

## General Information

- *Campylobacter* is a genus of Gram-negative, microaerophilic, motile, rod-shaped enteric bacteria.
- It is **the most commonly diagnosed cause of bacterial diarrhea** in people in the developed world.
- There are several significant species of *Campylobacter* found in both people and animals.
  - ▶ The most common species that cause disease in humans are *C. jejuni* subsp. *jejuni* (often simply called *C. jejuni*) and *C. coli*, which account for up to 95% of all human cases - *C. jejuni* is most often associated with chickens, but it is found in pets as well.
  - ▶ The most common species found in dogs and cats is *C. upsaliensis*, which uncommonly infects humans. Cats can also commonly carry *C. helveticus*, but this species' role in human disease (if any) remains unclear.
- *Campylobacter* is an important cause of disease in humans. Disease in animals is much less common, but **the bacterium is often found in healthy pets**. When illness occurs, the most common sign is **diarrhea**.
- *Campylobacter* infection can spread beyond the gastrointestinal tract, resulting in severe, even life-threatening **systemic illness**, particularly in young, elderly or immunocompromised individuals.
- The risk of transmission of *Campylobacter* between animals and people can be reduced by increasing awareness of the means of transmission and some common-sense infection control measures.



## Prevalence & Risk Factors

### Humans

- Campylobacteriosis is one of the most commonly diagnosed causes of bacterial enteric illness in humans worldwide. In Canada, annual disease rates have been estimated to be 26.7 cases/100 000 person-years, but because diarrheal diseases are typically under-reported, the true incidence is likely much higher.
- Over 90% of campylobacteriosis cases are **sporadic**, rather than associated with outbreaks, and more cases occur over the summer months.
- Contact with pets, particularly dogs, has been identified as a risk factor for campylobacteriosis in some studies. In other studies the risk is associated specifically with *diarrheic* or *young* animals.



- **Non-pet exposure is a much more common source** of *Campylobacter* in humans, including consumption of unpasteurized milk or raw/undercooked meat (particularly chicken) or any food that has come in contact with raw chicken. Other risk factors may include contact with chickens or cattle, swimming in natural water sources, and drinking untreated water. *Campylobacter* is also often found in pigs and raw pork.
- Campylobacteriosis can affect anyone, including healthy adults. However, young, elderly or immunocompromised individuals are at higher risk of developing disease and serious complications when exposed to *Campylobacter*.

### Animals

- A recent study in Ontario found *Campylobacter* in 21% of healthy dogs. This is consistent with studies in other regions. The prevalence of *Campylobacter* in cats tends to be slightly lower, but it is still quite common.
- Species of *Campylobacter* recovered in dogs vary depending on the publication and year of study. Earlier studies commonly reported *C. jejuni* and *C. coli*, but *C. upsaliensis* has become much more prevalent since its discovery in dogs in 1983. Prevalence of *C. upsaliensis* in dogs ranges from 7-42%, but can be as high as 51-87% in stray animals. Prevalence of *C. upsaliensis* in cats ranges from 16-66%.
- Dogs and cats less than six months of age, those kept in high-density housing (e.g. catteries, kennels, shelters) and strays are more likely to carry *Campylobacter*.
- Animals more likely to show signs of clinical illness due to *Campylobacter* infection include the young, the immunocompromised, and those under stress.
- Several studies have shown no association between diarrhea and fecal shedding of *Campylobacter* in dogs and cats.
- Other household pets may also shed *Campylobacter*, including ferrets, hamsters, birds and rabbits. In ferrets, *C. jejuni* can be very common, and is associated with proliferative colitis.





## Habitat & Environmental Survival



The natural environment of *Campylobacter* is the **intestinal tract** of animals and people. *Campylobacter* spp. are relatively fragile, fastidious organisms that are susceptible to heat (e.g. cooking) and desiccation. They are also microaerophilic, meaning they grow best in a low-oxygen environment. They have a relatively high minimal temperature requirement for growth (>30°C), therefore the organism does not typically multiply in the environment outside a host (e.g. in contaminated food), although it can *survive* in feces at room temperature for at least three days, and in refrigeration for at least one week. *Campylobacter* spp. can also survive in untreated or improperly treated water, and numerous human cases of campylobacteriosis have been traced to contaminated drinking water.

- ▶ *Campylobacter* spp. are killed by most disinfectants when used according to the manufacturer's recommendations for concentration and contact time, including bleach, quaternary ammonium compounds, iodophors and ethyl alcohols, as well as routine chlorination of drinking water.

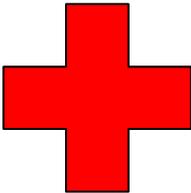
## Transmission of *Campylobacter*

- *Campylobacter* is usually transmitted by ingestion of **contaminated water or food**, or **contamination of the hands** with fecal material which is then transferred to the mouth. Raw or undercooked chicken is a particular concern. The risk of direct person-to-person transmission appears to be relatively low, but outbreaks have been reported in neonatal units.
- Animals may be infected in the same manner – by consuming contaminated water or food, or ingesting the bacteria after licking or chewing a contaminated object.
- The types of *Campylobacter* found in pets include many of the same types found in humans. Presumed transmission of both *C. jejuni* and *C. upsaliensis* between people and dogs and cats has been reported.
- The dose of *Campylobacter* required to cause infection in a person may be as low as a few hundred organisms.



## Symptoms and Signs

**Humans:** Campylobacteriosis is typically associated with self-limiting diarrhea, which may last a few days to more than a week. Diarrhea may range from mild to severe, and may be accompanied by vomiting, fever and abdominal cramps. Subclinical infection also occurs. Extra-intestinal disease due to campylobacteriosis is far less common than diarrhea, but may include abortion, arthritis, meningitis, myocarditis, abscesses, nephritis, prostatitis and cholecystitis. Disease is more severe in immunocompromised individuals. Serious long-term sequelae of infection that may occur in humans include immune-mediated diseases such as reactive arthritis and Guillain-Barré syndrome (an acute progressive peripheral neuropathy). Death due to campylobacteriosis in otherwise healthy individuals is uncommon.



**Animals:** Dogs and cats tend to develop less severe clinical signs (typically limited to watery mucoid diarrhea), even when exposed to *C. jejuni* isolates that cause much more severe disease in people. In general, diarrhea may last 5-15 days, and may or may not contain blood or bile, or be accompanied by anorexia, vomiting or fever. The majority of infections in pets are subclinical. Animals that are young (less than six months old) or stressed (hospitalized, sick, pregnant, post-operative) may be more likely to develop clinical signs. Concurrent infection with other enteropathogens (e.g. *Salmonella*, *Giardia*, parvovirus, coronavirus) may also increase the likelihood of clinical illness, particularly in cats. In some cases, infection has been associated with longer-term chronic or intermittent diarrhea. Cholecystitis and abortion due to campylobacteriosis have also been infrequently reported in dogs.

## Diagnosis of *Campylobacter*

**Bacterial culture:** Definitive diagnosis of campylobacteriosis is typically made by bacterial culture, usually of the feces. However, because *Campylobacter* can be found in healthy individuals, a positive culture alone does not necessarily indicate that the organism is the cause of the patient's disease. Culture must be interpreted in combination with clinical findings and other test results. Isolation of *Campylobacter* from tissues or fluid other than gastrointestinal content (e.g. blood, cerebrospinal fluid) confirms systemic infection. Because of the organism's fastidious growth requirements, selective culture media and incubation conditions are typically needed, but some culture media that are selective for *C. jejuni/coli* may inhibit the growth of *C. upsaliensis*. Culture of *Campylobacter* may take longer than standard culture (72-96 hours).





**Microscopy:** *Campylobacter* organisms can be identified using dark field or phase contrast microscopy. Live *C. jejuni* organisms exhibit a characteristic “darting” motion in fresh fecal samples, particularly from people with acute diarrhea. This test can be much more rapidly performed than culture, but cannot differentiate pathogenic *Campylobacter* spp. from non-pathogenic *Campylobacter* spp. and *Helicobacter* spp., so it is not really very useful.

A **fecal antigen test** is also available for use in people, which is relatively sensitive (80-96%) and quite specific (>97%). The test also cross-reacts with *C. upsaliensis*. This test has not been evaluated in animals. **Serologic tests** are sometimes used in people during outbreaks of disease to provide more information regarding exposure to *Campylobacter*, however these tests have not been evaluated in dogs and cats, and they are primarily a research tool at this time. No properly validated DNA-based or other molecular tests for *Campylobacter* are commercially available.

## Treatment of Campylobacteriosis



**Gastrointestinal infection:** In most cases, campylobacteriosis is subclinical in animals, and does not require specific treatment. Even with uncomplicated gastroenteritis, disease is often self-limiting and therefore may require only supportive therapy, including intravenous fluids to compensate for fluid loss in the diarrhea and anti-inflammatory medication. In immunocompromised or febrile animals, or in animals with evidence of hemorrhagic diarrhea, antimicrobial treatment may be indicated. Since *Campylobacter* has zoonotic potential, treatment should be considered for diarrheic dogs and cats with campylobacteriosis in households with immunocompromised humans and young children.

**Systemic infection:** In animals and humans with systemic infection or septicemia, antimicrobial therapy is warranted. Empirical therapy is often used because antimicrobial susceptibility testing of *Campylobacter* is very difficult due to its fastidious nature.

Most *Campylobacter* isolates are resistant to penicillins and cephalosporins. Macrolides or fluoroquinolones are most commonly used to treat *Campylobacter* infections. Resistance to fluoroquinolones is increasingly reported, and these drugs should be avoided in young animals due to possible adverse effects on cartilage growth. **Erythromycin** (a macrolide) is the drug of choice in people, and is also recommended for use in pets (dogs 20 mg/kg PO q12h for 5-21 days, cats 10 mg/kg PO q8h for 5 days), although this drug can cause gastric irritation and vomiting. Macrolide resistance has also been reported in human *Campylobacter* isolates. Other drugs may also be effective in animals include chloramphenicol and enrofloxacin.



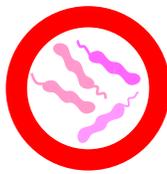
**There is no indication to treat healthy pets that are shedding *Campylobacter*.** Without identifying each *Campylobacter* isolate to the species level, is difficult to determine the relevance of a positive culture in a healthy animal. It is possible that unnecessary treatment could contribute to the development of antimicrobial resistance, and even prolong shedding through further disruption of the normal intestinal microflora. It is unknown how long an untreated animal will take to clear infection with *Campylobacter*, but this is likely influenced by the opportunity for repeated re-infection (similar to the situation with *Salmonella*).

**Probiotics** have also not been shown to be effective for eliminating shedding of *Campylobacter* in dogs. No effective **vaccine** for *Campylobacter* in any species has been developed to date.



## Infection Control For *Campylobacter* in Pets

As with *Salmonella*, measures to control the spread of *Campylobacter* and prevent re-infection of the patient (human or animal) are important. Infectious disease control measures are crucial whether or not an animal is treated with antimicrobials. **Control of fecal contamination** is of primary importance. Any dog or cat, healthy or sick, can potentially be shedding *Campylobacter* in its stool, therefore people should assume that feces are biohazardous and treat them as such. **With routine household infection control measures, the risk of transmission of *Campylobacter* from a non-diarrheic pet to a person is likely minimal.**



**Hand Hygiene:** Anyone **handling a pet or feces from a pet** should wash their hands immediately afterwards with soap and running water, or use an alcohol-based hand sanitizer. This is especially important in the case of sick or diarrheic animals, but applies to all animals, as even healthy pets can shed *Campylobacter*.



- ▶ Hand hygiene is also critical **after using the bathroom, prior to handling any food, and after handling any kind of raw meat product** (especially chicken).

#### **At Home & In Public:**

- Dog feces should be picked up immediately to prevent environmental contamination, especially in public areas like parks where other dogs and children may play.
- Prevent pets from drinking from puddles, ponds, lakes or other water sources that may be contaminated with feces from other animals.
- Dogs should be prevented from eating their own feces or those of other animals.
- Minimize the risk of foodborne infection by thoroughly cooking all meat products prior to consumption.
- Do not drink unpasteurized milk.



#### **Infection Control For Pets Carrying *Campylobacter***

Any animal with a confirmed or suspected *Campylobacter* infection should be kept separate from other animals, particularly young, geriatric, immunocompromised or otherwise sick pets. High-risk individuals (e.g. young, elderly and immunocompromised persons) should avoid contact with any known *Campylobacter*-positive pet, but the animal does NOT need to be removed from the home if appropriate infection control measures are well followed.

**In-Clinic Precautions:** All animals with acute diarrhea of unknown etiology should be considered infectious, because there are numerous infectious pathogens, including *Campylobacter*, that could be the cause.

- Animals with acute diarrhea should be admitted directly to isolation or an examination room, and should not have contact with other animals in the reception area.
- Contact precautions (i.e. examination gloves and a gown or dedicated laboratory coat) should be used when handling affected animals.
- Use of an alcohol-based hand sanitizer or hand-washing with antibacterial soap and water should be exercised after contact with the patient or areas that may have become contaminated, even if gloves are worn.
- Contaminated surfaces, particularly runs and kennels, must be thoroughly cleaned to remove all visible organic debris prior to applying a disinfectant. Most common disinfectants (e.g. bleach, quaternary ammonium compounds, accelerated hydrogen peroxide products) are effective if used at the label concentration and if adequate contact time (at least 10-15 minutes) is permitted.
- Linens that become contaminated with fecal material should be washed separately and **dried completely using high heat** in a dryer. Washing alone, even in hot water, will not necessarily kill pathogens such as *Salmonella*, although it would likely be effective against *Campylobacter*. Large amounts of gross contamination should be removed by hand using gloves and disposable paper towel prior to washing.

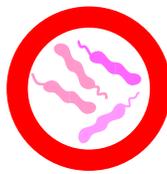


#### **Considerations For Therapy Animals**

Guidelines have been developed to reduce the risk of pets involved in animal visitation programs acquiring or transmitting infectious diseases. Owners involved in these programs should ensure that they follow these guidelines. Pets that visit healthcare facilities or are part of other animal visitation programs may come in contact with individuals with compromised immune systems who are more susceptible to infection with zoonotic pathogens. Routine screening of these animals for specific pathogens, including *Campylobacter*, is not recommended.

#### **Pet owners diagnosed with *Campylobacter***

People may be able to transmit *Campylobacter* to pets. Owners diagnosed with intestinal campylobacteriosis should be told to wash their hands thoroughly after using the washroom. Their pet(s) should be prevented from drinking from the toilet. There is no evidence that testing pets for *Campylobacter* is useful if an owner is diagnosed with campylobacteriosis.



In general, **testing or treating clinically normal animals for *Campylobacter* is not indicated**, but *Campylobacter* should be considered in animals that develop diarrhea. Transmission of *Campylobacter* from a pet to a human in a household is very unlikely if appropriate precautions (as described above) are observed. Even if there are high-risk individuals in the household, diligent attention to infection control measures will minimize the risk of transmission. Given the well-described benefits of pet ownership, **removal of the pet is not indicated**, unless extenuating circumstances exist which prevent proper infection control measures from being implemented. In these cases, the **pet may be temporarily removed** until its carrier status resolves, but this would very rarely be warranted.

Healthy pets that are shedding *Campylobacter* do not require treatment.

## Zoonotic Disease Risk

The zoonotic risk to the general population posed by *Campylobacter* in house pets such as dogs and cats is:

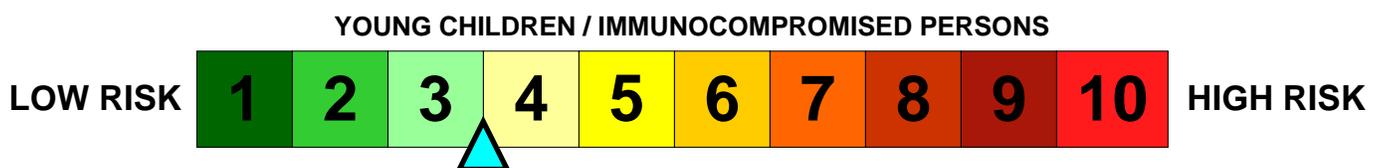


**Individuals with compromised immune systems** (e.g. HIV/AIDS, transplant and cancer patients) are more susceptible to many kinds of infections, including those which may be transmitted by pets. While these individuals are not advised to get rid of their pets, precautions should be taken to reduce the frequency of contacts that could result in pathogen transmission (e.g. avoiding contact with any animal feces), as well as the ability of infectious agents to survive in the household (e.g. prompt and thorough disinfection of potentially contaminated surfaces).

**Infants and young children** (less than 5 years old) are more likely than adults to extensively handle animals if given the opportunity, more likely to touch their faces or mouths, and less likely to wash their hands after handling an animal. Children may “snuggle” with pets; this very close contact can increase the risk of disease transmission.

- Young children should be supervised when playing with animals, and an adult should ensure that they wash their hands afterwards, and especially prior to handling food. Older children should be taught to do the same.

For these groups, the zoonotic risk posed by *Campylobacter* in house pets such as dogs and cats is likely:



## Additional Information

- ▶ Altekruze SF, Tollefson LK. Human campylobacteriosis: A challenge for the veterinary profession. J Am Vet Med Assoc. 2003;223:445-452.
- ▶ Crushell E, Harty S, Sharif F, Bourke B. Enteric *Campylobacter*. Purging its secrets? Pediatr Res. 2004;55:3-12.
- ▶ Damborg P, Olsen KE, Moller Nielsen E, Guardabassi L. Occurrence of *Campylobacter jejuni* in pets living with human patients infected with *C. jejuni*. J Clin Microbiol. 2004;42:1363-1364.
- ▶ Fox JG. *Campylobacter* Infections. In: Greene CE, ed. Infectious Diseases of the Dog and Cat. 3rd ed. Edinburgh: Elsevier Saunders, 2006:339-343.
- ▶ Hald B, Madsen M. Healthy puppies and kittens as carriers of *Campylobacter* spp., with special reference to *Campylobacter upsaliensis*. J Clin Microbiol. 1997;35:3351-3352.
- ▶ Torre E, Tello M. Factors influencing fecal shedding of *Campylobacter jejuni* in dogs without diarrhea. Am J Vet Res. 1993;54:260-262.