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Management of animal welfare in disease outbreaks

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Implications

- Disease outbreaks are biological disasters; in disasters, animal welfare will be optimal if the care of animals is managed using proven principles of emergency preparedness and response.
- Because animal welfare issues can arise quickly in modern animal husbandry systems, relying on a purely technical understanding of the disease is insufficient as a response strategy. To establish an effective and comprehensive response strategy that protects animal welfare preparedness, efforts before the outbreak should focus on identifying systemic issues that could give rise to critical resource shortages in a disease outbreak, such as personnel shortages and a poor public understanding of disease control methods.
- During the response, priority should be given to quickly characterizing the pathogen and the scope of the outbreak and approaches that create minimum disruption to functioning husbandry systems.

Key words: animals, emergency management, disasters, disease outbreak, epidemic, policy

Introduction

Animal welfare in disease outbreaks has received considerable attention in recent years as, throughout the world, numerous animal disease outbreaks have raised concerns over humane options for impacted animals. From these events, we can conclude that animal disease outbreaks are biological disasters and that most significant events have affected livestock (including horses). Because disasters arise when there is a temporary shortage of resources needed to mitigate the adverse impacts of a disruptive event, effective disaster preparedness aims to identify underlying systemic weaknesses that can either be corrected before a disaster or can be managed during the response (Figure 1). Similarly, to improve upon the care of animals in disasters, it is important to identify systemic problems that could become an animal welfare crisis in a disaster. Managing limited resources during the response to a disaster requires prioritization of issues to provide the greatest benefit to the most animals. This article will describe critical issues that, if not addressed before a disease outbreak, will have to be managed during a disease outbreak to minimize adverse impact on animal welfare.

To put animal welfare in disease outbreaks into context, the obvious solution to obtaining optimal animal welfare is to prevent animal disease outbreaks in the first place, as has been recently accomplished with the global eradication of Rinderpest. It also helps to appreciate that, although the focus of this article is on the impact of disease outbreaks on animal welfare, the number of animals suffering from substandard welfare as a result of production-related disease and poor management under non-disaster conditions dwarfs the number of animals suffering from geophysical, technological, and biological disasters combined. Finally, the reader should be aware of the extensive literature and experience showing that preparedness before disaster strikes as well as the reliance on proven management techniques during an event provide the greatest returns on investment in emergency management (Disaster Research Center, 2012; FEMA, 2012a; National Hazards Center, 2012). When the principles of emergency management are applied to the care of animals, animal welfare in disease outbreaks will be optimized.

Framework for Animal Welfare in Disease Outbreaks

Disease outbreaks/epidemics are defined by an increase in the incidence (new cases) of disease above normal. Depending on the background level of disease, a significant increase in the number of cases can be only a few cases (e.g., when a disease is known or assumed to be absent) or can be many cases (e.g., when the disease is endemic). For example, a few cases of Foot and Mouth Disease, Exotic Newcastle Disease, and Classical Swine Fever can be considered of high epidemic potential in countries free of these diseases but of low potential where the diseases are endemic. In other words, the potential of disease agents to cause epidemics is relative, and there is no singular definition of which pathogens can cause epidemics.

A framework for managing animal welfare in disease outbreaks comes from classifying unique states that animals can be in during epidemics and by defining categories of animal welfare that may be compromised. These states of animals in epidemics were used by the Federal Emergency Management Agency (**FEMA**) to develop the Animal Emergency Responder credentials (FEMA, 2012b) and are:

- susceptible and infected;
- susceptible with unknown disease/exposure status;
- susceptible but not infected/exposed;
- susceptible and dead (died/killed because of the disease); or
- not susceptible.

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Animal welfare becomes compromised when animals do not have:

- freedom from hunger and thirst;
- freedom from discomfort;
- freedom from pain, injury, or disease;
- freedom from fear and distress; or
- freedom to express normal behavior (Farm Animal Welfare Council, 1993).

The background level of disease, biological agent, scope of the outbreak, pathogen–host–environment interactions, prevalent husbandry systems, and policies to control the disease determine the number of animals in each state in any particular epidemic. Although combinations of these factors make many disease outbreaks look unique, the limited number of states in which adverse animal welfare outcomes can arise supports the notion that most problems with animal welfare are similar among outbreaks, and, but for their prevalence, can be managed if appropriately prioritized.

Animal Welfare Concerns for Animals that Have Been Infected

Infected animals are likely to require veterinary medical attention to provide freedom from pain, injury, and disease. The most common reason why veterinary medical care has not been adequate in epidemics is because of delays in deciding which response option to choose. Response options include: should animals be culled, treated, or left to recover or should a vaccination program be instituted for healthy animals that might make it difficult later to discriminate exposed from vaccinated animals on serological tests? Delays in the choice of options are typically the result of the need to balance internationally accepted trade policies with domestic public interests. For example, once a disease has been found in an exporting country, trade partners may refuse to accept imports until the disease has been proven to be eliminated again. Eliminating disease is often accomplished through depopulation (euthanasia of animal populations) of all susceptible animals that are known or have potentially been exposed to the agent. This approach potentially conflicts with domestic public opinion that might question the value of international trade if the consequences of trade are detrimental to domestic animals' lives and the production of animals for trade is damaging to the home environment. Neither of these consequences would occur if fewer animals were raised and allowed to live out their natural lives.

Therefore, if animal welfare is to be factored into disease control strategies, the particularities of each outbreak should be looked at in more detail to identify as many factors as possible that may be affecting the spread and containment of disease. Governments typically limit themselves to a purely technical understanding of the disease as a response strategy. This approach is analogous to solving a puzzle, where all that is needed is to align all the pieces and the complete picture will emerge (the outbreak will be contained). But from past experience, we know that even major factors contributing to the spread and containment of epidemics might not be known until years later. For example, existing (subsidies) or temporary (compensation) economic policies might be significant incentives for owners to move animals contrary to recommended containment methods and hinder investigations. Also the extent that a particular agent is transmitted via aerosol, the impact of weather and environment, and the role that wildlife may play as reservoirs or fomites might not be easily identified at the time of the outbreak. In other words, epidemics behave much more like mysteries because, more often than not, all of the factors contributing to the spread of the disease are not known in the early stages of an outbreak; rather, as the epidemic unfolds, the discovery of new variables impacts the relevance of all other variables. Hence, when depopulation is proposed as the only (technical) solution, as effective as that approach is, a government's reputation can be easily undermined when new variables emerge that require that the response be modified, but adaptation is slow or, worse, not given further consideration.

Depopulation might be suited to effectively control small outbreaks caused by infectious animal diseases, such as Classical Swine Fever, African Swine Fever, and Exotic Newcastle Disease, or zoonotic diseases such as Highly Pathogenic Avian Influenza, Bovine Spongiform Encephalopathy, and Hendra virus, but it is questionable if this scorched earth approach is always the most economic or humane choice for controlling large-scale epidemics, especially those caused by highly contagious diseases, such as Foot and Mouth Disease and Peste de Petite Ruminants.

A better approach to minimize the adverse impacts on animal welfare among infected animals is to address the following priorities at the outset of an epidemic:

1. characterize the biological and physical factors contributing to the spread and sustainment of the pathogen;
2. armed with information about the agent, define the likely scope of the outbreak;
3. identify economic and geophysical factors contributing to the spread of the disease; and
4. develop a strategy that is tailored to the outbreak's needs.

Addressing these priorities will allow emergency responders to balance competing resource needs within a sound framework for decision making.

To augment decision making, ongoing research efforts should aim to define the tipping points at which different disease control strategies will be most economical and humane as well as balance the need to protect the environment and trade overall. Specifically, better and more rapid deci-

Figure 1. Pre-existing husbandry conditions give rise to critical animal welfare issues in disasters, including disease outbreaks. Yet maintaining existing husbandry systems during a disaster is often the least stressful to affected animals; hence, the most effective time to mitigate poor standards of animal welfare is before a disaster strikes (© iStockphoto.com).

Figure 2. During disease outbreaks, the demand for technical services, such oral-pharyngeal swabbing for Avian Influenza, can be quickly overwhelmed, resulting in lower standards of animal welfare (photo courtesy of the US Fish and Wildlife Service).

sion making will come from epidemiological models that characterize the benefits and costs of different containment strategies for disease agents under different production scenarios, extent, weather, and geographic conditions. Using the mystery analogy of epidemics, a repository of scenarios would provide those responsible for controlling the disease with meaningful clues on how to solve the mystery quicker, such as when it is optimal to use depopulation versus vaccination versus acceptance of a disease becoming endemic.

Animal Welfare Concerns for Susceptible Animals with Unknown Infection/Exposure Status

Animals with an unknown disease status represent the great majority of animals in epidemics, and therefore, are usually the largest cohort for which animal welfare standards may be compromised. For disease control purposes, animals of unknown disease status are conventionally treated as if they were infected and may be euthanized. This situation is mostly the result of diagnostic resource shortages needed to differentiate infected from non-infected animals in a crisis and can lead to public confusion for lack of understanding why healthy animals should be killed at all (Figure 2). This perceived conflict raises concerns among the public as well as owners (farmers), who expect governments, for both ethical and economic reasons, to have sufficient diagnostic resources on hand to spare the lives of animals that have not been infected.

Treating animals of unknown disease/exposure status as if they were diseased has the potential to ignore many welfare concerns of animals. For example, animal movement controls will create backups at various stages of production, such as would be the case with pigs that, if slaughter of market-ready pigs were stopped, could rapidly result in massive and inhumane overpopulation of pigs at farrowing, weaning, and fattening facilities. Ignoring these likely effects would result in large losses from unnecessary culling and selling of animals and animal products below market price. Unless these animals could be cared for appropriately, this would result in fear, distress, discomfort, hunger, and thirst and a lack of freedom of movement for the animals when their numbers exceed the capability of individual farmers to care for them and the facilities to house them. These conditions may also later contribute to the spread of disease by lowering the immune status of animals and by creating greater potential for animal to animal contact.

A major factor underlying of these all-too-predictable outcomes are policies that define at-risk populations mainly by using geometric (ring-shaped) zones around premises where a diagnosis has been made to control and survey for the disease as well as the use of jurisdictional boundaries to enforce movement restrictions (World Animal Health Organization, 2011). Whereas farms with a positive diagnosis are important epidemiological cases, these premises are only one stage of a dynamic process of disease that must have been introduced and from which it could spread. Hence, although the use of geometric shapes may be a valuable surrogate of at-risk animals, geometric shapes bear little resemblance to environmental factors known to impact the spread of disease, such as natural geography and weather, nor do they reflect actual industry compartments designed to support efficient growth and movement of animals and animal products to market.

Therefore, to improve animal welfare in epidemics, our response should consider more environmental and economic factors when defining the size of the at-risk population. A realistic assessment of the number of at-risk animals will create less disruption to husbandry systems but may not reduce the number of animals considered at risk. For example, in areas where large numbers of animals are raised and animal products are marketed close by, such as is typical of large dairy, poultry, and swine agribusiness complexes that supply large human populations, the at-risk population might be larger than defined using geographic methods alone and might include the entire agribusiness complex limited by its marketing egress points (points at which animals and animal products from the complex are sold to other parts of the country). Although this approach would identify a larger number of animals, with appropriate tracking permits, it would provide a more stable solution to maintaining husbandry methods rather than creating conditions that are driven by crises. It would also allow animals and animal products of unknown disease status to move and be marketed freely within the complex as well as enable the implementation of an agribusiness complex-wide disease control strategy, which is more likely to be effective because it would have local support. By contrast, even large farms, including individual concentrated animal feeding operations (**CAFOs**) such as feedlots, that are isolated by open fields or other geophysical factors, such as rivers and mountains, and where access can be monitored closely, might be the full extent of control warranted in other situations, and biosecurity could be established and maintained entirely within the affected premises.

For these approaches to work, before an outbreak, consumer understanding has to be developed so that the public accepts that not all animal diseases lead to human disease. Also, regulations and processes need to be implemented that allow processors to handle animals and animal products of unknown disease status without compromising biosecurity and still allowing for reasonable market value.

Animal Welfare Concerns for Non-Susceptible Animals Impacted by Disease Control Policies

Even though some animals may not be susceptible to a particular disease, they can contribute to its spread, with their care providers and their transportation acting as fomites. The animal welfare issues that arise for this group of animals are similar to those of unknown disease status and arise when their lifecycle is disrupted by movement controls, potentially leaving animals to becoming unmarketable, or by not being able to provide appropriate standards of husbandry and veterinary care for everyday health. These detrimental situations should be limited as much as possible by quickly identifying the probable contribution that non-susceptible animals could make to the spread of disease and restricting these risk factors. For all other situations, the movement of animals, handlers, and vehicles should be tracked meticulously so that epidemiologists can evaluate the role these movements make to the actual spread of disease.

Management of Animals that Have Died as a Result of the Disease

In outbreaks, animals can die as a result of the disease or be euthanized as part of a disease control program. In all cases, adequate veterinary or designated humane oversight is needed to ensure appropriate level of humane care and to minimize suffering during culling. Unfortunately, there are only few practical guidelines for depopulation methods for species, other than poultry, and many of these attempt to extrapolate from methods used for individual animals to populations. This leads to unrealistic demands on resources, such as for sedatives, euthanasia drugs, skilled personnel, and time, resulting in delays that enable the spread of disease. A better approach to depopulation would be the use or adaptation of common slaughter practices. This would either involve moving animals to existing slaughter plants or setting up equivalent field operations, where experienced/certified slaughterers cull animals following accepted protocols for high-volume slaughter.

Large numbers of carcasses can also present huge challenges to protecting the environment. Threats to the environment result from the conventional approach to dispose of carcasses as a method of containing the agent but could be omitted if the focus were on decontaminating carcasses. With appropriate biosecurity, decontamination of carcasses would allow them to be transported to sites where the large biomass could be managed effectively and economically.

Both the use or adaptation of common slaughter practices and a focus on decontamination require modifications to existing regulations as well as public education before they could be accepted as part of our response armament.

Common Resource Constraints in Disasters

Common to many types of disasters is an initial shortage of personnel. In biological disasters, the greatest shortage of personnel negatively impacts the ability to issue permits and track movements and undermines existing animal husbandry methods. There is also a shortage of personnel who can collect actionable epidemiological data that would shorten the time needed to characterize, scope, and decide on a response strategy. Most of these tasks can be performed with appropriate oversight and with minimal on-the-job training. However, most of the focus in the past on ensuring adequate staffing in disease outbreaks has been on recruiting technical experts (veterinarians), of which the number typically on hand are not able to handle the workload adequately, and as a result, standards of animal care become sub-optimal. To manage large numbers of personnel and tasks during the outbreak, a single Incident Management System (FEMA, 2012a) should be instituted.

To quickly recruit sufficient personnel for permitting and tracking, before an event, rapid hiring mechanisms for responders need to be in place, which responsible federal and state entities can use once an event has been declared. This includes developing templates to hire under personal service contracts (Federal Acquistion Regulations, 2012). Data collection and recording systems also need to be developed in collaboration with the livestock industry that allow livestock owners to compile actionable data. For example, rather than expecting animal owners to maintain records on the movement of animals, people, wildlife, and services on and off their premises at all times, once a disease of concern has been identified, owners should be encouraged to compile and submit backdated data, to the best of their memory, for the one to two weeks prior to the disease occurring in their region. By having producers compile and share this information in a standardized format, epidemiologists would have rapid access to data to map the course of the disease, identify potential risk factors for its spread, and target areas where there is a local lack of information.

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