Insights from Questionnaire-Based Assessment of Farm Management Weaknesses during a Haemorrhagic Septicemia Outbreak in Prachin Buri, Thailand

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Summary

Surveillance systems in livestock and food production systems play a critical role not only in detecting disease outbreaks but also in identifying underlying risk factors embedded within farm management and biosecurity practices. This study evaluates the characteristic of animal health and farm management during an outbreak of haemorrhagic septicemia (HS) in Prachin Buri province, Thailand, with a particular focus on how questionnaire-based surveillance can reveal weaknesses in farm management that contribute to disease risk.

The investigation combined passive and active surveillance, laboratory confirmation, and structured questionnaires to assess animal health practices and farm-level biosecurity. While laboratory results confirmed *Pasteurella multocida* serotype B:2 as the causative agent, the questionnaire findings revealed substantial gaps in vaccination coverage, quarantine implementation, hygiene practices, and water management. These deficiencies represent critical vulnerabilities that may facilitate pathogen introduction, amplification, and transmission within livestock systems.

Although statistical analysis did not identify significant associations between individual risk factors and disease occurrence, the overall pattern of weak farm management and low biosecurity strongly suggests a conducive environment for HS outbreaks. The findings highlight the importance of integrating farm management assessments into surveillance systems to support disease prevention, improve livestock productivity, and strengthen food safety across value chains.

Introduction

Haemorrhagic septicemia (HS) is a highly fatal bacterial disease of cattle and buffalo caused by *Pasteurella multocida*, particularly serotypes B:2 and E:2, and is widely distributed in tropical regions of Asia, Africa, and the Middle East (1,2). The disease is characterized by rapid onset, septicemia, respiratory distress, and high mortality, often approaching 100% in untreated cases (2). Transmission occurs primarily through inhalation or ingestion of contaminated feed and water, as well as direct contact with infected or carrier animals (1).

Farm management and biosecurity play a critical role in the epidemiology of HS, as the disease is strongly associated with stress conditions, poor nutrition, inadequate vaccination, and environmental factors such as high humidity and rainfall (3). In endemic regions, a proportion of healthy animals may act as carriers, shedding the pathogen during periods of stress and contributing to disease spread (3). Biosecurity measures, including quarantine of new animals, sanitation practices, control of water and feed sources, and restriction of animal movement, are essential to prevent pathogen introduction and transmission. Similarly, proper animal health management, including vaccination, deworming, and record-keeping, plays a vital role in maintaining herd immunity and reducing disease susceptibility. Therefore, inadequate farm management and weak biosecurity systems significantly increase the risk of outbreaks.

In many smallholder and semi-intensive livestock systems, these practices are inconsistently applied due to limited resources, lack of awareness, or insufficient veterinary support. As a result, surveillance systems must not only detect disease events but also evaluate farm-level practices to identify systemic weaknesses that increase outbreak risk.

This study examines an HS outbreak investigation in Prachin Buri province, Thailand, with a specific focus on how questionnaire-based assessments, can identify weaknesses in farm management and biosecurity. The findings provide insights into how improving these practices can reduce the risk of HS and other infectious diseases, thereby enhancing the resilience of livestock production systems and safeguarding the food value chain.

Methods

The study was conducted as an outbreak investigation using a combination of passive and active surveillance. Passive surveillance was initiated following notification of abnormal buffalo deaths, while active surveillance was implemented to assess disease spread and identify risk factors in surrounding farms within a 5 km radius, focusing on cattle and buffalo farms in Nadee and Thung Po subdistricts, Prachin Buri province, during September to October 2024.

A structured questionnaire was developed to systematically assess farm management and biosecurity practices. The questionnaire covered four key areas, including general farm characteristics, active case detection, animal health management, and farm management practices. Particular emphasis was placed on evaluating biosecurity measures such as quarantine of new animals, sanitation and disinfection practices, water and feed management, housing systems, and vector control. The questionnaire also assessed animal health management practices, including vaccination, deworming, and record-keeping. A total of 29 farms participated in the survey, representing 93.55% of farms within the study area.
Data were collected through farmer structural and unstructural interviews, laboratory information management system, and field observations. Laboratory confirmation of HS was performed using bacterial culture and PCR methods.

Descriptive analysis was conducted to summarize farm practices and identify common weaknesses, while logistic regression was used to explore associations between risk factors and disease occurrence.

Results

Haemorrhagic septicemia was confirmed in a buffalo farm, with two laboratory-confirmed cases and three additional suspected cases. Active surveillance identified 15 suspected cases in cattle from nearby farms, although all recovered following treatment.

The questionnaire findings revealed widespread deficiencies in farm management practices that are directly relevant to HS risk. Vaccination coverage was inconsistent across farms, with several farms lacking prior HS vaccination despite its availability. Even among vaccinated farms, booster schedules were often not followed, reducing the effectiveness of immunization programs. Quarantine practices were notably absent, as farms introducing new animals did not implement isolation periods before mixing them with existing herds. This represents a significant biosecurity gap, as asymptomatic carriers of *P. multocida* can introduce infection into susceptible populations. Water management practices were identified as a critical weakness, as most farms relied on untreated natural water sources such as canals. The lack of water treatment increases the risk of pathogen transmission, particularly in environments where contamination from other animals or environmental sources may occur. Sanitation and hygiene practices were also insufficient, as although some farms reported cleaning animal pens, the use of disinfectants was uncommon. Cleaning frequency varied and was often based on visible dirt rather than a preventive schedule, reducing its effectiveness in controlling pathogens.
In addition, farm biosecurity measures were generally weak, with limited control over animal movement, minimal restriction of visitors, and lack of dedicated equipment for different animal groups. These conditions increase the likelihood of disease introduction and spread within and between farms.

Animal health management practices were similarly inadequate. Deworming programs were inconsistently applied, and only a small number of farms treated all animals systematically. Poor parasite control may contribute to reduced immunity and increased susceptibility to infections such as HS. Record-keeping was also limited, with many farmers lacking documentation of vaccination history, disease events, and treatments. This lack of data reduces the effectiveness of surveillance systems and hinders evidence-based decision-making.

Although, no statistically significant associations were identified between specific risk factors and disease occurrence. However, the overall pattern of poor farm management and low biosecurity suggests that these factors collectively contribute to increased disease risk.

Discussion

The findings of this study support the widely recognized relationship between poor farm management, low biosecurity, and increased risk of HS outbreaks. Disease occurrence is not solely dependent on the presence of the pathogen but is strongly influenced by management-related factors such as animal health status, environmental stress, and husbandry practices (3). In particular, stressors such as poor nutrition, overcrowding, and adverse weather conditions can trigger the transition from asymptomatic carriage to clinical disease (3).

One of the most important observations is the widespread lack of effective biosecurity measures across farms, including hygiene practices, disinfection, and controlled access to farms, creates an environment that facilitates pathogen persistence and transmission. The absence of quarantine for newly introduced animals represents a major vulnerability, as it allows potential carriers of *P. multocida* to enter the herd without detection. Similarly, inadequate sanitation and lack of disinfectant use create an where pathogens can persist and spread. Biosecurity principles emphasize that prevention of disease introduction is more effective and cost-efficient than treatment after an outbreak has occurred (4)

Water management emerged as a particularly important risk factor, as untreated water sources can serve as reservoirs for pathogens. This is of particular concern because *P. multocida* can survive for extended periods in moist environments, and contaminated water can act as a source of infection (1). Additionally, environmental conditions such as high humidity and rainfall have been shown to facilitate disease transmission and increase outbreak frequency (2). Contamination of water sources may play a significant role in disease transmission, especially when combined with high animal density and environmental stress.

Inadequate vaccination practices also emerged as a major concern. Although vaccination is considered the most effective preventive measure against HS, inconsistent application and failure to maintain protective immunity can leave animals susceptible to infection (5). Studies have shown that immunity from certain vaccines may be short-lived if booster schedules are not properly followed, further emphasizing the importance of adherence to vaccination protocols (5).
The role of animal health management is also critical, as poor nutritional status, parasitic infections, and lack of preventive care can weaken the immune system and increase susceptibility to HS. The absence of proper record-keeping further compounds these issues by limiting the ability of farmers and veterinary services to monitor and respond to health problems.

While statistical analysis did not demonstrate significant associations between individual risk factors and disease occurrence, the overall pattern of findings strongly indicates that poor farm management and low biosecurity act synergistically to increase susceptibility to HS outbreaks. This highlights a key limitation of relying solely on quantitative analysis and underscores the importance of descriptive and field-based surveillance approaches in understanding disease dynamics.

From a surveillance perspective, the use of questionnaires proved to be highly valuable in identifying these weaknesses. While statistical analysis did not yield significant associations, the descriptive findings provide strong evidence that poor farm management and low biosecurity are key contributors to disease risk.

These findings have important implications for livestock production systems and food value chains. Weaknesses at the farm level can compromise not only animal health but also food safety and trade, as diseased animals may enter the production chain if surveillance and control measures are insufficient.

Therefore, strengthening farm management and biosecurity should be a central component of surveillance systems. This includes promoting vaccination, improving hygiene and sanitation, ensuring safe water and feed, implementing quarantine measures, and enhancing farmer awareness and training.

Conclusion

This study demonstrates that surveillance systems in livestock production are not only essential for detecting and confirming disease outbreaks but also serve as critical tools for identifying underlying weaknesses in farm management and biosecurity that contribute to disease risk. Through the integration of passive and active surveillance with questionnaire-based assessments, the investigation of haemorrhagic septicemia (HS) in Prachin Buri province provided valuable insights into the conditions that facilitate the occurrence and spread of infectious diseases in cattle and buffalo farms.

Although laboratory findings confirmed the presence of *Pasteurella multocida* serotype B:2 as the causative agent, the broader significance of this study lies in the identification of systemic management gaps across farms. The absence of consistent vaccination practices, lack of quarantine for newly introduced animals, inadequate sanitation and disinfection, and reliance on untreated water sources collectively represent critical biosecurity weaknesses. These factors create an environment that not only allows the introduction of pathogens but also supports their persistence and transmission within and between farms.

From a broader perspective, the findings emphasize that improving farm management and biosecurity is fundamental to strengthening livestock production systems and safeguarding food value chains. Weaknesses at

the farm level can have downstream impacts on animal health, productivity, food safety, and trade, particularly in regions where smallholder and semi-intensive farming systems predominate.

In conclusion, strengthening farm management and biosecurity must be prioritized as central components of disease prevention strategies for haemorrhagic septicemia and other infectious diseases. By addressing these fundamental issues, surveillance systems can move beyond reactive responses to become proactive tools for improving animal health, ensuring food safety, and enhancing the resilience of livestock production systems.

Keywords: Biosecurity, Farm management, Animal Health Management, Surveillance, Haemorrhagic Septicemia.

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