Disclaimer

The following material has been prepared for the information of members of the Ontario Veterinary Medical Association as a guideline only relating to various safety issues encountered at a veterinary practice. In all cases, it is the responsibility of individual veterinarians to ensure that their practices and standards comply with all applicable federal, provincial, and municipal by-laws, regulations, and legislation. Nothing contained in this guide suggests or implies complete or proper training or certification of veterinarians or their staff as might be required by legislation.
Open any veterinary parasitology book and you will find a very long list of zoonoses. When considering the risk of occupational exposure, we can conduct a basic risk assessment by determining both the likelihood that transmission of a parasite will occur, and the magnitude of the result.

For likelihood of transmission, knowledge of local prevalence and distribution of parasites can be applied. That being said, it is still important to have a familiarity with exotic zoonotic parasites given the extensive travel of some companion animals. This is especially true if you see patients from international dog rescues. The Merck Veterinary Manual provides extensive coverage and may be a helpful resource in this context [1]. If likelihood of transmission exists, it can be decreased by employing straight-forward protective measures.

The magnitude of the result of infection varies greatly based on both the parasite and the immune status of the exposed individual. Immunocompetent individuals may be only mildly impacted by some zoonotic parasites. But for immunocompromised individuals, those ‘benign’ infections can be potentially fatal. Immunocompromised individuals include those with HIV/AIDS or other underlying chronic health issues such as cancer, autoimmune diseases, renal, hepatic or splenic disease. Pregnant individuals can also be immunocompromised. For an extensive list of immunocompromised conditions and accompanying resources, please see [2]. In some circumstances, staff may not openly disclose their health status, so a general discussion of the risks and resources available should be undertaken.

Based on this general risk assessment in Ontario, this section will focus on the following (in alphabetical order): Alveolar Echinococcosis, Cryptosporidiosis, Giardiasis, Larva Migrans, Leishmaniosis, Mange and Toxoplasmosis.

Alveolar Echinococcosis

*Echinococcus multilocularis* is an emerging parasite in Ontario [3]. Coyotes and foxes and occasionally dogs and cats are the definitive hosts. Eggs are shed in feces and if ingested by humans or dogs can lead to alveolar echinococcosis – a disease characterized by large tumor-like growths in the liver [4]. Prior to 2012, there were no documented cases of alveolar echinococcosis in Ontario [3,5]. Since that time there have been ten cases in animals, six of which were in dogs. The majority of these cases had no travel history, indicating that local exposure was likely. Major research efforts have been launched in the province and *E. multilocularis* (intestinal infection or alveolar echinococcosis) is now a reportable disease [3,5,6].
Dogs play an interesting role in the transmission cycle of *E. multilocularis*. A dog can be the definitive host (i.e., have an intestinal infection) and shed infective eggs without showing any clinical signs. A dog can also be an accidental host and develop alveolar echinococcosis. A subset of dogs with alveolar echinococcosis will also have an intestinal infection and therefore pose a zoonotic risk. Dogs that eat rodents are at highest risk of infection and therefore pose the highest risk of transmission to humans [5].

Veterinary exposure can occur through fecal contact. The eggs appear identical to other *Taenia*-type eggs and are immediately infective. It is recommended to use gloves when handling any feces and practice thorough hand-washing afterwards. If potential exposure has occurred, it is important to seek medical assistance [4,5].

**Cryptosporidiosis**

Cryptosporidiosis is very common gastrointestinal illness caused by *Cryptosporidium* spp. In humans, it is characterized by profuse watery diarrhea, potentially with fever, vomiting and abdominal discomfort [7].

Most species of *Cryptosporidium* are species-specific and do not pose a zoonotic risk. *Cryptosporidium parvum* genotype II infects both humans and cattle and is believed to pose the highest risk for zoonotic transmission. Other *Cryptosporidium* species common in dogs (*C. canis*) and cats (*C. felis* and *C. muris*) are believed to play a minimal role in human disease [7].

The prevalence of *Cryptosporidium* spp. on Ontario dairy and beef farm has been shown to be very high (approaching 100%) [8,9]. On dairy farms, shedding is generally highest in very young calves and declines with age [8]. Risk may be lower on beef farms, given that the majority of the *Cryptosporidium* genotypes isolated were not zoonotic [9].

*Cryptosporidium* spp. is transmitted via the fecal-oral route. Oocysts are shed in the feces of infected individuals and are immediately infective. The oocysts are highly resistant and can remain in the environment for prolonged duration [7].

To prevent occupational exposure to *Cryptosporidium* spp., it is critical to be vigilant with hand washing. Strong consideration should be given to donning gloves when handling feces. If a fecal sample is collected, oocysts can be inactivated prior to examination by mixing with formalin (1-part 100% formalin, 9-parts liquid feces) [7]. For cleaning, oocysts can be inactivated by application of a concentrated ammonia product (50%) for 30 minutes. Moist heat (steam or pasteurization) and thorough drying can also be used [7].

**Giardiasis**

There are seven assemblages of *Giardia duodenalis*, the causative agent of giardiasis. Dogs are predominately infected with assemblages C and D, while cats are infected with assemblage F.
Assemblages A and B are mostly identified in humans, with Assemblage A-I believed to be associated with zoonotic transmission. It is difficult to estimate the degree to which zoonotic transmission accounts for human giardiasis, although most human infections are believed to originate from other humans [10].

Several domestic species have been surveyed in Ontario. On dairy farms, there was a high prevalence, with chronic shedding evident [8]. Among the two assemblages identified (E and B), one was zoonotic. *Giardia duodenalis* was also detected on beef farms, but only non-zoonotic assemblage E [9]. Fecal samples from dogs and cats have also been assessed. Dogs consistently had low prevalence (<1%) of zoonotic assemblages, while cats may have a higher carriage, although further subtyping is required to understand this risk [11,12].

Strict hand hygiene after handing feces is the best way to prevent inadvertent exposure.

**Larva Migrans**

Visceral larva migrans occurs when the larvae of canine and feline roundworms (*Toxocara canis* and *T. cati*, respectively) migrate through internal organs of humans. Individuals may be asymptomatic or suffer from fever accompanied by persistent eosinophilia and hepatomegaly [13]. Visual symptoms can occur when if the larvae enter the eye, which is referred to specifically as ocular larva migrans. These diseases are also called visceral or ocular toxocariasis [14].

Larvae of raccoon roundworms, *Baylisascaris procyonis*, can also cause visceral or ocular larva migrans, as well as neural larva migrans if they enter the brain [13]. Dogs can occasionally develop intestinal infections and shed eggs, thus increasing potential human exposure. Prevalence in the Ontario raccoon population is believed to be high, estimated at 38% in one study [15].

Exposure to these parasites occurs via fecal-oral route. The importance of hand hygiene can therefore not be understated.

*Ancylostoma caninum* and *uncinaria stenocephala* are the common canine hookworms in Ontario. They may pose a low risk to humans, as hookworm larvae can penetrate and migrate through human skin, causing a condition called cutaneous larva migrans. However, this risk is believed to be predominately from larvae of *A. braziliense*, which is not present in Canada [16]. If risk exists, transmission occurs from contact with contaminated environment where the eggs have hatched into larvae. In this context, routine clinic hygiene is the best preventative measure. Diligent ‘poop and scoop’ in outdoor clinic areas is also recommended, along with the use of proper full footwear when outside in animal areas [17].

**Leishmaniosis**

Infection with *Leishmania* spp. is common in dogs that have lived in or traveled to areas of Europe and South America where the parasite is endemic. Dogs are the primary reservoir for *L. infantum*
as well as other *Leishmania* spp. Dogs can remain subclinically infected for an extended period of time, even with treatment. Transmission can occur to humans from dogs via the bite of infected phlebotomine sandfly. *Leishmania infantum* poses the greatest risk to humans as it can cause visceral leishmaniosis, a serious and potentially fatal disease [18].

In the clinical context, risk also exists from transmission via dog blood to human blood contact (e.g., needle stick injury, contact with open wounds). Although this route has not been well-documented, it cannot be excluded. A thorough travel history should be conducted on all canine patients and extreme care taken with blood and tissue contact [18].

**Mange (Scabies)**

Humans can develop skin irritation and itchiness from close contact with an animal that has sarcoptic mange (*Sarcoptes scabiei*). If sarcoptic mange is a potential differential diagnosis, covering up exposed skin during examination and thoroughly washing hands and any skin in contact with the animal is recommended. If exposure does occur, it is rare for the mite to complete its lifecycle on human skin, so symptoms are typically temporary. Most cases of scabies in humans are from human to human contact [19].

**Toxoplasmosis**

Toxoplasmosis, caused by exposure to sporulated oocysts of *Toxoplasma gondii*, can affect all warm-blooded animals, including humans. Domestic cats and other felidae are the definitive hosts that excrete oocysts. Infection is highest in cats that frequent outdoors and/or are fed raw food diets. If another animal ingests sporulated oocysts, they can develop tissue cysts. In humans, infection during pregnancy is the largest concern given the risk of severe birth defects such as retinochoroiditis. *Toxoplasma* encephalitis can also occur in severely immunocompromised individuals, such as those with HIV/AIDS [20].

Seroprevalence in human varies geographically, ranging from 25-50% in the United States. The most common route of transmission is through the consumption of raw or undercooked meat or shellfish. Exposure can also occur through contact with feline feces, although this route does not appear to account for a large proportion of cases [20].

In 2002, Shubaiber and team conducted a serosurvey of veterinarians and support staff at the Ontario Veterinary Medical Association conference. Seroprevalence was 14.1%, which was lower than the general population [21]. This is reassuring and may indicate that occupational exposure is not a high risk. That being said, wearing gloves when cleaning litter boxes and thoroughly washing hands afterwards is strongly recommended. Risk can further be reduced by cleaning litter boxes every day, since oocysts take 24 hours to sporulate and become infective. Cleaning
with a product containing 10% ammonia for at least 10 minutes or steam cleaning are effective at destroying sporulated oocysts [20].

**Take Home Messages**

- Risk of zoonotic parasitic disease is based on the likelihood of exposure to the parasite and the magnitude of the result.
  - Knowledge of current distribution and prevalence of parasites can help assess likelihood of exposure.
  - Magnitude of result varies by parasite. Extreme caution needs to be used if an individual is immunocompromised.
- Likelihood of exposure can be significantly decreased by employing some simple preventive practices:
  - Consider wearing gloves when handling feces.
  - Practice good needlestick safety.
  - Wash hands and any exposed skin thoroughly with soap and water after contact with potential infectious patients and their feces.
  - Follow good cleaning practices, which include using the appropriate cleaning product for the required contact time.
  - Never eat or drink in areas where there have been feces.
  - Wash your hands before eating or drinking.

**References**


