Optimizing Feedlot Diagnostic Testing Strategies Using Test Characteristics, Disease Prevalence, and Relative Costs of Misdiagnosis

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KEYWORDS

• Epidemiology • Diagnostic tests • Economics • Production medicine

KEY POINTS

- Diagnostic tests are frequently applied in feedlot production medicine and range from clinical observations to advanced physiologic assays.
- Positive and negative predictive values provide the greatest information to veterinarians in terms of how to interpret diagnostic test results; predictive values are determined by prevalence, diagnostic sensitivity, and diagnostic specificity.
- Economic estimates including relative costs and expected frequency of false-positives and false-negatives provide a method for evaluating the overall direct financial effects of implementing different diagnostic strategies.
- The value of retesting initially positive or negative animals changes with prevalence and is varies for different types of diseases.
- Estimates for diagnostic sensitivity, specificity, prevalence, and costs of misdiagnosis are valuable in evaluating appropriate diagnostic strategies.

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INTRODUCTION

Diagnostic strategies and interpretation of test results are a common challenge that feedlot practitioners manage on a daily basis. Diagnostic tests are performed to generate information that influences therapeutic, prevention, and disease control decisions. A diagnostic test may be as simple as a combination of clinical signs indicating a disease condition requiring therapy, or more intensive methods of specimen collection for analysis through an external laboratory. Test results may be instantaneous or may require days for a diagnostic laboratory to process and provide the information. Appropriate interpretation of diagnostic results is critical to optimizing therapeutic and preventative programs based on potential test outcomes.

Many diagnostic modalities are available to practitioners, and designing an appropriate diagnostic test strategy involves several basic principles regardless of the specific methods of diagnostic testing. Understanding the best method for interpreting diagnostic tests is critical because the test results may change the clinical decision process and influence animal health actions for the individual or cohort. More information about using and interpreting diagnostic tests is given by McKenna and Dohoo.[1]

This article provides approaches for including information on sensitivity, specificity, prevalence, positive and negative predictive values, and economics that should be considered when implementing a diagnostic testing strategy. Determining an appropriate diagnostic strategy in practice involves understanding the test characteristics, prevalence of disease, and the relative costs of misdiagnosis. **Fig. 1** provides the necessary components to consider in designing and implementing a diagnostic testing strategy for a feedlot cattle population. An opportunity exists to improve diagnostic capabilities in production medicine with the continued advancement of technology, but the evaluation of cost-effectiveness for a specific disease situation is essential for optimizing diagnostic test implementation.

SENSITIVITY AND SPECIFICITY

Diagnostic test accuracy is often reported in terms of diagnostic sensitivity and diagnostic specificity.[1,2] Sensitivity is the proportion of truly diseased animals the test correctly identifies as test positive. Specificity is the proportion of truly healthy animals classified as test-negative. Sensitivity and specificity estimates for diagnostic tests may be calculated by applying the tests to known truly diseased and truly healthy animals and determining the proportion of animals the test correctly identifies. Sensitivity

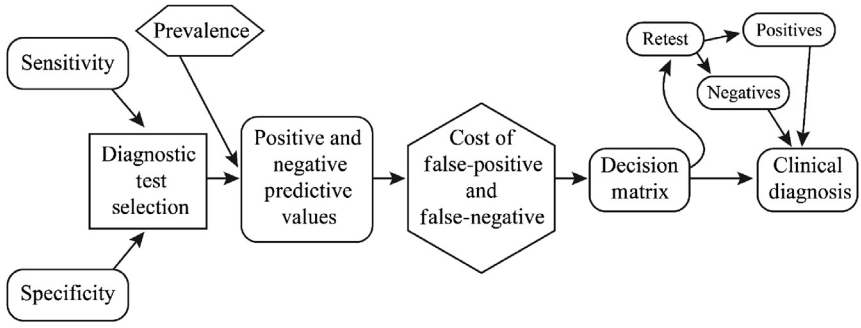

Fig. 1. Consideration for use and interpretation of diagnostic test in production medicine. (*Courtesy of* Mal Hoover, CMI, College of Veterinary Medicine, Kansas State University, Manhattan, KS.)