

To: Montana Legislature's Environmental Quality Council

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From: Valerius Geist, Profesor Emeritus of Environmental Science, The University of Calgary, Calgary, Alberta, Canada

April 27<sup>th</sup> 2010

Re: **Hydatid disease**

There is a fair amount of technical literature available on hydatid disease. However, this knowledge is useful only if interpreted professionally, rather than taken at face value. The latter can be misleading. Moreover, such interpretation does require some additional knowledge not covered by the technical literature.

Hydatid disease is most dangerous when it is spread by the family dog in the house, kennel and yard, in such a fashion, that infections of family members is ongoing, thereby leading to multiple infections. The danger arises from the family dog spreading with its feces the eggs of dog tape worms (*Echinococcus granulosus*) or Fox tape worm (*E. multilocularis*). The danger is heightened by moist lawns and yard conditions and lessened, but not eliminated, when the yard is dry and dusty. Moist conditions favor the survival of tape worm eggs, and dry sunny conditions reduce such. Since the dog cleans its anus and fur with its tongue, the tape worm eggs are also transferred to its fur, from which they are shed in the house, or when the dog is handled by the family. The continuous presence of infective eggs on the floor and furniture favors the infection of children who play on the floor and which may then transfer hydatid eggs from their dirty hands to their mouths.

The manner in which we handle our family dogs is based on a long standing tradition, one that does not include precautions pertaining to hydatid disease. This is in historical contrast to countries where hydatid disease is a serious concern, where dogs are kept out of homes, especially where dogs are considered unclean and thus rarely handled. In Russian Karelia not only were dogs kept out of homes, and warnings issued against petting or playing with dogs, but guests were also expected to wash their hands at the door.

Also, in northern Canada, where hydatid disease is prevalent, dogs are not usually kept as house pets, but as working sled dogs. The dogs are tied up away from houses, where there is limited interaction between the dogs or their owners. Secondly, they shed infected feces into wet herbaceous vegetation where tape worm eggs are less likely to be spread than on a ranch, rural or urban yard. A likely source of infection are fecal soiled sled harnesses.

Please note, that the manner in which we treat dogs as pets is highly conducive to passing on hydatid

disease to family members.

How can family dogs become infected with dog or fox tape worm? In order for the dog to become infected it needs to ingest the hydatid cysts found primarily in lungs and livers of big game such as deer, elk and moose. Or, in the case of the pastoral form of the dog tape worm, in the lungs and liver of domestic sheep.

In order that rural farm and ranch dogs or urban hunting become infected with dog tape worm, the dogs must have access to piles of infected big game offal, or to winter killed big game. Consequently, the crucial contributing factors are infected big game herds close to family dogs, a condition that is prevalent where, primarily, deer and elk stay close to ranches and farms or in rural hamlets and recreation communities. This is a condition found not infrequently in winter, especially if such big game animals crowd in close to humans in order to escape wolf predation. Under such conditions deer and elk, the intermediate host, harboring hydatid cysts come in close proximity of dogs, the definitive host of the dog tape worm.

Dogs guarding homes and buildings, but free to roam are likely candidates to roam far at night and come across infected gut piles left by hunters, or come across the carcass of elk and deer that died of natural causes. Moreover, hunting dogs are at risk if roaming ahead of their owners they come across infected big game gut piles.

Deer and elk become infected by hydatid eggs shed in the feces of coyotes and wolves. Such eggs find their way onto vegetation where they are ingested by feeding deer or elk. Wolves and coyotes are thus the reservoirs of hydatid disease. The more infected wolves and coyotes, the more infective eggs are passed on big game ranges, and the higher the incident of infected deer and elk. If these infected deer or elk move to lower elevations onto ranches, they carry hydatid cysts close to rural dogs for months on end.

While hydatid disease is not serious if one or two cysts form in liver or lungs, where they are encapsulated by the host tissue and where such cysts may calcify. The exception here is a cyst in the brain, as such is lethal. Cysts may appear in atypical locations such as the heart, lungs or long bones where they are medically problematic.

Hydatid disease becomes very dangerous where the individual human ingests hydatid eggs again and again. This leads to multiple cyst formation, and such can be lethal. Multiple cysts are much more likely than single infections to interfere with organ functions, overcome the immune system of the host, and grow to large size. This may take a decade or more. Large cysts may burst in the infected person during exercise such as football or hockey games. In a small percentage of cases this will lead to quick death through a severe allergic reaction. It will lead to hospitalization and extended attempts to clean the patient's peritoneal cavity as fragments of the interior lining of the cyst will grow new cysts full of tape worm heads. Extended medical care is then inevitable. A person's prognosis depends on whether rural doctors know and recognize symptoms of the disease.

While the most dangerous situation arises with infected family dogs, persons may also catch the disease handling the carcasses of infected wolves, coyotes and foxes, or ingesting contaminated berries and

mushrooms (if such are eaten raw). The tiny tape worm eggs can be liberated as the feces dries, and is disturbed by a curious onlooker poking into the fecal matter to discover what the wolf or coyote ate. Infection rates from such causes are low and multiple infections even rarer. Sensible precautions and hygiene can greatly reduce infections from such sources.

Family dogs living for many months on end close to sizable infected deer and elk populations are most at risk catching and passing on hydatid disease repeatedly to their owners. There are claims that hydatid eggs ingested by humans rarely lead to infections as conditions inside humans do not match such of deer or elk. I have seen no data supporting or contradicting this claim. Whatever the potential rate of infection, with multiple or continual exposure to abundant dog tape worm eggs, multiple infections, especially in children are likely.

You are probably aware that claims are made that based on the technical literature, hydatid disease is rare. This assessment in technical reports emanating largely from hospitals is based on the gross rate of that disease compared to other ailments the regional hospitals are dealing with. No report has isolated the the population at risk, namely the number of people who come in regular contact with infected wolves, as well as the number of people that feed infected offal from caribou and moose to their dogs. Not at risk are hunters and trappers that handle uninfected wolves or that feed uninfected offal to their dogs, because the disease is not found everywhere. Nor are the urban populations serviced by said hospitals at risk as their dogs are not fed infected offal, while those that hunt do not bring into cities infected offal. In short, the population at risk for hydatid disease is tiny compared to the population at large serviced by regional hospitals. This implies that the risk of becoming infected where the circumstances favor such is actually fairly high. I am not aware that a refined analysis trying to capture the population at risk has ever been done.

Not everything relevant is covered by the technical literature, as indicated by my experiences during my research work and retirement as recorded below.

Another reason for the low incident of hydatid disease historically is that wolves have been rare historically and have only in recent times increased sharply in number. For instance, I became aware in 1961 while on my study area for Stone's sheep that, years earlier, in northern British Columbia there had been extensive wolf control via aerial broadcast of poison bait onto frozen lakes in winter. I was informed of such by native trappers and guides who told me that the reason for said aerial poisoning was to control diseases. This happened to a wolf population which had apparently expanded after World War II. Hydatid disease was fairly widespread throughout British Columbia before the 1950's. Furthermore, trapping was common then and trappers widely used dog teams. However, one cannot travel extensively with dog teams where wolves are common. This has been formally reported by the Danish Greenland explorer Peter Freuchen. He was stranded in a meteorological station as supplies failed to get through to him as wolf packs attacked the sled dogs of the supply trains. In Greenland then there were regions with people (and dogs) and regions with wolves but without people (and dogs). During my studies, when native trappers were my neighbors a days trip away by dog sled, there were few wolves, but a great abundance of caribou. After the native trappers left, resettling to a native community, wolf numbers increased till super packs were recorded by my students. Caribou became very scarce. Furthermore, besides aerial control of wolves, British Columbia had a corps of predator control officers who were efficient as I can vouch form my personal experiences on Vancouver Island.

Where wolves became troublesome by preying on livestock they went into action, as they did on our neighbors farms, eliminating problem wolves. In earlier decades, conservation officers also went out after hunting season and trapped wolves. Moreover, wolves may be taken by hunters in season, and farmers with depredation problems can get permission to shoot or trap wolves and may not only call on provincial predator control officers for help, but also on professional trappers. All this happened in my neighborhood and two misbehaving packs of wolves were removed. In the Russian literature there are hints that hydatid disease is depended on densities of predators. Where such are low, the infection rate in wild ungulates is also low, and vice versa. Wolves built up since the 1980's in British Columbia. However, with its policies of wolf control in settled areas, wolf densities, and thus hydatid disease, and the availability of infected deer, elk and moose to rural dogs is likely to be low.

There are also claims that *Echinococcus granulosus* has a low infectivity in humans, implying that one need not worry too much about it. First of, if this claim is based on the low prevalence rate as reported in the literature, than it ignores the lack of a detailed analysis of the population at risk. As I indicated above, the apparent low rate of prevalence is due to the inclusion of populations not at risk. Secondly, this is in flat contradiction to the historical perception of this parasite. In Finland, the state sent helicopter crews equipped with submachine guns to eliminate wolves, in order to control this disease. In Russian Karelia rural people reduced contact with dogs, would not allow dogs in dwellings, and made even visitors wash hands at the door before entry. I was subject as a child to some of these teachings initiated by my maternal grandfather as a member of our family had died of hydatid disease. Thirdly, the claim of a benign parasite is flatly contradicted by Delane C. Kritsky; Professor Emeritus, Idaho State University, who was Associate Dean and Professor (35 years) within Department of Health and Nutrition. I am sure his statement has been circulated to you. It happens to coincide with what I was taught in parasitology classes at the University of British Columbia nearly fifty years ago by Professor Adams who had studied the disease hands on! We were instructed to be very cautious as an *Echinococcus* infection can be lethal, or lead to complicated surgery and extended recovery. We were then also shown colored slides of what such surgery taken in Vancouver hospitals looked like. It is not a disease I can take lightly.

The most serious concern is thus the transmission of *Echinococcus granulosus* eggs from wolves (coyotes) to deer/elk, followed by a transmission to family dogs in rural settings where deer/elk crowded in about ranches, farms and settlements, followed by repeat transmissions of hydatid eggs from infected yards, lawns and homes to their inhabitants, especially children. Multiple infections are almost certainly assured. The disease may take a decade or more to develop, and is not readily diagnosed, though some individuals with a cyst in the brain or heart etc may die earlier. If the transmission chain above is broken, you need not worry about hydatid disease in above context. Direct transmission from the feces or fur of infected wolves, coyotes and foxes is a lesser danger which can be countered by appropriate avoidance and hygienic practices.

Sincerely,

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