Lessons Learned from Recent Outbreaks of Highly Contagious Livestock Disease

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There are now dozens of official reports on experience with highly contagious livestock diseases (such as FMD, END, PRRS, PED, HPAI). They contain assessments of each outbreak and "lessons learned" for response in the future. The characteristics of particular pathogens and hosts and conditions on the ground, they say, all vary greatly and greatly matter. But whatever the particulars, every outbreak is also remembered as tough, pushing the limits of responders' capacity. It is basically miserable, more or less, no matter how people prepare and respond.

Emergency managers also come away with a singular conviction to do better "next time" by doubling down on much the same basic approach: surround, contain, and eradicate the pathogen; "recover" the status quo. Extensive surveys of the literature and stacks of after-action reports confirm an animating vision that has barely budged in a century.

Opportunities identified for improvement target means more than ends and vary on a small number of themes. Recent renderings include:

Increase the pace of detection and control of infection:

- Intensify normal, "peace-time" surveillance and biosecurity. With dense populations of relatively naïve – pathogen-free/low-immunity – herds in an increasingly inter-connected world, emerging pathogens are to be expected. Consider the cost and inconvenience of more intense disease management necessary for sustainable livestock care.
    - Monitor and minimize farm traffic. E.g., increase the use of buffers around facilities to reduce indirect contacts with livestock (e.g., employee and visitor parking, feed delivery, ventilation, manure handling, rendering).
    - Maintain consistent herd-health records in a standard, digital format (e.g., for premises and animal identifications).
    - Assure that livestock feeds, storage, and transport are uncontaminated (e.g., when imported from outside, stored, and moved across the U.S.)
    - Develop capability to suspend routine livestock shipments (e.g., to isolate stock for a minimal period – a couple of days or weeks, depending on the species and pathogen of concern – prior to and following movement).
    - Train for and support the reporting of suspicious symptoms (e.g., spikes in mortality or abortions, drops in production) not just for OIE- or USDA-mandated reportable/regulated diseases but also for potentially novel infections.
- Immediately isolate animals that are known or likely to be infected.
- Euthanize infected animals within 24 hours of their identification.
- Continuously, rapidly but carefully dispose of carcasses, bedding, and manure, which can carry infection.
- Accelerate data entry, a common bottleneck in planning and documenting response.
- Prepare and publicize in advance or as early as possible straightforward triggers for vaccination and criteria for indemnification.
- Prepare ready stores of multivalent vaccine, adjuvants, and supplies adequate to apply, at least until the best vaccine for a particular outbreak can be identified, manufactured, and distributed (e.g., through the National Veterinary Stockpile).

Improve coordination of effort among responding partners (vs. "stovepipes"):

- Across functions

    - Maintain a common operating picture (e.g., use EMRS).
    - Integrate epidemiological investigation and response.
    - Share data and unify communications among industry, state, federal, and contracted responders.
    - In staffing the Emergency Operations Center, insofar as possible, engage specialists in incident management (e.g., from local EMA) rather than subject-area specialists who may be more productive in field operations.
- Across jurisdictions
    - Be prepared both to lead and to follow initiatives from response partners, whether "up" or "down" the network of private and public sectors.
    - Establish and maintain cooperation among federal, state, and local agencies and the industries involved (e.g., farm operators and managers, state and local EMA, public safety, transportation, health, and environmental regulators).
    - Engage and maintain open communications with elected officials (i.e., "politicians" and "politics") in the surrounding jurisdictions.
    - In harmonizing plans, distinguish common and shared objectives, especially in leveraging resources.
    - Identify clear, consistent triggers for resource sharing and logistics (e.g., priorities for emergency vaccination).
    - Develop transparent, consistent criteria for routing, permitting, and tracking movement of livestock, waste, personnel, supplies and equipment.

Improve preparation for large-scale depopulation and carcass disposal:

- Use composting (which works!), but anticipate that capacity may be limited by the available terrain, supplies, and training. Alone, on-site composting may not suffice.
- Prepare alternatives (e.g., landfill, above-ground burial, rendering, gasification, mobile incineration), even though each may have more drawbacks than composting. (E.g., rendering or other techniques that entail carcass transport can spread disease).
- Prepare more thoroughly vetted and readily available guidelines and training on carcass disposal.

Get more response resources

- Improve the identification of farm premises and the traceability of their livestock.
- Identify and fill training gaps for disease prevention, detection, response, and recovery.
- Provide more consistent and effective oversight of response operations (e.g., for farmers, processors, and response contractors).
- Develop standard pre-requisites for common ICS positions.
- Identify a larger supply of personnel to fill shifts in Incident Command and to staff the most laborious operations (depopulation, carcass disposal, data entry, and C&D. E.g., use state EMA in ICS, inmates for depopulation, firefighters to foam and move water, state police to transport samples, state administrative staff to document response activities.)
- Take good care of responders (e.g., provide safety gear and phones, nourishment, toilets, showers, rest).
- Pursue cost-sharing with state and local partners (e.g., with state EMA, commodity groups).
- Have adequate vaccination supplies on-hand. (E.g., current supply for most FADs is probably inadequate for outbreaks that are more than focal/Type 1, and even then maybe only for ring vaccination or for select species. An FMD outbreak could well be Type 4 by the time it is detected, with a need for protective vaccination).

The lessons share a familiar lament: "If only we (incident managers) had MORE" – more time to assess the situation and to make decisions, local knowledge, biosecurity and monitoring, supplies of well-trained and coordinated responders, viable options for depopulation, disposal and vaccination, public forbearance, more rest, less stress. By this reasoning, as lessons and assets mount, outbreak experience should be getting better – less frequent, hazardous and costly – but so far, it hasn't. Nevertheless, after-action reports stick to the same basic concepts, goals and objectives that have reigned since the 1920s.

The vision remains essentially medical and geo-political. At the very outset, for example, action requires first sorting diseases into one of two, supposedly clear, stable categories: infections that do vs. do not merit eradication. Every pathogen must be associated with one or the other. The distinction is obviously a bit arbitrary – an evolving heuristic, human invention – but it is treated as if it were a phylogenetic feature of infection itself.

Sickness in livestock is either a "production" ("non-reportable") or a "reportable" ("foreign"/FAD or "transboundary"/TAD) disease. Responsibility for the first lies in the private sector. People who own livestock are expected to deal with it basically on their own. Responsibility for the second lies with both producers and public officials, as stipulated in myriad laws, codes, and trade agreements.

FAD outbreaks are in this way human constructs, but response foregrounds animals and the farms where they live. Logistics, for example, are organized around the epidemiological classification of livestock premises, ranging from "infected" to "disease-free." Results of microbiological tests for the presence of a reportable pathogen in the animals and their environment define the nature of the hazard (e.g., as either in or out of its "proper" niche) and what must be done about it. One side is designated "clean;" the other "dirty."

In this way, public and private sectors share responsibility for maintaining a biosecure "line of separation" – a sustainable, effective divide between reportable disease in one place (an "infected" premises or "endemic" jurisdiction) and susceptible hosts in another. So, every FAD outbreak presumably originates in a disruption of this "natural" order, most likely when people breach the barrier between the two. Careless practices, contaminated vehicles or poorly designed facilities can push or carry contagion across to a terrain or herds that are (otherwise, presumably eternally) free of that pathogen.

It is, of course, true that, whenever there is an outbreak, some breach in biosecurity has occurred. Establishing that fact requires and conveys little information beyond the presence of disease itself. If infection has spread, there must have been a breach. (Finding deficient biosecurity the "cause" of contagion is a figment of circular reasoning, a tautology, like blaming insomnia for sleepless nights or color blindness for an inability to tell red from green.) "Learning" that biosecurity has failed or even how it failed in a particular instance leaves open the question of how it could best be avoided in other instances or whether it can be avoided at all.

More by presumption than discovery, then, the reason a disease "breaks" is because someone let pathogens go where they are not supposed to be, from some "contaminated" native ground to immunologically naïve, FAD-susceptible hosts. Keeping them apart is the job of farmers, veterinarians, and regulators, particularly, legally speaking, animal-health officials in state and federal government. Global agreements require that countries return to verifiable "disease-free" (preferably, pathogen-free) status, before regaining their access to international markets. The quicker and more efficiently everyone rallies around that goal, the more likely, again it is both assumed and mandated, health and commerce can return to normal.

Given this medical and geo-political vision and the difficulty of every response, it should not be surprising that after-action reports stress the need for ever more intense biosecurity measures and public-sector initiatives to expel pathogens, to confine them in foreign countries or to eradicate them from the Earth, once and for all. Hence – again, more by presumption than discovery – doing better in the future mainly means pursuing the same end with yet more devotion and resources.

Even when response efforts are Herculean and the outcome disappointing, faith in the vision remains. For example, strikingly few after-action reports question the medical and geo-political vision itself. They stress unity, mutual respect, teamwork, imagination and improvisation in its single-minded pursuit. When confronted with challenges, they find "misunderstandings," flawed or incomplete data and bottlenecks in communications or operations. Divided opinion, insofar as it is acknowledged, tends to be discounted as "political," meaning narrow-mined and transitory – off-message "special interests." In hindsight, supposedly, everyone eventually can and should "understand" the challenge in the same way and get on board.

Success in this way can only confirm its medical and geo-political frame. Phenomena that are more social or ecological than spatial or immunological may be noted in passing, but after-action reports downplay them. For example, bureaucracy seems ever a complaint in practice (especially in getting resources where and when they would do more good, in the estimation of the complainer). But after-action reports blame idiosyncratic confusion, whining, or technical glitches rather than systematic variation or tension among goals, institutions, or participants. For example, the usual suspects in responder lore (dimwits/slackers/bureaucrats) are blamed less often (at least in public) than abstractions, like the scale and complexity of a crisis that could flummox the best of people. In other words, justifiable reasons for conflict (e.g., inequality among stakeholders, differential impacts, or legacy grudges) are unlikely to find their way into lessons learned, except as inscrutable obstacles to be overcome.

Of course, though, lessons have been learned. There have been great strategic advances. For example, after horrendous experience with FMD in the U.K. in 2001, massive, burning pyres from preemptive culls of contiguous herds are less likely to be seen ever again. Vaccination has become a more viable option. Diagnostic laboratories and disease-spread modelling have greatly increased their capacities. Plans to sustain agricultural operations with enhanced biosecurity have much matured. And all around the world, countries have improved their preparations to detect and contain outbreaks.

These strategic gains, though, are still grounded in an overwhelmingly medical and geo-political model of livestock health. Official lessons learned in this way have left orthodox disease-control concepts basically unchallenged, even as the frequency, scale and cost of outbreaks has mounted, in some cases where they should be least expected. Places with state-of-the-art husbandry, like the United States, have not been spared. In fact, the suffering seems to have been worse where the commitment to biosecurity – as in well-engineered, large-scale, indoor, all-in-all-out production facilities – was best, and while apparently "backward" – smaller, more dispersed, open-air facilities – seem to have suffered less, at least at tax-payers' expense.

What follows are some short papers on emerging perspectives that may broaden the prevailing vision of animal-disease and lessons to be learned. These perspectives expand the focus to include greater emphasis on economics and ecology, particularly community and evolutionary ecology.