

What Is Salmonella?

- ▶ *Salmonella* is a group of bacteria that normally inhabit the intestines of animals and humans. **Almost all warm- and cold-blooded animals**, including dogs, cats, rabbits, rodents and other small pocket pets, reptiles, birds and livestock (e.g. cattle, horses, poultry, swine) **can carry or be infected by Salmonella of some kind**. Disease due to *Salmonella* infection is called salmonellosis.
- ▶ The most important types (also called serotypes) of *Salmonella* in human and veterinary medicine mostly belong to the same subspecies, *Salmonella enterica* subsp. *enterica*. Therefore, unlike other bacteria, the species and subspecies are often not written, and the strains are simply referred to by their serotype, such as *Salmonella* Enteritidis, S. Heidelberg and S. Typhimurium.
 - **Salmonella Typhi**, the serotype that causes typhoid fever in humans, **does not infect animals** and is therefore not a zoonotic pathogen.
- ▶ *Salmonella* is an important cause of disease in humans and pets. The most common sign of illness is **diarrhea**. However, *Salmonella* can also be carried by humans and pets **without any signs of illness** at all.
- ▶ *Salmonella* can sometimes spread beyond the intestinal tract, resulting in severe, even life-threatening **infection of other parts of the body**, particularly in animals or people who are very young, old, or have a weakened immune system.
- ▶ *Salmonella* is so commonly found in reptiles that **all reptiles** should be assumed to be carrying *Salmonella*, and handled appropriately.
- ▶ The risk of transmission of *Salmonella* between animals and people can be reduced by increasing awareness of how it is transmitted and some common-sense infection control measures.



How Common Is Salmonella?

Humans

- Salmonellosis is one of the most common causes of bacterial diarrhea in humans worldwide. In Canada, approximately 6,000-12,000 cases of salmonellosis are reported yearly, but because diarrheal diseases are typically under-reported, the true number of cases may be closer to hundreds of thousands.
 - Most cases of salmonellosis are attributed to food poisoning, but outbreaks have also been linked to exposure to **contaminated pet food** and pet treats, exposure to **livestock**, and exposure to **pets, particularly reptiles**.
 - Salmonellosis can affect anyone, including healthy adults. However, the young, elderly or immunocompromised individuals (e.g. HIV/AIDS, cancer or transplant patients) are at higher risk of developing disease and serious complications when exposed to *Salmonella*.



Animals

- ▶ Recent studies estimate the between 1% to 4% of healthy dogs, and less than 1% up to 18% in healthy cats may carry *Salmonella* in their intestine. **The majority of dogs and cats with Salmonella show no signs of infection.**
- ▶ *Salmonella* in dogs and cats appears to be more common in animals that are housed closely together in high numbers such as kennels, catteries, and shelters.
- ▶ Risk factors for *Salmonella* carriage in dogs and cats include **raw meat diets** and exposure to **livestock**.
- ▶ *Salmonella* in **pocket pets** such as mice, rats, gerbils, hamsters, and guinea pigs is likely also quite common. In 2004, an outbreak of human salmonellosis in the USA was linked to hamsters. *Salmonella* is very commonly found in **reptiles**, and reptile exposure has caused multiple outbreaks of salmonellosis in humans.
- ▶ There is also evidence that *Salmonella* can be transmitted from dogs and cats to humans in some instances.
- ▶ Adult dogs and cats seem to be somewhat naturally resistant to disease due to *Salmonella*. **Risk factors for clinical salmonellosis** that have been identified during hospital outbreaks in dogs include pre-existing disease, prolonged hospitalization, major surgery, steroid therapy, cancer, chemotherapy, and antibiotic therapy.





How Do Animals & People Become Infected With *Salmonella*?

Salmonella normally lives in the **intestine of humans and animals**. However, *Salmonella* is a very hardy organism, and **can potentially be found almost anywhere** – in soil, water, or anywhere contaminated with animal stool or human sewage – and it can survive for long periods of time, particularly in the presence of organic matter.

- *Salmonella* is usually transmitted by swallowing **contaminated water or food**, or **contamination of the hands** with stool which is then transferred to the mouth.
 - ▶ Contamination of food is not limited to products of animal origin. For example, fruits and vegetables which have been irrigated or fertilized with contaminated water or manure, and which are not washed with potable water or cooked prior to being eaten, can also be an important source of *Salmonella*.
- Foodborne transmission (i.e. “food-poisoning”) is a much more common cause of illness due to salmonellosis, but contact with stool from either wild or domestic animals can also result in this disease.
- Animals may be infected in the same way as people – by consuming contaminated water or food, or swallowing *Salmonella* after licking or chewing a contaminated object.
- The **number of *Salmonella* organisms** that need to be swallowed in order to **cause illness** depends on the **strain** of *Salmonella* involved and the **health status** and **age** of the animal or person.



What Happens If A Person Or Animal Gets Salmonellosis?

Humans: Signs of salmonellosis in people can range from **none** to severe, sudden **diarrhea**. In some cases, the infection can also spread to tissues in the body beyond the intestine, resulting in **complications** such as bloodstream infection, abscesses, meningitis, and infection of bone, joints and heart valves. People with weakened immune systems (e.g. HIV/AIDS, cancer or transplant patients), young children or elderly individuals are at a particularly high risk for severe disease and complications associated with *Salmonella* infection, and in some cases the **infection can be fatal**, especially in infants. In most individuals with uncomplicated diarrhea, the infection resolves on its own, but chronic infection can occur in some cases, resulting in similar but intermittent signs over a period of months. Affected individuals, both human and animal, typically shed *Salmonella* in their stool even after signs of illness resolve, sometimes for weeks.

Animals: *Salmonella* infection does not usually cause visible signs of illness in pets, but it can cause acute, intermittent or chronic diarrhea, just like it does in people. Infection can also spread beyond the intestinal tract, causing infection of the bloodstream and other organs. Young animals, stressed/sick animals or those with a weakened immune system, and those kept in large groups such as kennels or shelters are at higher risk for getting sick. Over 90% of dogs and cats recover from acute salmonellosis.



How is *Salmonella* Diagnosed?



In both animals and people, the diagnosis of salmonellosis is typically made by **culturing the bacteria from the stool**. However, because *Salmonella* can be found in the intestines of healthy individuals, a positive culture alone does not necessarily mean that *Salmonella* is the cause of the person’s or animal’s disease. Isolation of *Salmonella* from tissues or fluid not associated with the intestinal tract (e.g. blood, lung secretions, urine) is more definitive, and indicates that the infection has invaded the rest of the body.

Shedding of *Salmonella* is intermittent in animals and people. The number of bacteria in the stool and how often they are passed varies from person to person and animal to animal. Therefore testing of **multiple fecal samples may be necessary for diagnosis**.



How is Salmonellosis Treated?

Diarrhea: Straightforward cases of diarrhea due to salmonellosis usually do NOT require antibiotic treatment – the infection typically resolves on its own, although oral or intravenous fluids may be needed to prevent dehydration if the diarrhea is severe. Antibiotic therapy in salmonellosis is only meant to prevent spread of bacteria to the rest of



the body, not to kill *Salmonella* within the intestinal tract. Since spread of the infection within the body is uncommon in otherwise healthy people or animals, antibiotics are likely unnecessary, and may actually lead to increased antimicrobial resistance, and may prolong the shedding period after the patient recovers.



- ▶ **Treatment of any kind must always be accompanied by infection control measures** to prevent the spread of *Salmonella* and prevent re-infection of the person or animal. **It is not possible to predict how long a person or animal will shed *Salmonella* following infection**, but shedding may persist intermittently for weeks. The duration of shedding is likely influenced by the patients overall health and the condition of the normal bacterial population in the intestine.

Systemic infection: In animals and humans with infection of the bloodstream or other tissues, antibiotics are needed, as well as other treatments depending on organ systems affected. Systemic infections are usually very serious, and may require hospitalization.

Healthy pets that are shedding *Salmonella* should not be treated with antibiotics. There is no evidence that antibiotic treatment helps pets stop shedding *Salmonella* sooner, and it may actually prolong the amount of time an animal sheds the bacteria, because antibiotics disrupt the normal bacterial population in the intestine. Unnecessary use of antibiotics can also lead to antibiotic resistance. **Probiotics** have also not been shown to be effective for eliminating *Salmonella* shedding in animals.

***Salmonella* vaccines** are not available for dogs, cats, or humans. An effective vaccine for dogs and cats may not be possible due to the large number of different serotypes of *Salmonella* that may infect these species.

How Can I Help Prevent My Pet From Getting *Salmonella*?

Completely preventing pets from carrying *Salmonella* can be very frustrating, and is likely impossible, because animals can carry the bacteria without signs of illness, and the bacteria survive so well in the environment. However, taking steps to control the transmission of *Salmonella* in pets and people is still **very important from a human and public health perspective**. Any *Salmonella* infection of an animal, whether the animal is sick or not, should be considered potentially transmissible to humans, and vice versa. **Control of stool contamination**, both human and animal, is the most important preventative measure.



Hand Hygiene: Anyone **handling a pet or stool 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 animals with confirmed or suspected *Salmonella* infection (e.g. a pet with diarrhea, any pet that is fed raw meat), but **applies to all animals**, as even healthy pets can shed *Salmonella*. Hand hygiene is also critical:

- ▶ After using the bathroom
- ▶ After handling any kind of raw meat product
- ▶ Prior to handling any food
- ▶ After handling any kind of pet food

At Home & In Public:

- **Dog stool 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 strongly discouraged from eating their own stool or that of other animals.
- **Thoroughly cook all food** (especially meat) fed to pets.
- Feeding a commercially prepared, heat-processed diet helps to reduce the risk of *Salmonella* contamination in the food, but even these products can occasionally contain *Salmonella*. Pet food should therefore be kept in a sealed container and should never come in contact with kitchen surfaces or food meant for human consumption.
- **Do not leave wet pet food in dishes at room temperature** for prolonged periods, as this provides ideal conditions for bacteria of many kinds to grow.
- **Prevent pets from hunting** and scavenging small wild animals and birds. Dogs should be supervised carefully when off-leash. Cats should ideally be kept indoors.





What Do I Do If My Pet Is Diagnosed With *Salmonella*?

High-risk individuals (e.g. children, the elderly or persons with a weakened immune system) **should avoid contact with diarrheic pets**, as these animals may shed high numbers of potentially zoonotic pathogens, including but not limited to *Salmonella*, in their stool. Members of households that include high-risk individuals must pay particularly close attention to hand hygiene and other infection control measures at all times, even if the pet in question is healthy, as any animal (or person) could potentially be shedding *Salmonella* in its stool.

- ▶ **Preventing stool contamination** of the environment, the pet's haircoat, and the hands and clothing of people in contact with the animal is of primary importance. Diligent attention to **hand hygiene, cleaning and disinfection** of any surface that becomes contaminated with pet feces are crucial. **Linens** that become contaminated should be washed separately and **dried completely using high heat** in a dryer.
- ▶ Most disinfectants, including a simple 1:10 solution of household **bleach**, can effectively kill *Salmonella* if all visible organic debris is removed beforehand, and adequate contact time (10-15 minutes) is allowed.



Animals Fed Raw Meat

Feeding raw meat to pets significantly increases the risk of *Salmonella* carriage. Raw meat diets and stool from animals fed these diets may pose a risk to other animals and people. Pets that live or have frequent contact with high risk individuals (e.g. very young or elderly persons, or those with weakened immune systems) should **NOT be fed raw meat**.

Pet treats made from raw animal tissues may also be contaminated with *Salmonella*, and outbreaks associated with these products have been reported. Raw treats such as **pig ears** and **rawhides** should be **handled in the same manner as raw meat**, and should not be given to dogs in households with high-risk individuals.

Therapy Animals

Pets that visit healthcare facilities or are part of other animal visitation programs should not be fed raw meat due to the increased risk of shedding *Salmonella*. Guidelines have been developed to reduce the risk of pets involved in animal visitation programs acquiring or transmitting infectious diseases. If your pet is involved in these programs, ensure that you follow these guidelines.



If I Have *Salmonella*, Should I Test My Pet?

People can potentially transmit *Salmonella* to pets and other people. Anyone diagnosed with salmonellosis should be very diligent about washing their hands thoroughly after using the bathroom, and pet(s) should be prevented from drinking from the toilet. ***There is no evidence that testing pets for Salmonella is useful if a person in the household is diagnosed with salmonellosis.***

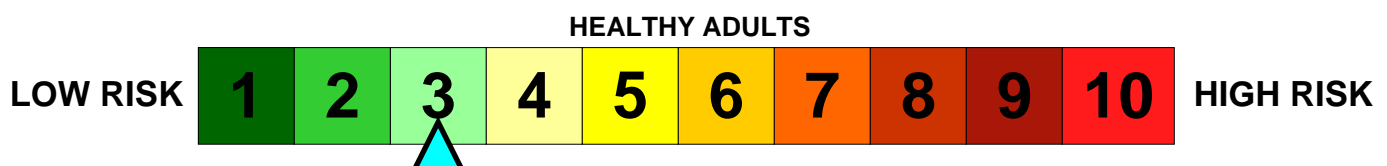
Reptiles & Amphibians

These animals are of **considerably higher risk** for transmission of *Salmonella* compared to other pets. In people less than 21 years old in the USA, contact with reptiles or amphibians accounts for 11% of all sporadic *Salmonella* infections. These are therefore **NOT** recommended pets for any household with young children or individuals with a weakened immune system.



Normal, healthy pets should not be tested or treated for *Salmonella*, but *Salmonella* should be considered in animals that develop diarrhea. Transmission of *Salmonella* 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, **permanent removal of the pet is not indicated**, unless extenuating circumstances exist which prevent proper infection control measures from being used. In these cases, the **pet may be temporarily removed** until it stops shedding *Salmonella*, but this would very rarely be warranted.

The risk of disease to the general population posed by *Salmonella* in house pets such as dogs and cats is:



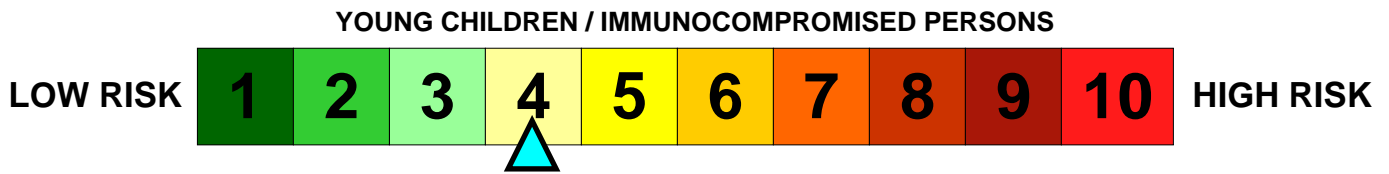


Individuals with compromised immune systems (e.g. HIV/AIDS, transplant and cancer patients) are more susceptible to many kinds of infections, including those which may be transmitted by pets. While these individuals are not advised to get rid of their pets, precautions should be taken to reduce the frequency of contacts that could result in pathogen transmission (e.g. avoiding contact with any animal stool), 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 risk of disease posed by *Salmonella* in house pets such as dogs and cats is likely:



Additional Information

- Centers for Disease Control and Prevention (CDC), Healthy Pets Healthy People. *Salmonella* Infection (salmonellosis) and Animals. 2006. Available at: <http://www.cdc.gov/healthypets/diseases/salmonellosis.htm>.
- Health Canada, It's Your Health. *Salmonella* Prevention. 2006. Available at: <http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/food-aliment/salmonella-eng.php>.

