These zoonotic diseases will be discussed in order of prevalence and severity especially considering the risky behavior being practiced by many clients.

**LISTERIOSIS**

The causative agent is *Listeria monocytogenes*. Listeria in animals is spread from soil, contaminated feed or feces and discharges from infected animals. Most infections are caused by ingestion but inhalation and direct contact are also possible.

Listeria in humans occurs primarily after consumption of raw meat, raw milk and raw vegetables. Secondarily, humans can be infected by contact with aborted fetuses and birth fluids or during necropsies. Susceptible people may be infected with as few as 1000 organisms.

Listeria is resistant to freezing, drying, heat and grows at temperatures from 33\(^\circ\) F to 113\(^\circ\) F. It will grow at a pH range of 3.6 to 9.5 but favors a pH of greater than 5. Pasteurization effectively kills listeria.

In healthy humans, clinical signs are rare but in pregnant women, infants and elderly septicemia is more common, resulting in abortion and/or meningitis. Prevention relies on food safety and protection during contact with infected animals. Annually, there are 2,500 cases reported in the U.S. with 500 fatalities.

In animals, clinical disease is seen most often in ruminants, sheep, goats and cattle causing encephalitis, abortions or septicemia. Encephalitis is usually expressed as “circling disease” and abortions are later in gestation. Septicemia is expressed by fever, depression and death. Listeria is excreted in both feces and milk of both clinical and sub clinically infected animals. In aborted fetuses and septic animals, Listeria can be cultured from all organs or the pons and medulla from encephalitic animals. PCR tests are effective. There is no effective vaccine for Listeria.

**Q FEVER**

What is Q Fever?

Query fever is named for the disease of Abattoir workers in Australia caused by the bacteria Coxiella brunetii. Q Fever is endemic in cattle, sheep and goats which are reservoirs for the disease and rarely show symptoms other than abortions. Canids are multipliers of the organism. If they ingest hundreds – they shed trillions. Felines also transmit high levels. Coxiella brunetii bacteria is resistant to heat, drying and many disinfectants and survives for a long time in soil, especially dust.
How is Q Fever Spread?
Birth fluids, placenta and fecal material all are ways Q fever is spread.

How Are People Infected?
Human infection is mostly inhaled in dust, assisting in births, drinking unpasteurized milk and tick bites. Human to human transmission is rare. Symptoms begin 2 – 3 weeks after exposure. Most recover uneventfully and will probably possess lifelong immunity.

Acute symptoms: 60% show no symptoms at all, flu-like illness, hepatitis, pneumonia, meningitis, purpuric rash, photophobia (eye sensitivity to light), miscarriage, stillbirth, premature birth, low birth weight, intrauterine and growth retardation. There can also be chronic symptoms: arthritis, infections of the bone, liver or reproductive organs, such as testes in males, aortic aneurysms and endocarditis which is 100% fatal if untreated.

Testing in Goats
Placentas, serum, culture and ELISA/PCR all can be used to test for Q fever.

Testing in Humans
Physician diagnosis requires complete patient history.
Has the patient:
~ traveled to rural communities
~ been around infected livestock
~ had occupational exposure
~ lived a high-risk lifestyle, such as consuming raw milk.

Laboratory confirmation can be obtained by a blood test – polymerase chain reaction (PCR).

Treatment
Doxycycline is recommended as a first line treatment for all adults and children with severe illness. Those with life threatening allergies and pregnant patients should consider alternative antibiotics. Chronic Q fever endocarditis is very difficult to treat and typically requires multiple medications over a period of years.

Prevention & Control
Prevention and control requires education of breeders so they understand the infection, prevention, & symptomatology. Breeders should dispose of birthing membranes, fluids & placenta, as well as aborted fetuses with great care.
~ Access to infected housing should be restricted.
~ Humans should use only pasteurized milk & milk products.
~ Research workers should be vaccinated.
~ Imported animals need to be quarantined.

If selling or drinking raw milk, animals should be routinely tested for antibodies to C. burnetii.
Disinfecting
Coxiella burnetii bacteria is resistant to heat, drying and many common disinfectants. Breeders should not become complacent. They must be diligent and careful in the disposal of all aborted fetuses, placentas, birth fluids and fecal material.

**TOXOPLASMOSIS**
This zoonotic disease is caused by Toxoplasma gondii, an obligate intracellular protozoan parasite.

Felidae are the definitive hosts while most all mammals and birds can serve as immediate hosts. Among domesticated animals, small ruminants and pigs are most affected. Humans are also susceptible to T. gondii. There are 4 major forms of T. gondii shed in feline feces: sporozoites, tachyzoites, bradyzoites and tissue cysts.

Toxoplasma undergoes an asexual reproductive cycle in all species when eaten. Infection occurs in the small intestine releasing tachyzoites which infect other intestinal cells and enter the lymphatic circulation and the blood stream. As host resistance develops: the tachyzoites disappear and form bradyzoites within tissue cysts which persist for many years.

In Felidae, the parasites simultaneously undergo several replication cycles resulting in many oocysts being shed in the feces. The oocysts sporulate resulting in multiple sporozoites, the infectious form of T. gondii. Carnivores and humans are infected by consuming undercooked meat or sporozoites from the environment. Milk borne infections are possible as are venereal transmissions in sheep, goats and dogs. T. gondii readily crosses the placenta in most mammals including humans. T. gondii is resistant to most disinfectants but is readily destroyed by temperatures above 151°F.

Clinical Signs
Toxoplasma is a significant cause of reproductive losses in sheep and goats. Infections in cats are asymptomatic in all but young kittens who may exhibit diarrhea. Sheep and goats infected during pregnancy will abort, have stillbirths, mummification and weak newborns. Swine show similar reproductive failure. Toxoplasmosis can be difficult to diagnose. Mineralization of cotyledons in the placenta occurs in sheep and goats. PCR is probably the most reliable.

Toxoplasmosis in humans is expressed most commonly as gastroenteritis that is usually self-limiting. Ocular toxo can be quite serious and is seen most commonly in adolescents and young adults. Toxoplasmosis in pregnant humans causes fetal abnormalities in the eyes, brain and abortion if infected during the first trimester.

Prevention in humans involves cooking meat uniformly above 151°F and pasteurizing milk. Care should also be taken when being exposed to environmental sources such as litter boxes or birth fluids.
CAMPYLOBACTERIOSIS

C. jejuni and C. coli are major causes of enteritis in humans. Campylobacter species are ubiquitous; they are found in humans and many animal species. The major human pathogens are C. jejuni and C. fetus which can also infect cattle, sheep and goats. Animals often become chronic carriers of the disease.

Humans are infected from contact with infected animals, especially feces, undercooked meat (especially poultry) and unpasteurized milk.

Campylobacter in cattle, sheep and goats is transmitted by ingestion. Campylobacter is susceptible to drying but survives a long time in a moist environment. It will survive for weeks in 39°F water but only a few days in water at 59°F. It is viable for 9 days in feces and 3 days in milk. Campylobacter is susceptible to most disinfectants and also NaCL and pH extremes. Incubation is short ± 3 days.

C. jejuni in animals
Cattle are most commonly affected with enteritis, especially calves. The abortion forms are the predominant type seen in sheep in the U.S. Goats are also affected. Lesions in aborted fetuses include bronchopneumonia, fibrinous, pleuritis and peritonitis. Placentas show hemorrhagic necrotic cotyledons. Enteric cultures for Campylobacter are difficult so PCR Assays are the most widely used diagnostic tool.

TREATMENT
Antibiotic treatment won’t prevent shedding in colonized animals but may prevent exposed sheep and goats from aborting. Tetracycline has been the drug of choice but resistant strains are a growing problem. Vaccines are available to prevent abortion in sheep, but are not often used in goats. In humans C. jejuni and C. coli cause enteritis. C. fetus mainly causes septic infections but abortions are rare. In Europe, there are 46 cases/100,000 population. It is the common cause of travelers’ diarrhea in many regions. Guillain-Barré Syndrome is seen in 1 out of 1000 infections with 31% of GBS cases attributed to Campylobacter with a 15% death rate. Prevention is good food sanitation and pasteurization of milk.

SALMONELLA
There are up to 2,500 serovars of Salmonella that cause disease in mammals. Even more cause disease in a wide range of animals from reptiles to birds. Most isolates that cause disease in humans and mammals are in the S. enterica subsp. enterica group. Salmonella species are transmitted by the fecal-oral route. People are infected from eating contaminated foods. Eggs are a major source. Salmonella are susceptible to most disinfectants and by moist heat to 121°F for 15 minutes or dry heat to 170°F for 1 hour. The major symptoms in livestock are enteritis and septicemia. There are no pathognomonic postmortem lesions. Intestinal lesions are most common in the ileum and large intestine. This also includes fatty degeneration of the liver.
Diagnosis
Diagnosis is difficult. Some PCR tests are validated, ELISA’s can be used for bulk milk screening and cultures. Culture is not confirmatory as many asymptomatic animals will shed salmonella. Salmonella is uncommon in small ruminants but abortion storms in sheep have been seen; enteritis and acute deaths have been seen in goats.

Treatment
Uncomplicated cases don’t warrant antibiotic treatment as this will increase the chance of chronic intestinal infections and shedding.

Prevention
~ Colostrum is of primary importance in preventing disease in young animals.
~ For pets, prevent the consumption of raw meat.
~ Vaccines are available and effective for some serovars. Vaccines will reduce colonization and shedding.
~ Prevention in humans requires food safety and prevention from contact with shedding animals.
~ Avoid contact with young livestock in fairs or petting zoos. After contact, be sure to use hand sanitizer if soap is not available.

ENTEROHEMORRHAGIC ESCHERICHIA coli 0157:H7 (EHEC 0157)
This group of organisms is important as the cause of hemorrhagic colitis and hemolytic uremic syndrome in humans, primarily children. Ruminants, particularly cattle and sheep, and rarely goats seem to be maintenance hosts for EHEC 0157. Goats are asymptomatic carriers. Other groups or strains are able to cause disease but are human to human and not zoonotic. Transmission is by the fecal-oral route. Ruminants can shed transiently, intermittently and long term. Young ruminants are more likely to shed than adults. People become infected with EHEC 0157 by ingesting contaminated water and food during contact with animals, especially ruminants’ feces and soil. The infective dose for humans is as little as 100 organisms. Foodborne outbreaks are associated with uncooked food or unpasteurized milk. Other outbreaks are linked to contaminated vegetables or sprouts from irrigation water. Swimming in lakes and streams has been the source of infection.

Disinfection
~ EHEC 0157 is readily killed by most disinfectants including ethanol, cooking to 121°F with moist heat for 15 minutes or 170°F dry heat for 1 hour.
~ E. coli in biofilms are much more difficult to kill.

Clinical Signs
~ EHEC 0157 is asymptomatic in ruminants.
~ Clinical signs in humans are watery diarrhea, hemorrhagic colitis or hemolytic uremic syndrome.
Diagnosis

EHEC 0157 can be difficult to identify in ruminants since it is a minor player in the gut flora population. Specialized enrichments or concentration on antibody coated magnetic beads may allow culture and identification.

Prevention

Prevention is mainly targeted for humans since animals are not affected. Vaccines may be effective at reducing shedding but are not widely used. Manure management practices may be useful in reducing environmental contamination.

Treatment in Humans

Antibiotics do not seem to reduce symptoms and may increase the risk of developing HUS.

Prevention is Key

~ Frequent hand washing can decrease the risk. The Scottish EHEC 0157 Task Force recommends that on land used for camping, animals not be grazed for 3 weeks prior to use.
~ Cook meat, especially hamburger to well done and avoid unpasteurized milk.
~ It is advisable to use dilute chlorine or vinegar to wash fresh vegetables. Organisms carried internally in the tissues of the plant can only be killed by cooking.

CRYPTOSPORIDIOSIS

~ Cryptosporidiosis is caused by a coccidian parasite Cryptosporidium parvum.
~ Transmission is by fecal-oral route with incubation of 1 to 12 days.
~ Cryptosporidiosis is resistant to almost all disinfectants but can be killed with desiccation.
~ Symptoms usually are characterized by profuse watery diarrhea with cramping.
~ Transmission from infected animals is common including other humans.
~ C. parvum is common in small calves, sheep and goats but is rarely seen in cats, dogs or horses.
~ Diagnosis is by fecal floatation and finding C. parvum oocysts.
~ There are no specific treatments and no vaccines.
~ Immunosuppressed animals are more prone to severe disease.

CONTAGIOUS ECTHYMA, ORF, SORE MOUTH

These are caused by a parapox virus and infect primarily sheep, goats and humans. The virus survives in the dried crust or scabs and in a dry environment may survive up to 12 years. Infections are usually caused by direct contact with skin abrasions in the susceptible animal. Sodium hypochlorite and quaternary ammonium disinfectants are effective at inactivating the virus but ethanol is not. Incubation after contact is 2 to 5 days. Without treatment lesions resolve in 1 to 2 months.

For prevention at shows spraying sodium hypochlorite on the pens and panels will help. Vaccination uses a live virus that will cause Orf in other susceptible animals. A total washing of all surfaces in housing after an outbreak may break the annual Orf cycle.
Sheep can carry the dried virus scabs in their wool for months after recovery. In humans, the lesions are small non-healing papules on the skin, often on the hands and arms, resolution occurs in 3 to 6 weeks. There are at least 11 strains of Orf virus that exhibit varying degrees of severity. In sheep and goats, an infection with one strain appears to offer immunity for life to all strains.

References: