

## Wolves and Disease

Information Sheet 8.006

People and Predator Series | Colorado Wolves

By the *Center for Human-Carnivore Coexistence* (5/20)

### How might wolves affect chronic wasting disease in elk and deer in Colorado?

Chronic wasting disease (CWD) is a contagious and fatal neurological disease found in deer, elk, and moose. It is caused by the transmission of an abnormal protein called a prion. CWD is relatively widespread in Colorado.



Mule deer herd

Wolves are predators that chase prey. Wolves tend to target slower, more vulnerable individuals, including sick and diseased animals.<sup>1,2</sup> One study developed a mathematical model predicting that selective predation by wolves would result in a more rapid decline in CWD in deer compared to hunting by humans.<sup>3</sup> The model suggested that wolf predation may help limit CWD. There has been no field study to test this prediction. However, wolf predation has been shown to help control disease (tuberculosis) in wild boar in Spain.<sup>2</sup>

Insight can be gained from other predators. Studies in the Front Range of Colorado showed mule deer killed

by mountain lions were more likely to be infected with CWD than mule deer killed by hunters.<sup>4</sup> This suggests that mountain lions select infected animals when targeting adult deer. Such selective predation by mountain lions, however, did not limit CWD transmission in deer populations with high infection rates.<sup>5</sup> Unlike wolves who run when hunting, mountain lions are considered “ambush” predators that sit and wait for prey to pass. Such predatory behavior might make them less likely to detect sick animals compared to wolves.<sup>5</sup>

When carnivores eat infected prey, CWD prions can remain infectious in carnivore feces.<sup>6</sup> But, canines appear to be naturally resistant to prions.<sup>7</sup> We therefore would not expect the number of prions to increase in their digestive tracts. In fact, CWD prions may be degraded as they pass through the digestive system.<sup>6</sup> While predation may not eliminate CWD from deer or elk populations, predators that selectively prey on infected animals would be expected to reduce the number of infections. This would be more likely in areas where wolves are well-established.

### What is hydatid disease and can wolves spread it to humans?

Hydatid disease is caused by tapeworms in the *Echinococcus* genus.<sup>8-12</sup> *Echinococcus* tapeworms require two hosts to complete their lifecycle.



### Key Points

- Chronic wasting disease (CWD) is a contagious and fatal neurological disease found in deer, elk, and moose in Colorado. Selective predation by wolves on sick and diseased animals may help limit CWD in big game, but no field study has tested this prediction.
- Hydatid disease is caused by the *Echinococcus* tapeworm. Canines such as wolves, coyotes, foxes, and domestic dogs are the definitive host, and ungulates such as deer, elk, moose, and domestic livestock are intermediate hosts. In rare circumstances humans may be infected by accidentally ingesting eggs, but direct human infection from wolves is extremely unlikely.
- Dogs and wolves are closely related and also can share many of the same parasites and diseases. Dogs are much more likely to infect wolves than vice versa.

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Definitive hosts support adult tapeworms. Domestic dogs and wild canines (e.g., coyotes, foxes, and wolves) are definitive hosts. Intermediate hosts support the immature (cyst) form of the tapeworm. Several species can be intermediate hosts, including small mammals (e.g., rodents) and ungulates (hoofed animals), including both wild ungulates (e.g., deer, elk, moose) and domestic livestock (e.g., sheep, pigs etc.).<sup>8,9</sup>



Tapeworm cysts in moose lung. Photo by Alaska Department of Fish and Game

Tapeworms need both the definitive and intermediate hosts to complete their life cycle (Figure 1). The adult tapeworm lives within the intestines of the canine and releases eggs into the environment via canine feces. The intermediate host then ingests the eggs by eating contaminated vegetation. The cycle is completed when a canine eats the infected organs of an intermediate host.

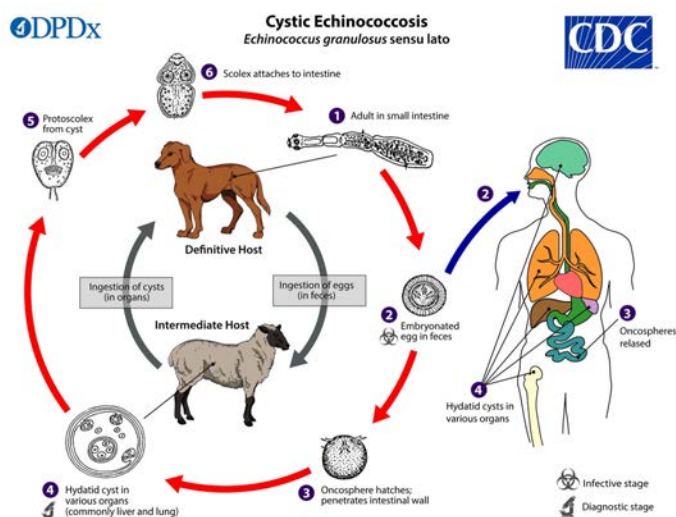


Figure 1. *Echinococcus* life cycle for domestic cycle of tapeworm infection, including domestic dogs and domestic livestock. Reprinted from Center for Disease Control.<sup>12</sup>

North America has multiple wild and domestic cycles of tapeworm infection. The wolf/ungulate wild cycle has been documented since the early 1900s.<sup>8-10</sup> The species of tapeworm most commonly found in wolves is *Echinococcus canadensis*. Recently, *E. canadensis* was confirmed as regularly cycling in wolves and wild ungulates in western North America, with infections present in 30-60% of wolves tested.<sup>9,10</sup> *E. canadensis* has been documented in Colorado.<sup>11</sup> In 2017, a hydatid cyst was identified in a Colorado moose. This case occurred in the apparent absence of resident wolves, suggesting other canids may have been involved. In 2020, *E. canadensis* eggs were identified in feces from gray wolves that migrated into northwestern Colorado.<sup>11</sup>

Humans may be infected from accidentally ingesting tapeworm eggs. Infections are typically from the species of tapeworm (*E. granulosus*) in the domestic cycle between dogs and livestock (often sheep or pigs; Figure 1).<sup>8,10,12</sup> People are infected from interaction with working or companion dogs with eggs in their feces or on their paws or fur. However, human infection is rare in North America. There have been no documented human cases of hydatid disease originating from within the United States for several years, although some people have acquired infection traveling abroad.<sup>8</sup>

Direct human infection from wolves is therefore extremely unlikely. Also, the hydatid disease caused by *E. canadensis* is considered relatively benign in comparison to those infections arising from the domestic cycle between dogs and livestock.<sup>8,10</sup>

There are several basic precautions that can minimize the risk of human infection. Avoid touching or handling feces of wild canines. Hunters should wear gloves when field dressing carcasses and wash hands thoroughly. Contact with or consumption of the hydatid cysts in the organs of ungulates can be a source of infection to domestic dogs. To minimize risk of infection, dog owners should prevent their dogs from consuming ungulate carcasses and should regularly deworm their dogs.

## Can wolves and domestic dogs transmit diseases to one another?

Dogs and wolves are closely related and can share many of the same parasites and diseases.<sup>13</sup> Dogs are much more likely to infect wolves than vice versa. Dogs are the world's most common carnivore<sup>14</sup> and typically greatly outnumber wolves.<sup>15, 16</sup> Thus, diseases can be maintained in dog populations and can then spill over to wolves.<sup>13</sup> Also, diseases in wolves and dogs can occur in other wildlife, which often outnumber wolves too. So, the risk of dogs being infected by wolves is low.

Wolves that are deliberately released during restoration programs are typically vaccinated against common canid diseases and treated with antiparasitic drugs. Such was the case for wolves restored to Yellowstone National Park.<sup>17</sup> Upon release, wolves therefore should be healthy, but can subsequently contract diseases and parasites when exposed in their new environment.



Rabies, parvovirus, and distemper can be particularly impactful to wolves. Rabies is a fatal viral disease that infects the central nervous system.<sup>18</sup> Rabies has occurred sporadically in wild wolves globally.<sup>13</sup> It is rare in North American wolves, with only infrequent accounts in Alaska and Canada.<sup>19,20</sup> When rabies outbreaks do occur, it can result in local declines in wolf numbers.<sup>13, 19-21</sup> However, wolves are unlikely to be a long-term reservoir host for rabies.<sup>13</sup> Most incidents of rabies occur in other wildlife such as raccoons, skunks, foxes, and bats.<sup>13,18</sup> Wolves can contract rabies from other species, including dogs. For example, dogs appear responsible for transmitting rabies to endangered Ethiopian wolves.<sup>14, 22, 23</sup> This caused massive outbreaks in the wolf population.

Distemper and parvovirus (“parvo”) are contagious viral diseases that can infect both wolves and dogs.<sup>24,25</sup> Parvovirus is primarily spread from direct contact and contaminated feces. Distemper is typically spread through airborne exposure from sneezing or coughing. Dogs can transmit these diseases to wolves.<sup>13,26</sup> For example, an outbreak of parvovirus in wolves in Isle Royale National Park likely came from dogs.<sup>27,28</sup> Distemper outbreaks in Ethiopian wolves also likely originated with dogs.<sup>22, 23</sup> Distemper and parvovirus also have been detected in wolves in Yellowstone, Banff, and Jasper National Parks.<sup>29-31</sup> However, dogs are likely not playing an important role in these areas. Rather, the diseases are likely circulating in other wild carnivores (e.g., raccoons, skunks, coyotes, and foxes) in and around the Parks.

External parasites can also infect both wolves and dogs.<sup>13</sup> For example, wolves in Alaska have been infected by lice introduced by dogs.<sup>32</sup> Dog lice can impact the health of individual wolves but is not considered a threat to wolf populations. Sarcoptic mange – a skin disease caused by parasitic mites – can also infect both wolves and dogs. However, there is no indication of transmission of mange between dogs and wolves.<sup>13</sup> Rather, wolves are more likely to be infected from wild canids, such as foxes, coyotes, and other wolves.<sup>17, 33, 34</sup> Mange outbreaks can cause local declines in wolf populations.

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