiratory route
 - Before the HIB vaccination was introduced, the *H. influenzae* was the most common cause of meningitis among children in the US




HIB IN NORTH DAKOTA AND U.S.

- North Dakota had a case of HIB in an infant in 2013 and 2015.
 - Only cases of pediatric HIB since 1991
 - One child was unvaccinated and the other child had an underlying condition.
 - Nationally, the United States only saw 27 cases of invasive HIB disease in children under five in 2014
 - So far, there have been 19 cases nationally in 2015

Estimated annual incidence of invasive HIB disease in children aged <5 years
— United States, 1980–2012

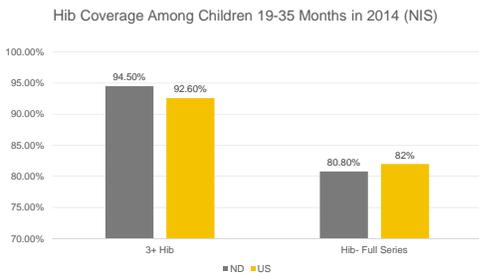



VACCINATION RECOMMENDATIONS

- **HIB vaccine is routinely recommended for children between the ages of 2 months and 5 years**
- **Depending on the type of vaccine, children should receive three doses at 2, 4 and 6 months or two doses at 2 and 4 months of age. A booster dose should be given at 12 to 15 months of age**
 - ActHIB(PRIP-T) is a three dose series at 2,4, and 6 months with a booster at 12 to 15 months.
 - Pentacel contains ActHIB.
 - PedvaxHIB(PRIP-OMP) is a 2 dose series with a booster at 12 to 15 months.
 - Comvax contains PedvaxHIB.
- **HIB vaccine is required for childcare attendance**



HIB VACCINATION RATES

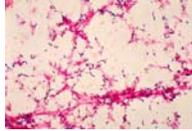


Streptococcus pneumoniae



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



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S. PNEUMONIAE

- **Spread through airborne droplets**
- **More than 90 serotypes of *S. pneumoniae***
 - *A relatively limited number of serotypes cause the majority of invasive pneumococcal disease.*
- **Approximately 10% of all patients with invasive pneumococcal disease die of their illness**

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PNEUMOCOCCAL DISEASE IN NORTH DAKOTA

- **All cases of invasive pneumococcal disease in children under 5 are investigated.**
 - So far this year, North Dakota has had 5 cases of invasive pneumococcal disease in children under 5.
 - Nationally, the United States had 917 cases of invasive pneumococcal disease in children under 5.

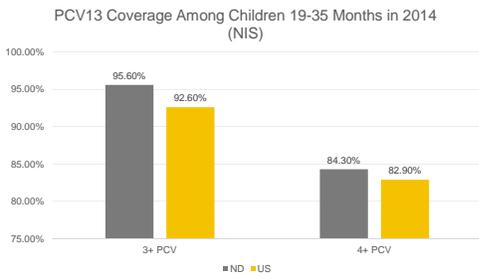
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PNEUMOCOCCAL VACCINATION

- **PCV13 (Pevnar13®) 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.**



PNEUMOCOCCAL VACCINATION RATES



CHICKENPOX



CHICKENPOX

- **Very contagious disease caused by the varicella-zoster virus (VZV)**
 - Causes a blister-like 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**



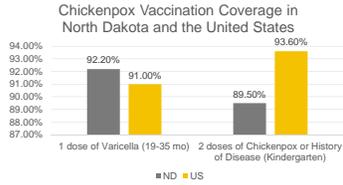
CHICKENPOX VACCINATION

- **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
 - However, the rash could also be caused by varicella virus; it is difficult to tell the difference
 - If this occurs, the child should not attend school until all of the lesions crust.
 - The child should also avoid close contact with people who do not have evidence of varicella immunity and who are at high risk of complications of varicella, such as immunocompromised people, until the rash has resolved.



CHICKENPOX VACCINATION RATES

- Data taken from the NIS and the National School Immunization Assessment
- North Dakota had the 6th worst rates for kindergarten chickenpox coverage



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>



MANDATORY REPORTABLE VACCINE PREVENTABLE DISEASES

- | | |
|---------------------------|--|
| Pertussis/Whooping Cough* | Tetanus |
| Chickenpox | Invasive <i>Streptococcus pneumoniae</i> |
| Meningococcal disease* | Invasive <i>Haemophilus influenzae</i> |
| Influenza | Hepatitis A |
| Measles* | Hepatitis B |
| Mumps* | Polio* |
| Rubella* | |
| Diphtheria* | |

*Report Immediately



INFLUENZA

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DISEASE CONTROL 101 CONFERENCE
DECEMBER 3, 2015



INFLUENZA

Influenza's global impact is two-fold:

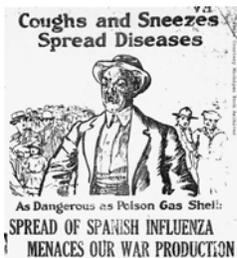
- A seasonal infection, causing annual epidemics of respiratory disease.
- An emerging infection causing periodic pandemics.



2009 H1N1 pandemic as seen using internet search monitoring



INFLUENZA PANDEMICS



Modern Pandemics

- 1918 Spanish flu
 - H1N1
 - >650,000 deaths in US
- 1957 Asian flu
 - H2N2
 - 70,000 deaths in US
- 1968 Hong Kong flu
 - H3N2
 - 34,000 deaths
- 2009 Pandemic
 - H1N1
 - 15,000 deaths

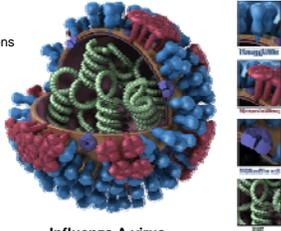


INFLUENZA

Influenza is caused by the influenza virus.

- **Influenza A**
 - Infects humans and animals
 - Typed based on surface antigens
- **Influenza B**
 - Infects humans only
 - Two lineages

Hemagglutinin #3
 ↓
A H3N2
 ↑
 Neuraminidase #2



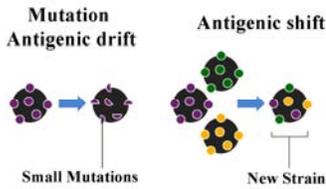
Influenza A virus



INFLUENZA ANTIGENIC DRIFT AND SHIFT

Drift = small changes due to mutation

Shift = large changes due to reassortment that result in a novel virus.



INFLUENZA TRANSMISSION

Via coughs, sneezes, touching contaminated surfaces.

Infectious one to two days before and about five days after symptom onset.



INFLUENZA PRESENTATION

"Influenza-like illness" = a fever of 100°F accompanied by a cough and/or sore throat.

Also:

- Body aches
- Runny nose
- Chills
- Fatigue
- Headache
- Earache
- Conjunctivitis

Vomiting and diarrhea possible in children but uncommon.
A reportable disease in North Dakota.




INFLUENZA PRESENTATION



NOPE.



INFLUENZA PREVENTION

Vaccination
Handwashing
Cover coughs and sneezes
Stay home when ill




SEASONAL COMPARISON: A TALE OF TWO INFLUENZA A STRAINS

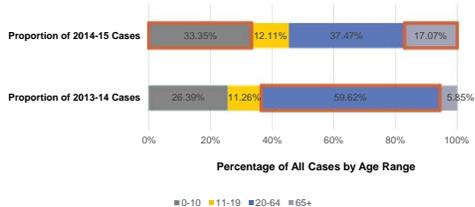
North Dakota 2013-14 versus 2014-15 Influenza Season Comparison

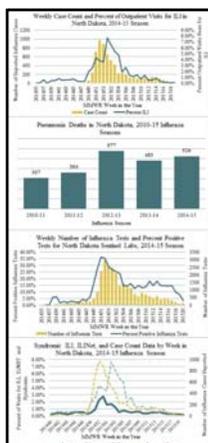
2013-14 Season	2014-15 Season
Predominantly 2009 A H1N1	Predominantly A H3N2
2,922 laboratory-identified cases:	6,443 laboratory-identified cases:
<ul style="list-style-type: none"> 4 A H3N2 452 2009 A H1N1 2,310 A not subtyped 156 B 	<ul style="list-style-type: none"> 314 A H3N2 2 2009 A H1N1 4,908 A not subtyped 1219 B
147 hospitalizations	275 hospitalizations
8 deaths	54 deaths
3 long term care outbreaks	40 long term care outbreaks
Vaccine efficacy: 51%	Overall vaccine efficacy: 19%



SEASONAL COMPARISON: A TALE OF TWO INFLUENZA A STRAINS

Age Distribution of Influenza Cases in North Dakota,
2014-15 Season Versus 2014-13 Season

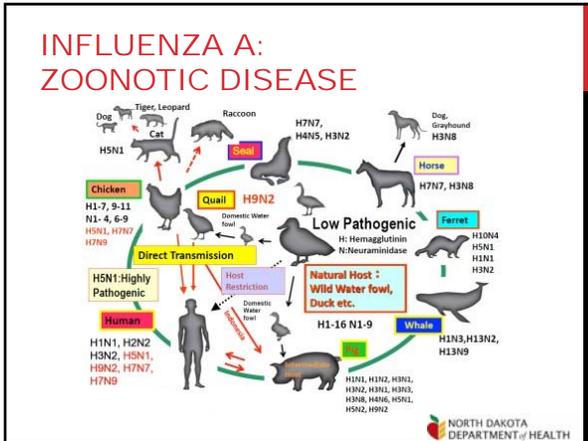


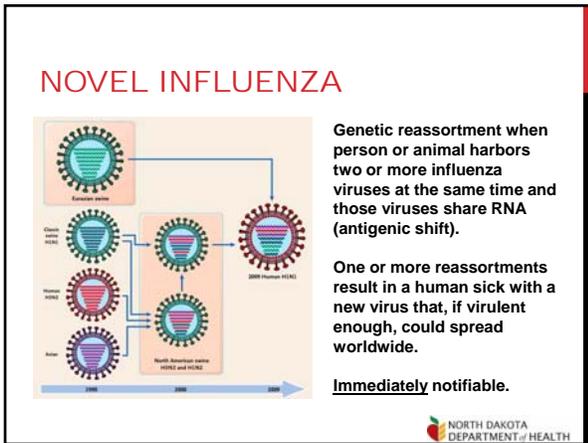


INFLUENZA SURVEILLANCE

- Reported cases (required)
- Hospitalizations (ad hoc reports)
- Deaths (ad hoc reports and viral records)
- Outbreaks
 - Schools
 - Long Term and Basic Care
- Sentinel Sites
 - Outpatient Influenza-like Illness Network
 - Sentinel Labs
 - School Absenteeism
- Syndromic Surveillance
- National Picture







NOVEL INFLUENZA: VARIANT INFLUENZA

“Variant” Influenza: an influenza strain that normally circulates in swine that is found in a person.

- 377 US cases since 2005
- H3N2v, H1N1v, H2N1v

Exposure to sick pigs

No human cases in North Dakota, but sick pigs in 2014.

Identification at state lab required.

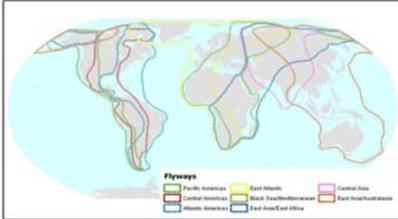
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NOVEL INFLUENZA: AVIAN INFLUENZA

High Pathogenic v. Low Pathogenic

Significant economic impact

Migration = local to global movement of avian influenza viruses



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NOVEL INFLUENZA: AVIAN INFLUENZA IN THE UNITED STATES

20 states affected

H5N1, H5N2, H5N6 (aka H5NX)

Commercial flocks, backyard flocks,
wild birds

Most recent wild bird detection
6/24/15

Monitoring of exposed individuals

No associated human cases
(identification at state lab required)

Update on Avian Influenza Findings
Poultry Findings Confirmed by USDA's National Veterinary Services Laboratories



219 Detections Reported	48,082,293 Birds Affected
12/19/14 First Detection Reported	6/17/15 Last Detection Reported

Wild bird detections only in Michigan,
Wyoming, Kentucky, Nevada and Idaho.

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THANK YOU!

Questions?

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