Investigating Outbreaks of Disease or Impaired Productivity in Feedlot Cattle

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KEYWORDS

• Feedlot • Cattle • Disease • Outbreak investigation • Impaired productivity

KEY POINTS

- Outbreaks are an unexpected increase in morbidity, mortality, or impaired productivity.
- The reasons for investigating outbreaks of disease or impaired productivity are to reduce losses from existing cases, prevent additional cases, and understand how future outbreaks can be avoided.
- Outbreak investigations are more likely to be successful if an orderly process of investigation is followed using logic based on causal theory.
- Outbreaks are often the result of decisions and actions taken within the system, even though those actions may have taken place long ago or in a different location from the current problem.
- The investigation should be followed up with a clearly written report, which includes recommendations for measurable actions.

INTRODUCTION

The goal of a feedlot production system is to receive cattle to feed and finish, then market the cattle for harvest and processing into beef. Most cattle move through this system without health problems or impairment of productivity. Some feedlot cattle do become ill or unproductive. Disease and poor growth performance are expected to occur at some level of frequency in most feedlots.[1] The direct cause of disease in feedlot cattle may be well known and well characterized, although sometimes it is not. Even with excellent understanding of the pathophysiology of the disease, it may still be a challenge to understand what factors in the production system have

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led to the current problem.[2] Understanding what has gone wrong and how to remedy the situation may be particularly important when the disease occurs at an unexpectedly high rate.

An outbreak is defined as an unexpected increase in morbidity, mortality, or impaired productivity.[3–5] Outbreaks of disease or impaired productivity are indications that something in the production system is out of control.[6] Often, the root cause of an outbreak relates to a change in human actions or decisions, sometimes far removed in time or space from the clinical occurrence of the problem.[7]

IMPORTANT CONCEPTS

Causal Reasoning

Outbreak investigations are studies of causation. In conducting the investigation, we are trying to understand what caused the disease or impaired productivity to occur and hoping to prevent future problems. It is not easy to conduct an investigation that solves the problem, even if we do come to understand the disease process, because causal inference is complicated.

By the nature of their training in infectious diseases, with emphasis placed on individual animal medicine, veterinarians often spend considerable time and money trying to identify a pathogen to blame for health problems. Sometimes, knowing the pathogen(s) involved in a disease outbreak can useful. For example, it is useful to know that recent feedlot deaths were associated with infection with *Clostridium chauvoei* or *Listeria monocytogenes*. However, that causal information alone does not explain why cattle deaths suddenly occur from either of these widely distributed environmental source pathogens. Outbreak investigations can become sidetracked, and both human and capital resources consumed, in the sole pursuit of a causative agent, rather than identifying more useful explanations for the outbreak. Knowing the name of the causative agent may provide an explanation for the observed disease and might provide therapeutic insight. However, that knowledge rarely explains the course of events that led to the outbreak or provides a solution for preventing future problems.

Each factor that contributes to the development of disease is a component cause. Disease is observed when component causes add up to complete a sufficient cause.[8] Without a sufficient cause being completed, there is no observation of disease. That factor explains why we might recover *Mannheimia hemolytica* from a deep nasopharyngeal swab of a calf without respiratory disease, or why 1 feedlot manager might observe greater rates of respiratory disease with changes in the weather and another after a feed change. Each outbreak of respiratory disease is the result of the completion of a sufficient cause, which might have also included the presence of viral and bacterial pathogens, a certain state of immunity, or other component causes of respiratory disease in cattle that we fail to understand. In general, the objective of an outbreak investigation is to determine which potential component causes (eg, causal factors or risk factors) contribute to the completion of a sufficient cause. Removing 1 or more component causes prevents the expression of disease. Manageable component causes are called key determinants. In this example, it is rarely possible to control the weather, so managing feed changes may be the key determinant. Sometimes, key determinants are far removed in time or place from the immediate problem.

We may be more successful meeting the objectives of a field investigation if we can identify how certain actions or decisions inherent to the production system led up to (caused) the problem. For example, solutions are more likely to come from knowing that the blackleg cases occurred in pens in which the pen surface had recently been dug up or scraped aggressively, or that *Listeria* cases coincided with opening