

Medical Ecologist Investigates Risk of Waterborne Pathogens from Livestock

Environmental animal health specialist and medical ecologist Rob Atwill is responding to a need for unbiased, scientific information about waterborne pathogens.

Using quantitative epidemiology, Dr. Atwill and several colleagues are investigating the source, transmission and prevalence of *Cryptosporidium parvum*, *Giardia duodenalis* and other microbes that could potentially contaminate lakes, rivers and streams, affecting human health. They are working to

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provide scientific information to California ranchers, agricultural leaders, water district officials, public and animal health officials and federal land managers such as Forest Service and Park Service personnel.

Outbreaks of gastrointestinal illness attributed to infection by the single-celled parasite *Cryptosporidium parvum*, such as the 1993 contamination of Milwaukee drinking water that led to illness in 400,000 people, have put considerable pressure on state public health agencies and regional water districts to develop watershed management plans that will reduce the risk of human illness. The source of waterborne pathogens typically remains unknown due to lack of sophisticated techniques for differentiating pathogens from wildlife and livestock.

Illness occurs when an infected individual sheds parasite oocysts (eggs) in feces, and a susceptible individual ingests the oocysts directly or through contaminated food or water. In humans *C. parvum* can cause severe stomach cramps, diarrhea and fever. Once ingested, there are no highly effective antibiotics for eliminating the parasite from the gastrointestinal tract. The infection is self-limiting for those with competent immune systems—clinical cryptosporidiosis lasts a few days to several weeks.

But the severity of illness from *C. parvum*, particularly for anyone with a weakened immune system—AIDS or chemotherapy

patients for instance—has prompted the U.S. Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention, state and local public health agencies, and regional water districts to seek ways of reducing contamination of surface water by this parasite.

Cattle are often perceived to be a leading environmental source of waterborne *C. parvum*, and the EPA has warned that new restrictions will likely be placed on the location and management of livestock operations situated within watershed regions. Dr. Atwill says, “At stake is not only water quality and human health, but also the economic viability of those citizens who depend on California rangeland for grazing.” Such restrictions will also affect the consumer who relies on ample and affordable meat.

Scientific evidence to support the claim that cattle are a significant source of *C. parvum* in surface water is incomplete. Better information is needed on the distribution of *C. parvum* shedding in beef cattle herds located on open range with access to important watersheds.

Dr. Atwill says “It is premature at this time to claim that cattle production is a leading environmental source of infective *C. parvum* for our western watersheds.” *Cryptosporidium* is found in 60–90 percent of all surface waters of the United States.

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Oocysts from the organism have also been found in pristine surface waters, indicating that *Cryptosporidium* occurs naturally in watersheds. Little is known about oocyst shedding from wildlife species with access to surface waters or what contribution humans themselves make to surface water contamination.

There are various *Cryptosporidium* species, some of which are noninfectious to humans. But with current laboratory assays to detect

Cryptosporidium, it is often difficult to determine which species is present. Dr. Atwill and his colleagues are working to develop DNA fingerprinting techniques to accurately define which *C. parvum* species is detected from a particular livestock or wildlife host. They also aim to define a scientifically valid threshold for laboratory tests, in order to eliminate false positives or negatives when testing samples for *C. parvum*.

“If we as a profession are willing to reach out and extend scientific information to where it is needed,” says Dr. Atwill, “we can help insure that public policy is based on good data and not on assumptions.”

Some California Water districts have excluded recreational use of horses within watersheds contributing to their reservoirs out of fear that equine manure could contaminate water supplies and lead to human disease, despite a near absence of scientific data to support such a policy.

In order to determine if horses used for recreational riding on public lands in California backcountry are a significant source of *Cryptosporidium parvum* or *Giardia duodenalis*, Rob Atwill and colleagues conducted a pilot study of 91 horses. None of the animals were shedding parasite eggs after having been ridden in the backcountry, which led to the conclusion that recreational riding does not appear to pose a significant risk for contamination of regional surface water supplies by these microbes.

The investigation has been expanded by funding from the Center for Equine Health to study the occurrence and distribution of these microbes in all types of California horses. The American Water Works Association, Centers for Disease Control and Prevention, U.S. EPA and other groups have expressed interest in the results of current research, which includes development of a DNA fingerprinting technique to distinguish between strains of *C. parvum* shed by horses, humans, wildlife or other livestock, as the strain found in horses may not be the same strain that infects humans.