

Busting *E. coli* on the Homefront

Understand how *E. coli* O157:H7 and other infectious pathogens are transmitted on the farm and in the home.

Story & photos by **Ed Haag**

Tom Besser, professor of veterinary microbiology at Washington State University (WSU), has witnessed a change in how the research community views *E. coli* O157.

“When O157 first hit the news it was because of outbreaks, and outbreaks are almost always related to food,” he says. “As people did more sophisticated analysis and started looking at cases, one at a time, the risk factors that emerged weren’t necessarily due to contaminated food.”

According to the Centers for Disease Control and Prevention (CDC) in Atlanta, Ga., the *E. coli* bacterium causes an estimated 73,000 cases of infection and 61 deaths each year in the United States. Although most of the cases are still related to food contamination, a growing number can

be traced to people physically handling live animals.

“As we learn more about the transmission of *E. coli*, we are realizing that some of this food contamination leads back to livestock,” Besser says. He cites *E. coli* as an example of a pathogen that is common in livestock environments. In summer research projects in which he has participated, it has not been unusual to detect *E. coli* in 20% or more of the cattle in a herd.

The American Veterinary Medical Association (AVMA) “Zoonosis Update” of Oct. 15, 2002, supports Besser’s observations. It notes that while the prevalence of *E. coli* O157:H7 has been reported to be from 1%-5% in numerous studies in the United States, Canada, Australia, Norway and Finland, studies using

more sensitive methods for detection now report rates of *E. coli* O157:H7 fecal contamination as high as 13%-28% of animals.

It adds that the mean duration that an individual animal has positive culture results is 30 days, but the range in duration can vary from a few days to a year. This variation has been attributed to many factors, such as diet, drinking water contamination, competing microbial flora, immune response, age, breed, *E. coli* strain, housing conditions and season.

The update notes that warm weather (summer months) correlates to an increase in rates of *E. coli* O157:H7 fecal shedding. It goes on to hypothesize that strains of *E. coli* O157:H7 carried in the gastrointestinal tract of cattle are often being replaced by new and different strains, but herd infection is still maintained.

“There are those in the research community who believe that every farm has a reservoir of *E. coli*,” Besser says, adding that the high-profile pathogen isn’t the only potentially harmful bacteria commonly found on U.S. farms and ranches. “Salmonella and campylobacter are two others that are associated with livestock.”

Besser notes that *E. coli* and these other potentially dangerous bacteria can be transmitted to humans when a relatively small number of cells present in the infected animal’s feces are orally ingested.

It has been long understood by epidemiologists that individuals who are continuously exposed to some of the more common livestock-borne pathogens will establish a level of resistance to them. While some find comfort in that fact, few who regularly handle livestock consider that their resistance could easily be compromised by illness. At equal risk are those who have not developed a natural resistance to these germs and who come in contact with them on a farm or ranch.

E. coli O157 does not sicken cattle carrying and shedding the bacteria, and it is not known to have a negative effect on beef production. However, in humans it produces a toxin that causes diarrhea that is often bloody and abdominal cramps. The illness usually lasts five to 10 days, but can cause hemolytic uremic syndrome, a potentially fatal form of kidney failure, in 2%-7% of patients.

Recent cases and subsequent investigations in Europe and North America confirm that children younger than 5 years of age are particularly vulnerable to livestock-transmitted *E. coli* O157.

In October 2004, the North Carolina Department of Health and Human Services (NCDHHS) investigated an *E. coli* O157



▶Antibacterial hand rubs are an excellent tool for controlling the transmission of *E. coli*.

outbreak associated with its state fair. One hundred and eighty reports of illness were received, most of which occurred in children 5 years old or younger. Fifteen of those cases developed hemolytic uremic syndrome.

In December of that same year, a report released by the NCDHHS associated the *E. coli* outbreak with four livestock exhibits. The PFGE (pulsed field gel electrophoresis) patterns of *E. coli* culture samples taken from the exhibit sites matched 19 of 30 culture samples taken from those who were affected by the bacteria.

The report recommended restricting direct contact with animals and implementing stricter measures to control fecal contamination. It concluded that particular attention should be paid to the potential exposure of young children and individuals with suppressed immune systems.

Since 2000, similar cases have been confirmed in California, Pennsylvania, Arizona, Washington state and, most recently, in Florida.

So what can a rancher do about the presence of pathogens in his herd, and how can he or she prevent its spread from infected animals to those who are most at risk?

Limit contact with livestock

While we might be tempted by the perfect photo opportunity of a young child embracing a doe-eyed calf, such an endeavor might be reconsidered in light of the risks involved. According to the previously mentioned AVMA "Zoonosis Update," *E. coli* O157:H7 can be found in the feces of calves that are only 48 to 72 hours old.

It goes on to state that handling calves is a common source of human infection, as calves are colonized by *E. coli* O157:H7.

Hugh Pennington, a professor of bacteriology at Aberdeen University in Scotland and a principal investigator of a 1996 *E. coli* O157 outbreak in his country that led to the deaths of 21 people, warns of the heightened risk of toxigenic brain and kidney damage to children under the age of 5. He notes that these children are more difficult to manage, have no understanding of hygiene, have a tendency to suck on their fingers and are more susceptible to disease-related complications.

His recommendation is to keep children younger than 5 away from livestock areas where they can come in direct contact with animals or their feces.

John Gay, WSU livestock epidemiologist, also recommends establishing proper sanitation procedures while handling livestock. This includes the use of disposable gloves when handling sick animals and



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avoiding practices that run the risk of inadvertently carrying any pathogens on clothing or hands out of the livestock area.

For Besser, the No. 1 transmission source is oral ingestion of the *E. coli* bacteria. As few as 90 living cells have been known to infect an individual under the right conditions. Those handling livestock should avoid eating, smoking or doing any other activities that might inadvertently introduce bacteria to the mouth.

"Anything that requires putting your hand to your mouth substantially increases the risk factor," he says. "This means anyone eating in the barn is asking for trouble."

Besser suggests always carrying antibacterial hand rubs and using them as often as possible. "The alcohol hand gels are excellent products, and I use them myself," he says. "Under some conditions I trust them better than I trust my ability to wash my hands properly."

A house free of *E. coli*

Experts agree that the best line of defense against any harmful pathogen lies somewhere in between the location of your animals and your home. Gay notes that the procedures used to determine whether or not a home is contaminated with *E. coli* are very revealing.

"The first thing we check are the used vacuum bags," he says. "*E. coli* will usually show up first on the living room floor."

In most cases, the *E. coli* bacteria gets a free ride into the house on a shoe or some other item of clothing. It is a good idea to have a washer and dryer located outside of the main house so clothes worn while handling animals can be thoroughly washed and dried on a hot cycle.

Shoes or boots should be left outside. If they are worn into the house, they should be first cleaned and disinfected. Besser notes that it is important to remove all manure or other sources of bacteria from shoes before disinfecting them. Bacteria located under foreign material could remain viable throughout the disinfecting process. For more information on disinfectant procedures, access Ohio State University Extension Fact Sheet VME-0008-01: "Disinfection in On-Farm Biosecurity Procedures" available online at <http://ohioline.osu.edu/vme-fact/0008.html>.

Visitors who will be in the livestock area and then entering the house should be issued clean coveralls and boots before entering the site. It is recommended that there be several clean pairs on hand for such occasions and that they be available in three sizes. Disposables are also appropriate.

When visitors leave the livestock area they should be supplied with sealable plastic bags in which to place their soiled coveralls and dirty boots. Another option is to have them deposit these clothing items in designated receptacles. Before leaving the livestock area, visitors should wash their hands with soap and hot water or with an antibacterial rub.

People aren't the only creatures who can transmit pathogens into a house, Gay adds. Pets are proven vectors of the bacteria when they spend time both indoors and outdoors, and flies are known to transmit enough of the bacteria to sicken an individual with a compromised immune system.

Don't forget your hands

One of the most common means of transmitting pathogens in a ranch setting is by way of hands. That can involve touching infected animals and then introducing the bacteria into food preparation areas, or it can involve direct ingestion of the bacteria by the primary contact.

In order to avoid the introduction of pathogens into kitchens, hands should be washed with hot water and soap for a minimum of 15 seconds before one enters the main living quarters. For those individuals handling livestock in the field who have no access to hand soap and hot water, Besser again recommends using one of the commonly available alcohol-based antibacterial hand rubs before eating, smoking or taking snuff.

"Most of these precautions are based on common sense," Besser says. "Just think about keeping the bacteria away from your mouth, away from your home and away from your family."

