

CRYPTOSPORIDIOSIS

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Cryptosporidiosis is a disease caused by a one-celled parasite, *Cryptosporidium parvum*.

Epidemiology

It is one of the most common enteric pathogens worldwide. It can infect and reproduce in the digestive and respiratory tract of most vertebrates (fish, birds, reptiles and mammals). It is more common in developing countries:

- Oocyst prevalence of 1% to 3% in industrialized countries
- Oocyst prevalence of 5% to 10% in developing countries
- Seroprevalence studies with ELISA (IgM, IgG and IgA) suggest higher prevalence than those observed by microscopy: 25% to 30% in industrialized countries and 50% to 60% in developing countries.
- Children have higher prevalence.

In AIDS patients with diarrhea in the U.S., 20% are found with oocysts in their stools, while in Africa it may reach 50% to 60%.

Transmission: *Cryptosporidium* infection is transmitted by the fecal-oral route and results from the ingestion of *Cryptosporidium* oocysts through the consumption of fecally contaminated food or water or through person-to-person or animal-to-person transmission. The oocysts are infectious immediately upon being excreted in feces.

The infectious dose is low; ingestion of as few as 10 to 30 oocysts has been reported to cause infection in healthy persons. Certain infected persons have been reported to shed less than, or equal to 10^9 oocysts in their stool per day and to excrete oocysts for less than, or equal to 15 days after their symptoms have resolved.

Epidemiologic patterns: *Cryptosporidium* can be transmitted to humans from farm livestock or pets. It can also be waterborne, foodborne, or spread person-to-person.

Incidence: For 2002, incidence of cryptosporidiosis ranged from 0.2 cases (multiple states) to 9.5 cases (Wisconsin) per 100,000 population, with Minnesota, North Dakota, South Dakota, Vermont, and Wisconsin each reporting more than four cases per 100,000 population. Wisconsin reported the greatest number of cases per 100,000 population for each of the four years of the reporting period. Louisiana reported low rates (0.2 to 0.4 per 100,000 population) with no outbreaks from 1999 to 2004.

Diarrheal diseases are highly under-reported because:

- 1) not all infected persons are symptomatic
- 2) those who are symptomatic do not always seek medical care
- 3) health-care providers do not always include diagnostics in their workup of diarrheal diseases because they might treat patients without testing stool for the pathogen
- 4) case-reports are not always completed for positive laboratory results or forwarded to public health officials

The cryptosporidiosis disease burden in Louisiana in 2002 could have been 1,000 to 5,000 according to CDC estimates (20 to 100 cases per 100,000 population).

Oubreaks

Waterborne outbreaks have occurred involving contaminated water supplies and swimming pools. Since the parasite is resistant to chlorine, appropriately functioning water filtration systems are critical for the safety of public water supplies. Most sand filters used for swimming pools are ineffective for removing oocysts from contaminated water. *Cryptosporidium* is the leading cause of reported recreational water-associated outbreaks of gastroenteritis; transmission through recreational water is facilitated by the substantial number of *Cryptosporidium* oocysts that can be shed by a single person; the extended periods of time that oocysts can be shed; the low infectious dose; the resistance of *Cryptosporidium* oocysts to chlorine; and the prevalence of improper pool maintenance (i.e., insufficient disinfection, filtration, and recirculation of water), particularly of children's wading pools.

Person-to-person transmission occurs and can cause outbreaks in child care centers, with rates of 30% to 60% reported. Oocysts appear in the stool at the onset of symptoms and are infectious immediately. Oocysts continue to be detected in stool a mean of seven days after symptoms resolve. In most people, shedding of *C. parvum* stops within two weeks, but in a few, shedding continues for up to two months.

A zoonotic disease, cryptosporidiosis also affects domestic (e.g., dogs, cattle, and sheep), and wild animals. *Cryptosporidium hominis* (known previously as *Cryptosporidium parvum* genotype I) naturally infects only humans, whereas *Cryptosporidium parvum* (known previously as *Cryptosporidium parvum* genotype II) infects both humans and cattle. Infected cattle serve as an important reservoir of *C. parvum* and therefore, are substantial contributors to sporadic human cryptosporidiosis. Use of the term *cryptosporidium* denotes either species unless otherwise noted.

Cryptosporidium parvum also causes traveler's diarrhea.

Surveillance data display a bimodal age distribution, with the greatest number of reported cases occurring among children (aged 1 to 4 years and 5 to 9 years), and among adults (aged 30 to 34 years and 35 to 39 years). These data are consistent with reports of cryptosporidiosis incidence being higher among younger children and of transmission to their caregivers ((e.g., child care staff, family members, and other household contacts).

A five- to six-fold increase in reported cryptosporidiosis cases by illness onset occurred during June to October (i.e., weeks 25 to 42 [early summer through early fall]) compared with January to March. A marked seasonality in the onset of illness occurs in early summer through early fall,

and a five- to six-fold increase in transmission of cryptosporidiosis occurs during the summer. This increase coincides with increased outdoor activities (e.g., swimming during the summer recreational water season), and might reflect heavy use of community swimming (essentially communal bathing) venues by younger children.

Persons at increased risk for infection include:

- 1) persons who have contact with infected animals
- 2) persons who have ingested contaminated recreational (e.g., lake, river, pool, or hot tub) or drinking water
- 3) close contacts of infected persons (e.g., those in the same family or household or in child care settings)
- 4) travelers to disease-endemic areas.

The incubation period is 7 days, with a range of 2 to 14 days.

Clinical Description

Frequent, nonbloody, watery diarrhea is the most common presenting symptom. Other symptoms include abdominal cramps, fatigue, vomiting, anorexia, and weight loss. Fever and vomiting are relatively common among children.

Approximately 2% of AIDS patients reported to CDC are infected with cryptosporidiosis when AIDS is diagnosed, and hospital experience indicates that 10% to 20% develop infection at some time during their illness. In immunocompromised persons, especially those with human immunodeficiency virus infection, chronic severe diarrhea can develop resulting in malnutrition, dehydration and death. Pulmonary, biliary tract, or disseminated infection can occur in immunocompromised persons, although infection usually is limited to the gastrointestinal tract.

The infection is usually self-limiting, but it can lead to severe complications in immunocompromised hosts.

Laboratory Tests

Testing for cryptosporidiosis is not routinely done and so must be specifically requested. Cryptosporidiosis is diagnosed by:

Finding oocysts on microscopic examination of stool specimens. Oocysts are small (4 to 6 μm in diameter), and can be missed in a rapid scan of a slide. Unfortunately, routine laboratory examination of stool for ova and parasites is inadequate to detect *C.parvum*, so health care professionals should ask laboratory personnel to test specifically for *C.parvum*.

The sucrose flotation method or formalin-ethyl acetate method is used to concentrate oocysts in stool before staining with a modified Kinyoun acid-fast stain.

Enzyme immunoassay for detecting antigen in stool.

- Monoclonal antibody–based fluorescein-conjugated stain for oocysts in stool; DFA is the most sensitive and the most specific detection method.
- Enzyme immunoassay (EIA) for detecting antigen in stool are available commercially. With EIA methods, false-positive results may occur, and confirmation by microscopy may be necessary.

Identifying the organism on intestinal biopsy tissue.

Only genetic testing (e.g., PCR) can be used to speciate isolates of *Cryptosporidium*.

The shedding of oocysts can be intermittent so at least two stool specimens should be examined before considering the test to be negative.

Surveillance

Cryptosporidiosis is a reportable condition within five business days.

Case Definition

Clinical description: An illness characterized by watery diarrhea, abdominal cramps, loss of appetite, low-grade fever, nausea and vomiting. The disease can be prolonged and life-threatening in severely immunocompromised persons.

Laboratory criteria for diagnosis: Laboratory-confirmed cryptosporidiosis shall be defined as the detection of a member of the genus *Cryptosporidium* by one of the following methods:

1. Organisms in stool, intestinal fluid, or tissue samples or biopsy specimens in intestinal fluid or small-bowel biopsy specimens, or
2. Antigens in stool or intestinal fluid, or
3. Nucleic acid by PCR in stool, intestinal fluid, or tissue samples or biopsy specimens

Case classification

Confirmed: a case that meets the clinical description and at least one of the criteria for laboratory-confirmation as described above. When available, species designation and molecular characterization should be reported.

Probable: a case that meets the clinical description and that is epidemiologically linked to a confirmed case.

Investigation

The purpose of investigation is to identify cases, to determine the mode of transmission (whether person-to-person or by common vehicle), and to institute disease control measures whenever indicated.

- Upon receipt of a report of cryptosporidium, contact the physician and/or hospital to confirm the diagnosis.
- It is not necessary to follow-up on each individual, isolated case of *Cryptosporidium*; only when it is thought to be part of a food or waterborne outbreak.
- Infected foodhandlers should be removed from jobs that require handling directly food that will not subsequently be cooked.
- Infected children should be excluded from child care until diarrhea stops or can be controlled by a diaper. The child care center should be notified to determine if any other cases have occurred.

Case Management - Treatment

Other than rehydration and correction of electrolyte abnormalities, definitive therapy has not been established. Paromomycin, azithromycin, or nitazoxanide, an investigational agent with potential benefit, may be beneficial for some persons.

Control Measures:

1-Always practice good hand hygiene.

Wash hands with soap and water for at least 15 seconds, rubbing hands together vigorously and scrubbing all surfaces

- after using the toilet
- before handling food
- after every diaper change (even if wearing gloves)
- after direct contact with preschool-aged children
- after any contact with animals or their feces

Prevent contamination of recreational water (e.g., swimming pools, spas, interactive fountains, lakes, rivers and oceans).

- Do not swim when ill with diarrhea (e.g., swimming in or entering the water at pools, spas, interactive fountains, lakes, rivers, or oceans).
- Take children on frequent bathroom breaks and check their diapers often.
- Change diapers in the bathroom, not at the poolside.
- Wash children thoroughly (especially their bottoms) with soap and water after they use the toilet, or after their diapers are changed and before they enter the water.
- Shower before entering the water.

Information about recreational water illnesses (RWIs) and how to stop them from spreading is available from CDC at <http://www.cdc.gov/healthyswimming>.

Prevent infection and illness caused by water that might be contaminated.

- Do not swallow water in swimming pools, spas, and interactive fountains.
- Do not swallow untreated water from lakes, rivers, springs, ponds, streams, or shallow wells.
- Do not drink inadequately treated water during communitywide outbreaks caused by contaminated drinking water.
- Do not use or drink inadequately treated water when traveling in countries where the water supply might be unsafe.
- If the safety of drinking water is in doubt, disinfect it by heating the water to a rolling boil for one minute, or use a filter that has been tested and rated by National Safety Foundation (NSF) Standard 53, or NSF Standard 58 for cyst reduction; filtered water will need additional treatment to kill or inactivate bacteria and viruses.

Information about water filters and bottled water is available from CDC at

http://www.cdc.gov/ncidod/dpd/parasites/cryptosporidiosis/factsht_crypto_prevent_water.htm.

Prevent infection and illness caused by eating food that might be contaminated.

- Use properly treated water to wash all food that will be eaten raw.
- Do not eat uncooked foods when traveling in areas where cryptosporidiosis is common.

Prevent contact and contamination with feces during sex.

- Use a barrier (e.g., a condom) during oral-anal sex.

- Wash hands immediately after handling a condom used during anal sex and after touching the anus or rectal area.

Additional recommendations for prevention and control of cryptosporidiosis for persons with compromised immune systems.

- Minimize contact with the stool of all animals, particularly young animals.
 - Have others change litter boxes and clean cages.
 - Wear disposable gloves when cleaning up after a pet and always wash hands when finished.
- Wash hands after any contact with animals or their living areas.
- Wash hands after gardening, even if wearing gloves.
- Wash, peel and, if needed, cook, all raw vegetables.
- Boil or filter drinking water to ensure its safety, particularly in an area experiencing an outbreak; filtered water will need additional treatment to kill or inactivate bacteria and viruses.

Hospital precaution and isolation: In addition to standard precautions, contact precautions are recommended for diapered or incontinent individuals.