Introduction to Communicable Disease Surveillance and Investigation in North Carolina

Cryptosporidiosis Surveillance in North Carolina

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North Carolina Public Health

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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

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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

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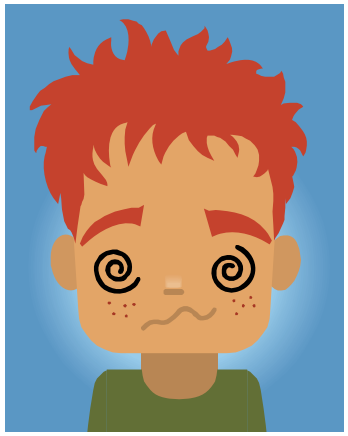
Clinical Features

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

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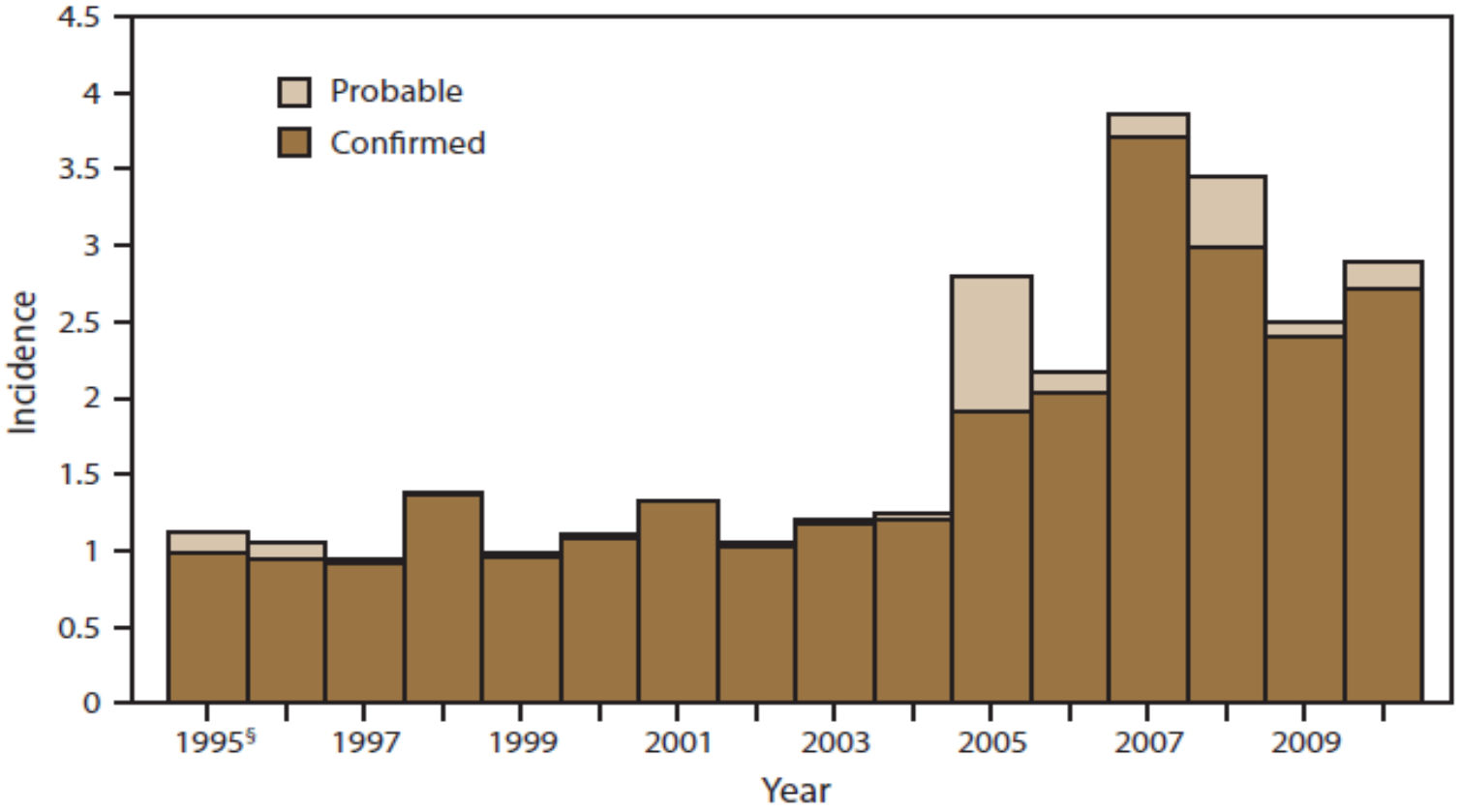
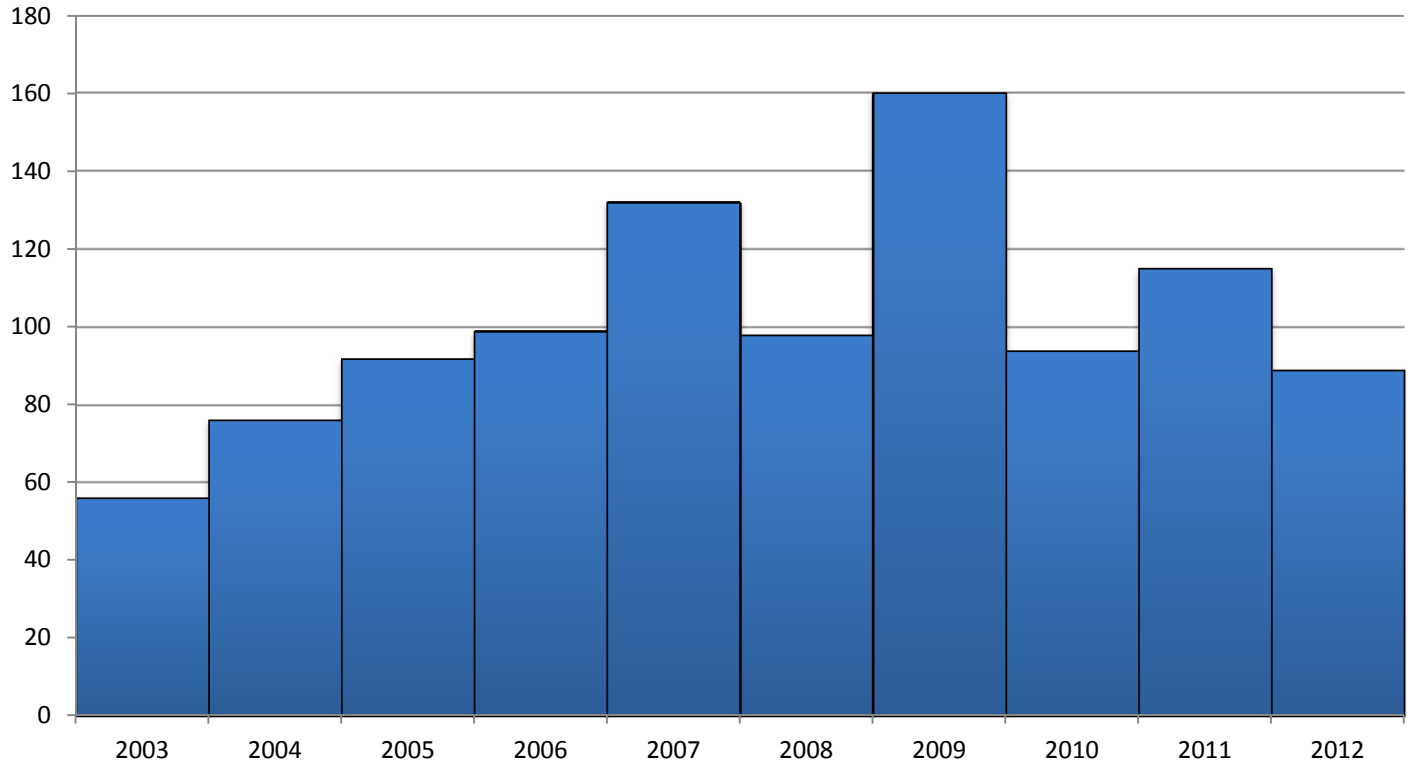
National Surveillance

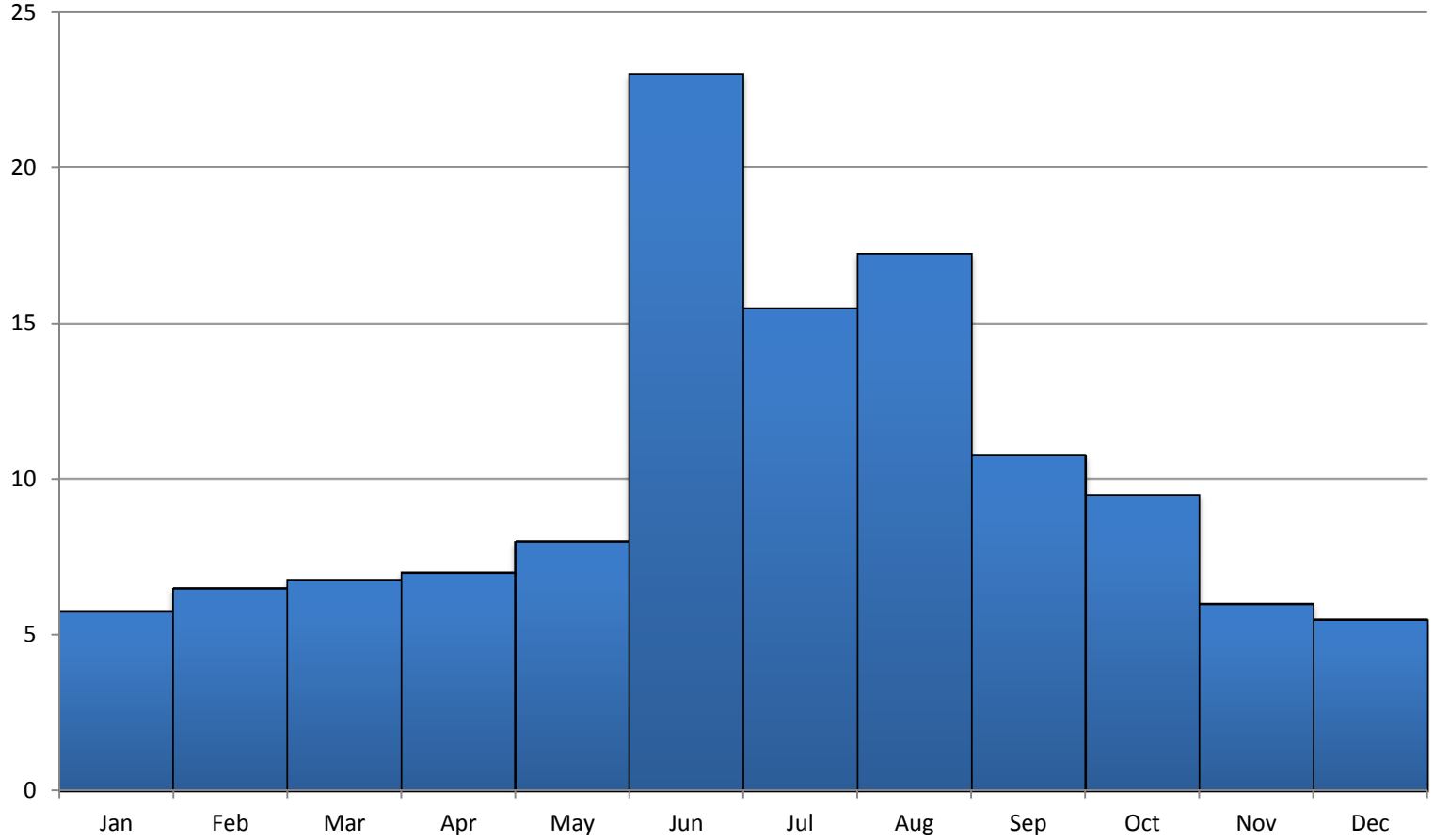


MMWR Cryptosporidiosis Surveillance US 09-10; Sep 7, 2012 / 61(SS05);1-12

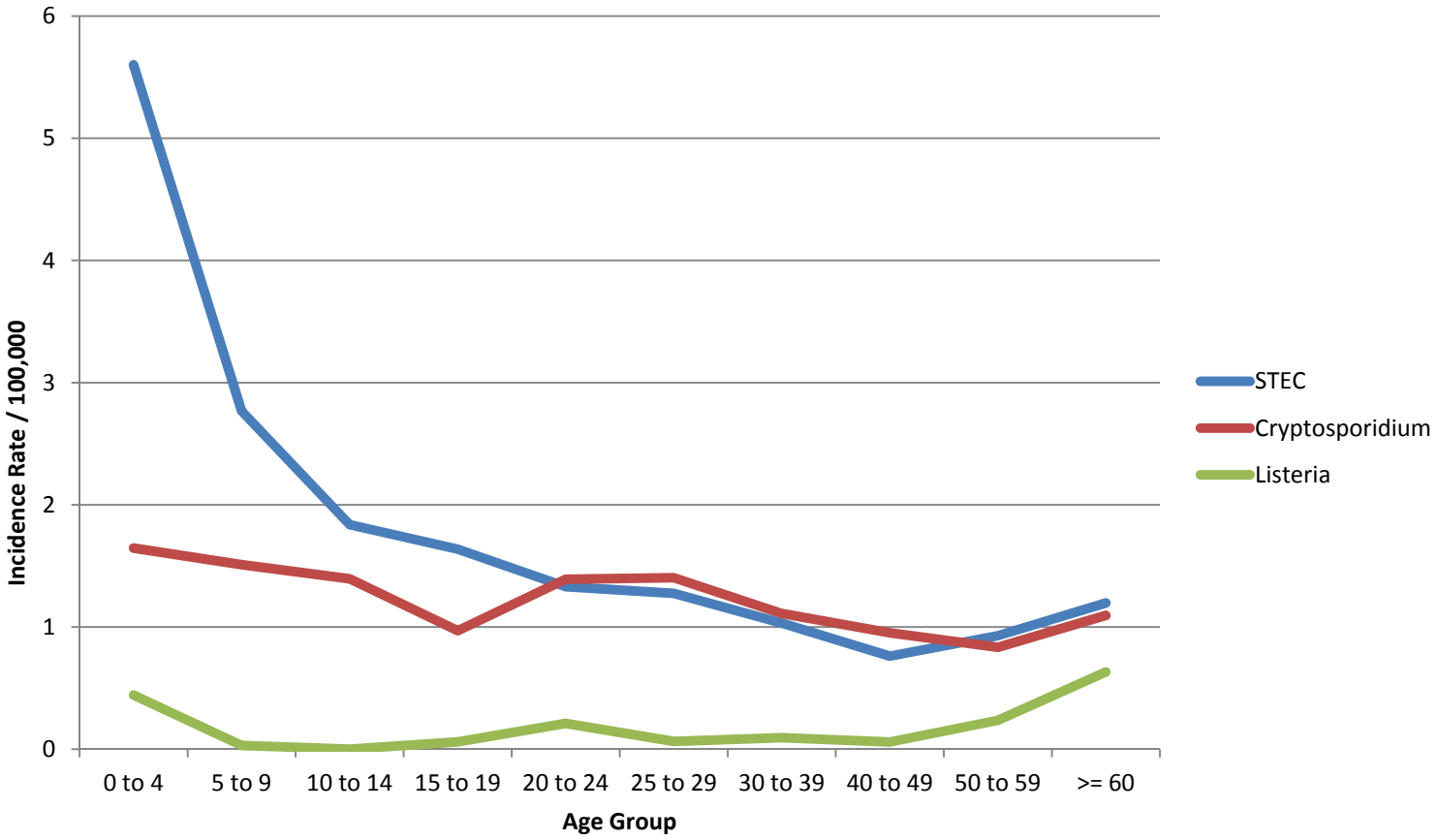
Cryptosporidium Cases by Year of Onset, N.C.



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

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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 *Cryptosporidia* 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.

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Positive Predictive Value (PPV) of Results of Diagnostic Tests for Cryptosporidium Used by Clinical Laboratories in Minnesota, 2008.

	Nonrapid assays				Rapid assays		
Period	Modified Kinyoun acid-fast stained smear	Wampole ELISA	MERIFLUOR DFA test	Any	Remel Xpect	ImmunoCard STAT!	Any
January–May Low prevalence season	100% (*n* = 1)	100% (*n* = 1)	100% (*n* = 2)	100% (*n* = 4)	33% (*n* = 6)	34% (*n* = 47)	34% (*n* = 53)
June–October High prevalence season	100% (*n* = 12)	…	95% (*n* = 19)	97% (*n* = 31)	70% (*n* = 10)	69% (*n* = 67)	69% (*n* = 77)
January–December	100% (*n* = 13)	100% (*n* = 1)	96% (*n* = 23)	97% (*n* = 37)	56% (*n* = 16)	56% (*n* = 126)	56% (*n* = 142)

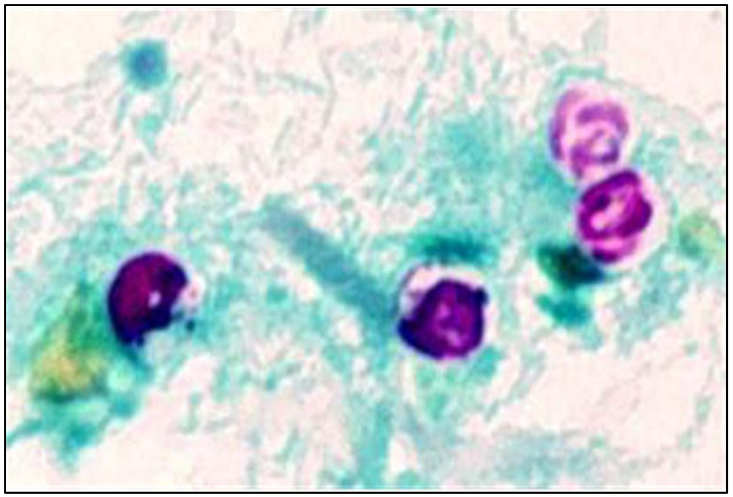
NOTE. Confirmatory testing at the Minnesota Department of Health Public Health Laboratory was used as the gold standard to calculate PPVs. The months of November and December are not included in either the low or the high prevalence season. DFA, direct fluorescent antibody; ELISA, enzyme–linked immunosorbent assay.

Robinson T J et al. Clin Infect Dis. 2010;50:e53-e55

Clinical Infectious Diseases

Light Microscopy Detail

- Modified acid fast stain
- Confirmatory method
- Rarely used by labs
- Enter in NCEDSS as “ova and parasite preparation”



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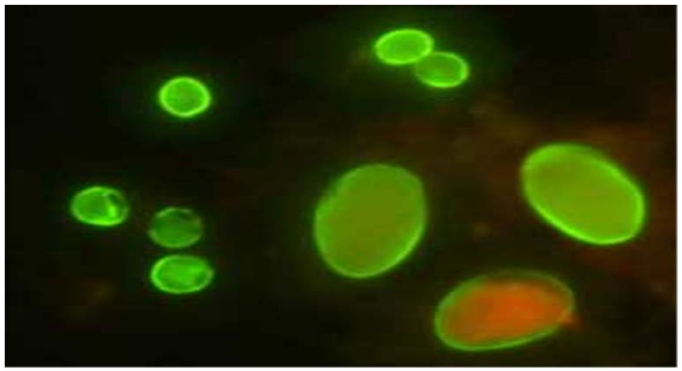
Direct Fluorescent Ab (DFA) Detail



MERIFLUOR®

CRYPTOSPORIDIUM/GIARDIA

Direct immunofluorescent detection procedure for the simultaneous detection of *Cryptosporidium* oocysts and *Giardia* cysts in fecal material

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

Rapid Immunocromatographic Card Detail

Meridian Biosciences shown

- **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.

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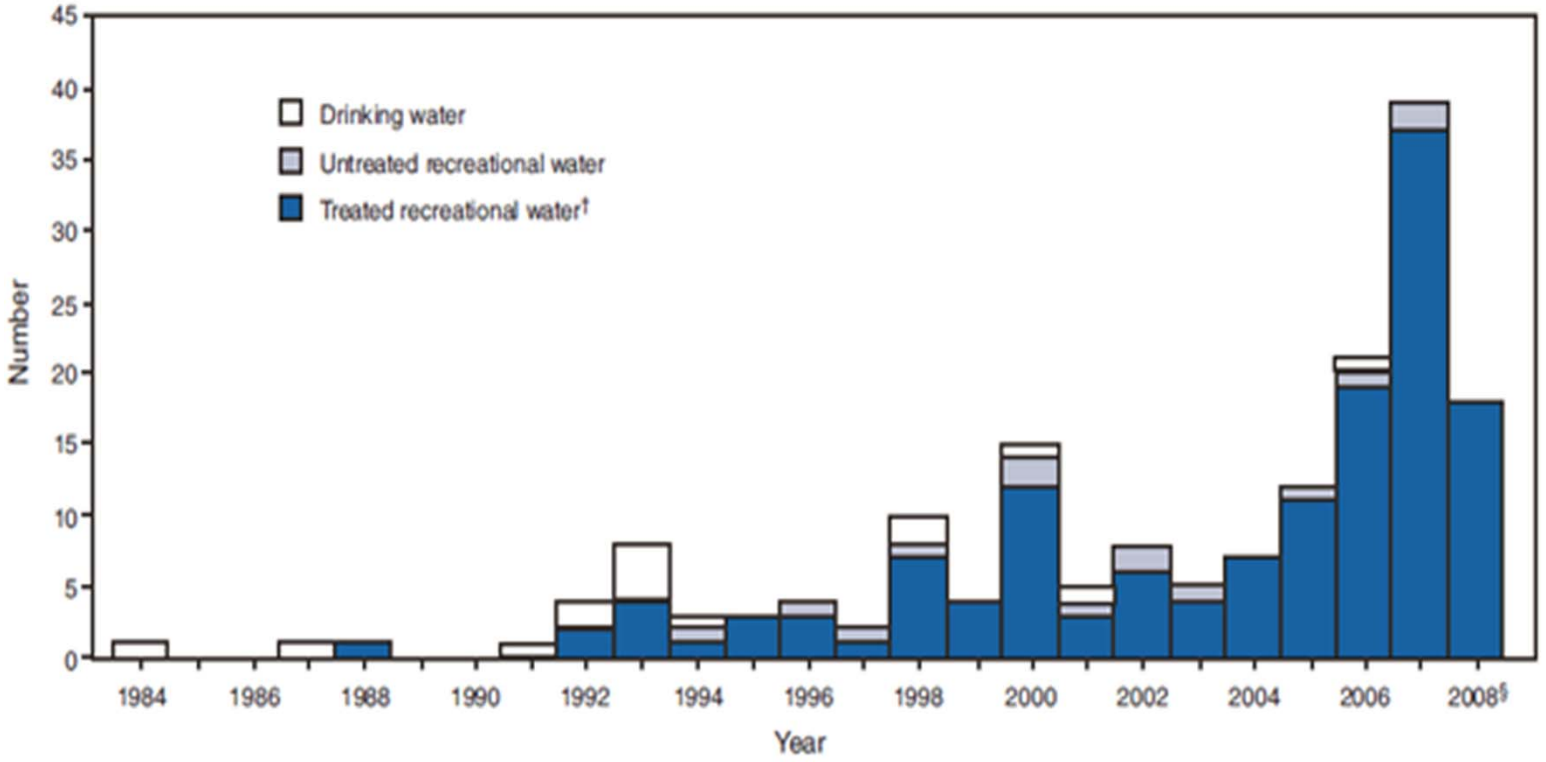
Cryptosporidium Culture?

- 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



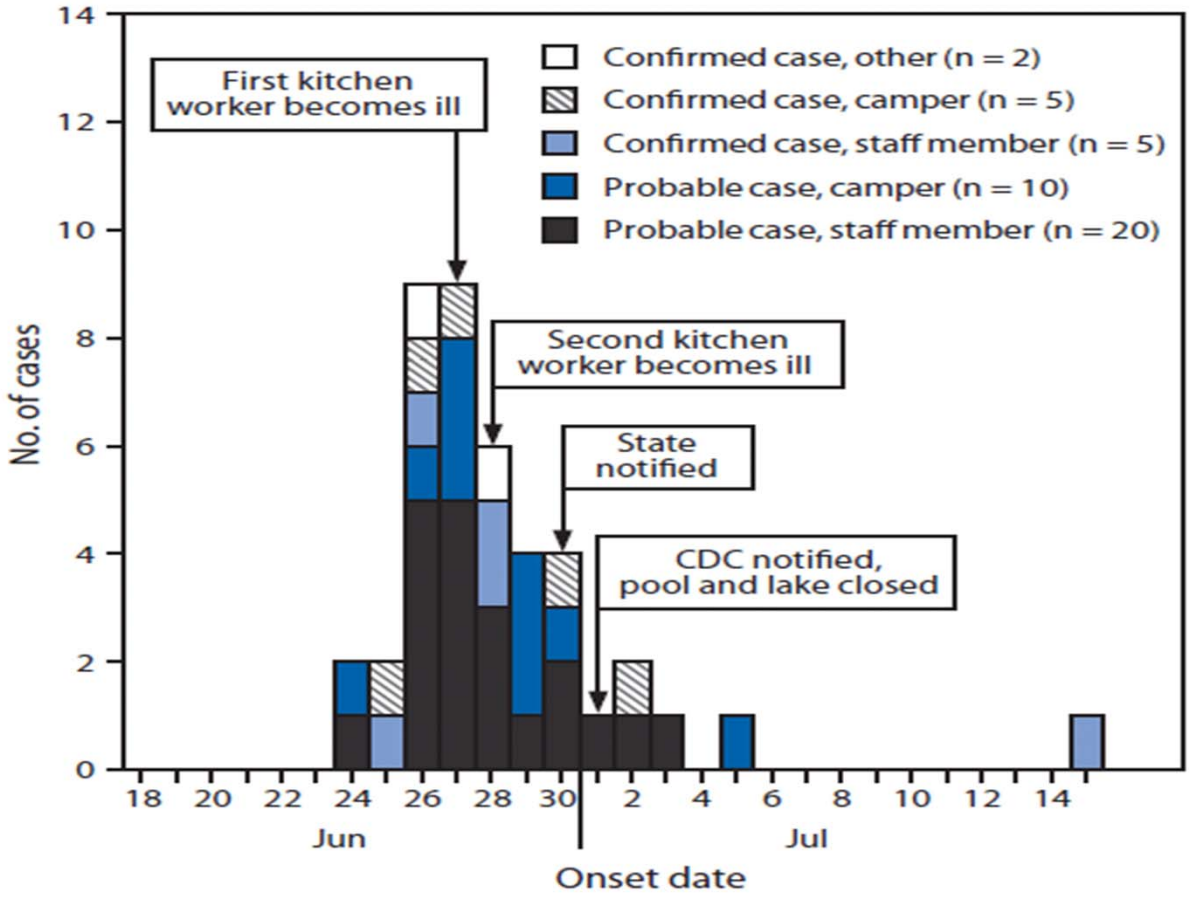
MMWR Cryptosporidiosis Surveillance US 06-08; June 11, 2010 / 59(SS06);1-14

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

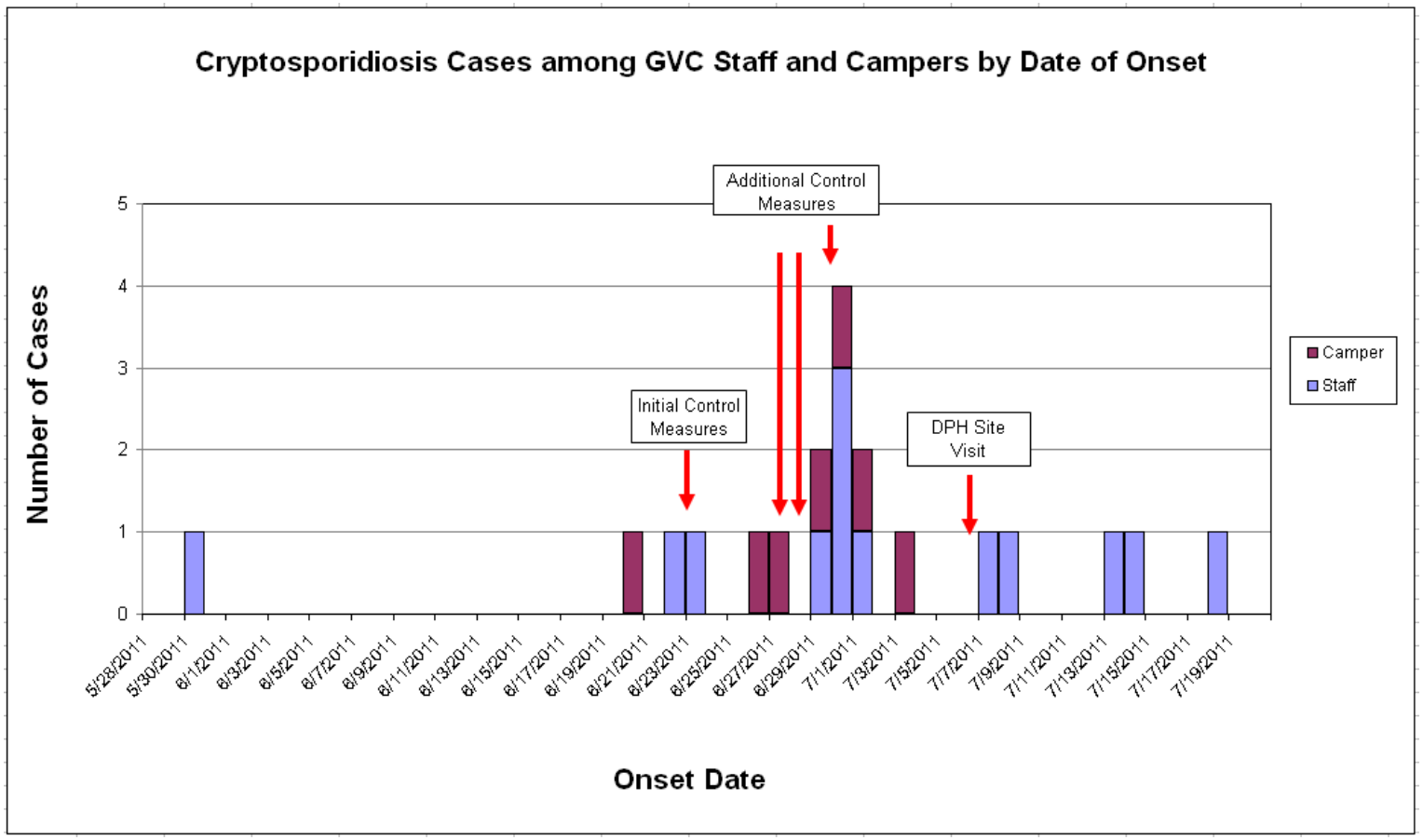
Feltus, et. al. Evidence Supporting Zoonotic Transmission of Cryptosporidium spp. in Wisconsin. JOURNAL OF CLINICAL MICROBIOLOGY, Dec. 2006, p. 4303–4308

2009 N.C. Summer Camp Outbreak

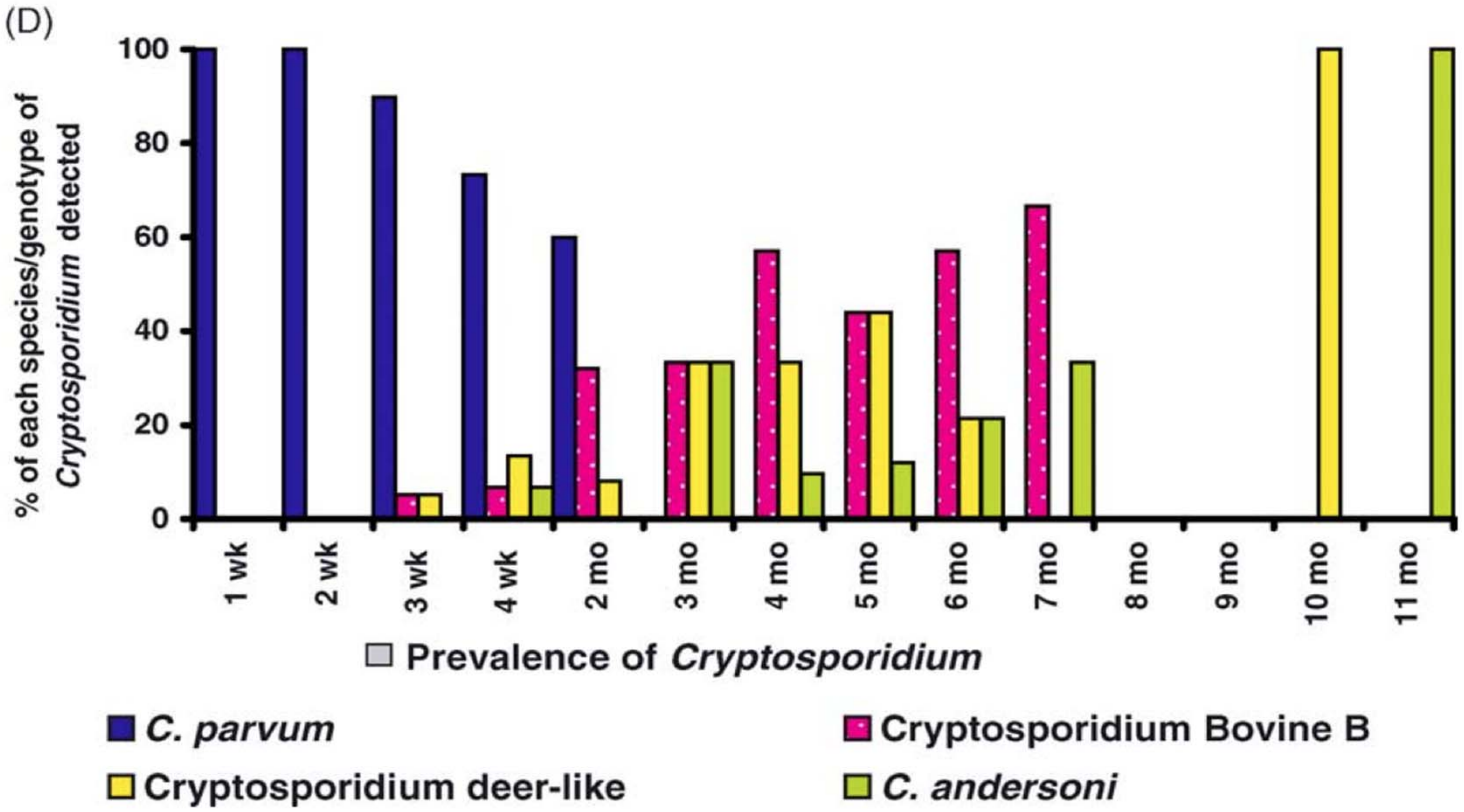


MMWR Cryptosporidiosis Outbreak at a Summer Camp — North Carolina, 2009. July 15, 2011, Vol. 60, No. 27

2011 N.C. Summer Camp Outbreak



Crypto Shedding in Calves?



Santin. (2004). Prevalence and age-related variation of Cryptosporidium species and genotypes in dairy calves. *Veterinary Parasitology , 122*, 103-117.

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