

## Echinococcus granulosus in wolves

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Background:

*E. granulosus* is a common cestode parasite in wolves. Wolves and other canids can serve as definitive host (with adult stages in the intestine) for this tapeworm, and ungulates serve as a common intermediate host with larval stages. The discovery of *E. granulosus* in wolf carcasses in Idaho and Montana (Foreyt et al. 2009) is not surprising. A literature review by Brand et al. (1992) reported a variety of parasites in wolf populations, including *E. granulosus*, in northern (Alaska, Yukon, and Northwest Territories) and southern (Minnesota, Manitoba, and Alberta) regions. The USGS-National Wildlife Health Center has documented *E. granulosus* in wolf carcasses from Wisconsin as well. These parasites have limited pathogenicity and are likely to be relatively benign to wolf populations (Brand et al. 1992).

Predator-prey population dynamics may affect the prevalence of hydatid cysts in cervids, such as moose. A regulatory mechanism, proposed by Messier et al. (1989) for moose in southwestern Quebec where *Echinococcus* spp. are enzootic, was that increasing density of wolves would lead to concentrated sites of parasite egg deposition that could enhance moose exposure to the parasite. Larval stages primarily develop in the liver and lungs of intermediate hosts, but can occur in several tissues including skeletal muscle (Jones and Pybus 2001). Cysts found in moose are often benign without evidence of significant reduction in lung capacity (Jones and Pybus 2001). The potential exists that infected moose would have reduced stamina and thus, are more susceptible to predation by wolves (Messier et al. 1989). Whether the recent reports of larval stages *E. granulosus* in cervids in Idaho and Montana indicate the parasite is enzootic remains to be determined. Hydatid cysts occur in cervids in areas where wolves are not present and other canids, such as coyotes or dogs, act as the definitive host (Jones and Pybus 2001).

Infections with *Echinococcus* spp. are found worldwide. Wild animals are involved in cycles in different parts of the world; although the human health significance of such cycles is minimal compared to domestic animal cycles (Eckert 2001). Epidemiological evidence suggests that the sylvatic strain of *E. granulosus* in northern North America is infective to humans (called hydatid disease or echinococcosis), causing a benign infection of low pathogenicity, with predominant localization of cysts in the lungs (Thompson 2001). There also is epidemiological evidence that certain strains of *E. granulosus* may be of no or low infectivity to humans, such as

the form adapted to horses (Thompson 1995). Developmental differences between species and strains of *Echinococcus* spp, and variation in the onset of egg production, is likely to be a limiting factor in control programs for breaking the cycle of transmission that employ regular, adult parasite drug-control treatment of canid definitive hosts. This difficulty has been demonstrated in several strains of *E. granulosus* (Eckert 2001). Eggs of *E. granulosus* are susceptible to desiccation and can die if exposed to dry ground and direct sunlight for 2 hours (Jones and Pybus 2001). Wet conditions increase survival of the eggs.

We know of no known transmission of *E. granulosus* from a wolf to a human. However, hydatid disease has been reported in shearherders and native people that have close associations with their domestic dogs (Schantz 1977). A survey of a related species, *E. multilocularis*, in Montana found the disease in coyotes (Seese et al. 1983) and foxes. A concurrent survey examined blood samples from trappers for anti- *Echinococcus* spp. antibodies to measure the trappers' infection over a period of 7 years. No trappers were found to have titers to *Echinococcus* spp. (M. Sterner, personal communication). To prevent diseases in all persons handling wildlife, we recommend proper hygiene, including wearing disposable gloves followed by handwashing. Hunters are likely to discard the majority of the cysts that form in the liver, lung, mesenteric tissue, and other viscera. Care can be taken to avoid breaking the cysts, which will minimize exposure to tapeworms. Freezing also kills tapeworms within cysts. Thoroughly cooking meat is advised for all wild game. These precautions are appropriate for any potential zoonotic disease, including other parasitic diseases caused by *E. multilocularis*, *Trichinella* spp., and *Baylisascaris* spp. that are known to infect humans.

Information on understanding *Echinococcus granulosus* and infection in wolves:

Questions posed by USFWS:

1. Mortality and health risks to humans, ungulates, and wolves?
  - Our opinion is that mortality and health risks are low for all groups based on available literature. For human health issues, the CDC is the most appropriate source of information.
2. How does the risk of infection by humans compare with other wildlife-related parasites?
  - Handling wolf feces is the most likely route of infection and can easily be prevented with proper hygiene, similar to other zoonotic parasites.
3. Is there evidence that this parasite has the potential to cause fluctuations in wolf and ungulate populations?
  - It is unlikely this parasite has a substantial impact on wildlife populations.

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