FMD:

Prepare early, respond quickly

Dr. Pam Hullinger, University of California, Davis

The first steps in an outbreak of FMD would be to stop animal movement and establish biosecurity measures in the affected area.

Lessons from past outbreaks help guide response planning.

By John Maday

There's an old joke about paranoia: "I know I'm paranoid, but I worry that I'm not as paranoid as I should be."

Maybe we don't need to be "paranoid" over the prospect of a foot-and-mouth disease (FMD) incident in the United States, but a high level of concern is appropriate. And that concern should lead to an enhanced level of preparedness.

The United States has been free of FMD since 1929, but the virus remains endemic in much of the world and significant outbreaks have occurred recently in several previously FMD-free countries. The good news is researchers and veterinarians have learned a great deal about FMD in recent years, and historical experience should enable a more effective response. The bad news is the virus is one of the most infectious known and can easily spread within or between herds through direct or indirect contact. An outbreak in the United States would result in significant losses to the beef, dairy and other livestock industries.

Speaking at this year's FMD symposium in Louisville, Ky., Sebastian Heath, VetMB, PhD, branch chief of program development at the Federal Emergency Management Agency, said the United States would recover from an outbreak and return to FMD-free status, but long-term effects would be significant. Those impacts include direct or additional costs of doing business in an outbreak, such as federal compensation for culled animals and interest on loans for recovery. In the 2001 U.K. outbreak, direct costs totaled $2.4 billion. Outbreaks also bring indirect costs such as revenue not

CASE STUDY: TWO OUTBREAKS, DIFFERENT OUTCOMES

The experiences of the United Kingdom and Uruguay, which each suffered similar FMD outbreaks in 2001, show a striking contrast between control strategies and outcomes. The two countries have similar numbers of cattle and numbers of herds.

In the United Kingdom, the index farm did not report problems as they appeared and ended up shipping infected pigs well after the outbreak began. Early in the outbreak, farmers did not have accurate information and biosecurity practices were inadequate. The country depopulated about 10,000 farms and slaughtered an estimated 6 million to 10 million animals, resulting in economic impacts that continue today. U.K. officials depopulated uninfected farms adjacent to infected farms, a practice Pam Hullinger, DVM, MPVM, DACVPM, at the University of California-Davis, says probably was not necessary and would not be used in the United States.

In Uruguay, animal-health officials quickly recognized the rapidly spreading outbreak, which infected herds on 28 farms in the first five days. They initially implemented a "ring-vaccination" program, but within seven days, with 131 farms infected, switched to a national cattle-vaccination program. In cooperation with the government, farmers administered two rounds of over 12 million doses of the vaccine to susceptible animals across the country. Only 7,000 animals were destroyed, and the country was recognized by the World Organization for Animal Health as FMD-free by May 2003. The outbreak endured for four months, compared to seven months in the United Kingdom. Most of Uruguay's beef exports resumed within one year. The national vaccination program continues today.

earned on depopulated herds, effects of quarantines on livestock species not affected by FMD and non-agricultural impacts such as loss of tourism. Following an outbreak, producers typically face new production costs such as new requirements for testing or recordkeeping.

Finally, outbreaks can lead to shifts in revenue streams that can be positive or negative. During the U.K. outbreak, for example, the government paid about $263 million less in export subsidies in 2002 than in 2001, about equal with the lost trade revenue. For years after the out-

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Veterinarians and producers should watch for signs of FMD such as these lesions to the foot and mouth.

break, Heath says, waste-management companies were doing lucrative business managing runoff and seepage from the sites where thousands of culled animals were buried. Someone was making money from the outbreak; it just wasn't farmers.

WHAT WE'VE LEARNED

In preparing for a potential outbreak, the United States has the benefit of lessons learned in other countries. Pam Hullinger, DVM, MPVM, DACVPM, at the University of California-Davis, lists three key lessons from past outbreaks: the importance of effective biosecurity, the need for early detection and the viability of vaccination as a control strategy.

BIOSECURITY

Hullinger says effective biosecurity practices will help prevent the spread of many common endemic diseases while also providing a buffer against foreign animal diseases such as FMD. Beef and dairy operators are fortunate in that cattle are not routinely affected by as many transmissible diseases as hogs, but as a result, they have not adopted biosecurity practices at the level of those typical on hog operations.

Hullinger has helped develop plans for the National Secure Milk Supply (SMS) Project, which provides national guidance to safely keep milk moving and protect the continuity of dairy businesses in the case of an FMD outbreak. Past history shows we do not need to stop all movement of all animals or products, she says. Instead, the industry can manage movement based on risk factors and effective biosecurity. Within the dairy sector, milk probably is the top priority for continued movement, since dairies

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Scenes such as this one from the United Kingdom in 2001 probably could be avoided in the United States with a quick, strategic response to an FMD outbreak.

need to ship milk every day.

With proper preparation, dairies in an outbreak area could continue shipping milk to processing. Off-site calf rearing would present another large challenge for dairies. This is the next area that the national SMS hopes to address. Hullinger says dairies likely would need to adapt their facilities to temporarily house calves, or possibly move them to a site that could house calves from a single farm without commingling.

Cow-calf operations do not move cattle as often as dairies, but sales of live cattle pose a risk for spreading disease to other locations. Feedyards, on the other hand, are more of a dead end, with cattle that ship out going directly to slaughter. Hullinger notes cow-calf and stocker operators have more "elasticity" or flexibility in moving their product compared to the swine or dairy industries. If calves or yearlings need to remain on an operation for a few extra weeks, it is an inconvenience to the operator but not a business killer. Feedyards also have some level of elasticity in their marketing schedules.

Small holdings or non-commercial farms with small numbers of animals present relatively low risk of spreading the virus but could serve as reservoirs for the virus, as they could be slower to detect and report disease.

Hullinger says wildlife probably would not play a major role in spreading this disease, based on experience in other countries where researchers have tracked FMD in wildlife such as deer and wild hogs.

Private veterinarians play a key role

in educating clients and helping them develop biosecurity protocols such as regulating where particular vehicles or implements are allowed on the operation, sanitizing vehicles and equipment between uses and restricting commingling of animals, Hullinger says.

EARLY DETECTION

Historically, outbreaks have occurred when FMD cases were not reported early, or subjected to the wrong test, resulting in the virus spreading before control measures were implemented. FMD is a nimble adversary, Hullinger says. It is highly contagious but also presents differently from one outbreak to another. Veterinarians need to be vigilant in their everyday work. Don't make assumptions about signs of disease, she says. A delay of a day or a week in identifying and reporting a case of FMD could mean the difference between a manageable outbreak and a crisis.

University of Illinois pathobiology professor Gay Miller, DVM, PhD, agrees, saying a recent epidemiological model shows every hour of delay in detecting the disease and imposing quarantine in an area with a high concentration of livestock could result in an additional 2,000 animals culled. Multiple variables affect the behavior of this disease, however. "All models are wrong," Miller says. "Some models are useful."

VACCINATION

In most outbreaks, the control strategy begins with quarantine followed by "stamping out," meaning depopulating all infected animals and those suspected of exposure to the virus. Historically, vaccination has been viewed as a secondary strategy, primarily because the FMD-protective antibodies in vaccinated animals mimic those resulting from exposure. However, attitudes regarding vaccination as an early intervention strategy are changing. During their recent outbreaks, Japan and Korea eventually responded with vaccination, and other countries including the European Union are shifting away from depopulation as their primary control strategy.

Results in countries with recent outbreaks indicate early adoption of vaccination in widespread outbreaks results in better control and less depopulation of animals (see sidebar).

Public perception also could play a

role in control decisions. Images of large numbers of animals being killed and buried to prevent the spread of a disease that does not affect humans will not play well in the public arena.

Miller says past experience shows stamping out can succeed if the outbreak is confined to a relatively small area. If the outbreak has spread to a wider geography or to multiple areas, stamping out becomes less viable as a stand-alone strategy. "We need to prepare ourselves to implement vaccination," she says.

Early, targeted intervention is critical for vaccination to be successful, Miller says, and supplies of vaccine doses likely would be limited. Upon news of an outbreak, the Secretary of Agriculture would activate the North American FMD vaccine bank, operated in cooperation with Canada and Mexico. The challenge would then be to produce adequate doses of the appropriate vaccine based on the serotype of the outbreak, maintain a cold chain and distribute doses to veterinarians in the field. In addition to the North American vaccine bank, U.S. officials likely would need to purchase vaccine doses on the international market. Supplies of vaccine might struggle to meet demand, especially if an outbreak were to occur in an area with high livestock density.

Currently, Miller says, there is no national plan which provides extensive scenario details for how or under what specific circumstances to implement a vaccination program, and more research is needed to identify trigger points for decisions. Local, state and federal animal-health officials would need to make those decisions. A local vaccination strategy could contain the disease within a quarantined area, but if the outbreak is more widespread, a regional or national vaccination program could be needed.

Historically, the idea in the United States was for teams of federal government employees to fan out over an outbreak area to administer vaccines. Now opinions have shifted toward a government-private partnership, with farm personnel conducting vaccinations under the supervision of a government representative overseeing the incident.

The level of risk and logistics for control vary across U.S. livestock sectors. In the dairy industry, where animals are largely confined and concentrated and most are handled on a daily basis, vaccines could be distributed and administered quickly. Integration in the swine industry provides similar benefits. In contrast, the extensive nature of U.S. cow-calf production would complicate vaccine distribution and administration.

Other than supply and logistical concerns, the primary downside to using vaccinations would be its impact on trade, at least temporarily. The presence of vaccinated animals in U.S. herds likely would delay resumption of meat and dairy exports to FMD-free countries, even after the outbreak is controlled. However, Miller says, resumption of normal trade likely would be slow in any case, even if an outbreak was controlled quickly without vaccinations.

Hullinger says the industry would need to weigh the impact of temporarily losing our export market against the value of vaccination in controlling the outbreak and protecting the confidence of domestic consumers and domestic markets.

Miller says a key advance in FMD preparedness is the development of a novel vaccine that can be manufactured in the United States. In 2012, USDA issued a conditional license for GenVec, Inc.'s FMD vaccine for use in cattle. GenVec also granted Merial rights to develop and commercialize the vaccine. Federal law prohibits handling live FMD virus anywhere inside the United States, other than at the Plum Island Animal Disease Center. The manufacturing process for this vaccine, however, does not require use of live FMD virus. Also, the FMD-protective antibody produced by vaccinated animals will be readily differentiated from the antibody produced as a result of disease exposure. Currently, though, the GenVec vaccine covers just one of at least seven serotypes of the FMD virus.

THE VETERINARIAN'S ROLE

During "peacetime," Miller says, front-line veterinarians as well as producers across the country should be involved in surveillance in their everyday work. They also should take time to prepare. Every clinic should have an emergency response plan including biosecurity practices in case of an outbreak. Veterinarians also can help their clients develop biosecurity protocols and emergency response plans covering various scenarios such as an outbreak in the region or in the local community.

In the event of an outbreak, Miller believes federal and state officials should oversee any FMD vaccination effort while enlisting the services of accredited private-sector veterinarians to work with their clients to vaccinate herds. Companies that currently market typical, commonly used livestock vaccines could serve as a distribution channel, she says, as they have an established infrastructure for supplying veterinarians and protecting cold chains.

A modeling study of a Minnesota FMD outbreak indicated a vaccination program administered only by state and federal workers could vaccinate about 50 herds per day. In contrast, a program utilizing private practitioners under government oversight could vaccinate 1,500 herds per day, resulting in earlier control and a smaller outbreak.

A relatively small investment in preparedness could greatly reduce the cost and impact of an incident, Hullinger says, and provide benefits beyond FMD, as the plans could apply to other domestic or foreign animal diseases we have not considered. BV