Introduction to Communicable Disease Surveillance and Investigation in North Carolina
Cryptosporidiosis Surveillance in North Carolina

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Cryptosporidium Learning Objectives

• State reservoir and means of transmission
• Identify why surveillance is conducted
• Explain the different diagnostic methods and how they relate to case classification
• Discuss the impact of outbreaks
Cryptosporidiosis

Oocyst-forming parasite

- *C. parvum* (humans, cattle, other mammals)
- *C. hominis* (humans)

First reported to cause human illness in 1976

Reservoir: People and cattle primarily

Transmission: Fecal – Oral

- Person to person
- Animal to person

Vehicle for indirect transmission

- Food and Water
Clinical Features

Incubation period is 7 days (range: 2 – 14 days)
Frequent, watery diarrhea
Other symptoms can include:
  – Dehydration
  – Abdominal pain
  – Weight loss
  – Nausea and vomiting
  – Fever
  – Severe and chronic symptoms in immune compromised patients

Symptom persist 2 to 20 days
Cryptosporidium Cases by Year of Onset, N.C.
Average Number of Cryptosporidiosis Cases by Month of Disease Onset, N.C., 2008-12
Average Annual Incidence Rate, N.C., 2008-2012
Why Conduct Surveillance for Cryptosporidiosis?

• Surveillance for cryptosporidiosis is necessary to identify and control outbreaks and to expand the scientific understanding of the role that each of the species play in human disease
  
  CSTE Position Statement 11 - ID – 14

• Waterborne illnesses pose a high risk for affecting masses of people so we want to closely monitor for illness in public and recreational water
Surveillance Case Definition

- **Clinical Description**: A gastrointestinal illness characterized by diarrhea and one or more of the following: diarrhea duration of 72 hours or more, abdominal cramping, vomiting, or anorexia.

- **Case Classification**
  
  **Probable**
  
  - A case with supportive laboratory test results for *Cryptosporidium* spp. infection using a method listed in the probable laboratory criteria. When the diagnostic test method on a laboratory test result for cryptosporidiosis cannot be determined, the case can only be classified as probable, OR
  
  - A case that meets the clinical criteria and is epidemiologically linked to a confirmed case.

  **Confirmed**
  
  - A case that is diagnosed with *Cryptosporidium* spp. infection based on laboratory testing using a method listed in the confirmed criteria.
Laboratory Criteria for Diagnosis

• **Confirmed**: Evidence of *Cryptosporidium* organisms or DNA in stool, intestinal fluid, tissue samples, biopsy specimens, or other biological sample by certain laboratory methods with a high positive predictive value (PPV), e.g.,
  - Direct fluorescent antibody [DFA] test,
  - Polymerase chain reaction [PCR],
  - Enzyme immunoassay [EIA], OR
  - Light microscopy of stained specimen.

• **Probable**: The detection of *Cryptosporidium* antigen by a screening test method, such as **immunochromatographic card/rapid card** test; or a laboratory test of unknown method.
Positive Predictive Value (PPV) of Results of Diagnostic Tests for Cryptosporidium Used by Clinical Laboratories in Minnesota, 2008.

<table>
<thead>
<tr>
<th>Period</th>
<th>Nonrapid assays</th>
<th>Rapid assays</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modified Kinyoun acid-fast stained smear</td>
<td>Wampole ELISA</td>
</tr>
<tr>
<td>January–May</td>
<td>100% (n = 1)</td>
<td>100% (n = 1)</td>
</tr>
<tr>
<td>Low prevalence season</td>
<td>100% (n = 12)</td>
<td>... (n = 19)</td>
</tr>
<tr>
<td>June–October</td>
<td>100% (n = 13)</td>
<td>100% (n = 1)</td>
</tr>
<tr>
<td>High prevalence season</td>
<td></td>
<td></td>
</tr>
<tr>
<td>January–December</td>
<td></td>
<td></td>
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</tbody>
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**NOTE.** Confirmatory testing at the Minnesota Department of Health Public Health Laboratory was used as the gold standard to calculate PPVs. The months of November and December are not included in either the low or the high prevalence season. DFA, direct fluorescent antibody; ELISA, enzyme-linked immunosorbent assay.


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Light Microscopy Detail

- Modified acid fast stain
- Confirmatory method
- Rarely used by labs
- Enter in NCEDSS as “ova and parasite preparation”
Direct Fluorescent Ab (DFA) Detail

- Gold standard crypto test
- Confirmatory method
- Rarely used
- Meridian Biosciences shown
- Enter in NCEDSS as “ova and parasite preparation”
Rapid Immunocromatographic Card Detail

- Very common in many labs
- The most common test used in N.C.!!!
- Allows for probable classification only
- Enter in NC EDSS as “cryptosporidium sp Ag:” or “Antigen detection”
PCR Detail

• Confirmatory result, Becoming widely used
• 1/15/2013: Luminex Receives FDA Clearance for First Comprehensive Gastrointestinal Pathogen Infectious Disease Diagnostic in the United States
  • xTAG® Gastrointestinal Pathogen Panel (GPP) simultaneously tests for greater than 90% of bacterial, viral, and parasitic causes of infectious gastroenteritis in a single molecular test.
Cryptosporidium Culture?

• There is NO culture test for cryptosporidiosis
• Do not enter culture as a laboratory method for cryptosporidiosis
Number of Crypto Outbreaks Associated with Water...Remember Milwaukee ‘93

MMWR Cryptosporidiosis Surveillance US 06-08; June 11, 2010 / 59(SS06);1-14
Sporadic Case Reports vs Waterborne Outbreaks

- Wisconsin has a high rate of cryptosporidiosis disease, but very few cases are associated with outbreaks
- Sporadic cryptosporidiosis caused by zoonotic transmission from cattle is the likely main cause of this disease in Wisconsin

2009 N.C. Summer Camp Outbreak

2011 N.C. Summer Camp Outbreak

Cryptosporidiosis Cases among GVC Staff and Campers by Date of Onset

- **Number of Cases**
- **Onset Date**

- **Additional Control Measures**
- **Initial Control Measures**
- **DPH Site Visit**

Legend:
- Camper
- Staff
Crypto Shedding in Calves?

Summary

• Many methods of lab testing; be sure to identify which method is used

• Non-waterborne outbreaks have occurred in N.C.
  Work closely with persons facilitating animal contact

• Waterborne outbreaks occur frequently
  Work closely with Environmental Health Staff