

A Multilevel Analysis of Pneumonia Morbidity Counts in US Feedlots

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Summary:

The incidence of initial pneumonia morbidity was followed for 12 weeks in 123 pens of feedlot cattle. Incidence density was greatest in the first week on feed and decreased in following weeks. Weekly incidence rate varied from 0 to 27.7 cases of pneumonia per 100 animal weeks at risk. Mixed sex groups, cattle from multiple sources and increasing distance shipped were associated with increased risk for initial respiratory morbidity. Increasing entry weight was associated with decreased morbidity risk.

Introduction:

Bovine respiratory disease is a major cause of disease and economic loss to feedlots in the United States accounting for 70-80% of total morbidity and 40-50% of mortality (Smith 1998). The majority of respiratory disease occurs in the first 45 days following arrival at the feedlot (Smith 1998). Economic losses include labor and treatment costs, mortality and decreased performance in affected animals. The United States Department of Agriculture, National Animal Health Monitoring System's Feedlot '99 study was designed to survey health and management of cattle in US feedlots. As part of this study, selected feedlots provided detailed daily health information of 1-3 pens of cattle from arrival to finishing.

Objectives:

To identify risk factors for increased initial respiratory disease incidence in feedlot cattle in the United States.

Materials and Methods:

Management data were collected using a questionnaire during a personal interview on 520 feedlots in 12 states in the US. As a part of the Feedlot '99 survey, feedlots were asked to track morbidity and mortality by perceived cause in 1 to 3 pens of cattle over the course of the feeding period. A total of 103 feedlots returned data on 123 pens of cattle. Data were collected on management practices of each feedlot as part of the larger Feedlot '99 study. Additionally, management practices specific to the individual study pens were collected for analysis of morbidity and mortality risk. Within each pen, cattle identified as sick or dead were recorded in specific disease categories resulting in daily morbidity and mortality counts by perceived cause. Sick cattle were also identified as initial or repeat morbidities. Cattle in the study pens were initially placed on feed between July 23, 1999 to March 22, 2000.

The analysis reported here is limited to the incidence of initial pneumonia cases. The analysis was performed using a commercially available statistical software program (Stata Corp, 2003). Summary statistics and weekly incidence rates of initial

respiratory cases were calculated for individual pens. Candidate risk factors were screened for association with morbidity counts by a univariate multilevel, negative binomial generalized estimating equation (xtgee). Management, calf and vaccination factors were screened for relationship to pen pneumonia morbidity rate. Variables that were associated with weekly morbidity counts at $p < 0.25$ were offered to a final multivariable model. The initial pneumonia morbidity count data were modeled using a multilevel, negative binomial generalized estimating equation (xtgee) to evaluate risk factors for elevated pneumonia rate.

Results:

Average cattle on feed inventory as of July 1 1999 for participating feedlots was 10,354 head. The 123 pens in the study population included 20,236 cattle. Mean pen size was 164 head with a range of 10 to 569. Yearling cattle (cattle 12 to 18 months of age) comprised 71.5% of the pens (88/123) and calves (cattle less than 12 months of age) 28.5% of pens (35/123). Pens of steers alone comprised 60% of all pens, heifers 30% and 10% of pens were mixed steer and heifer pens. Cattle in 96% of pens received an initial vaccination on arrival at the feedlot but cattle were revaccinated in only 33% of pens. In 86% of the pens, cattle originated from a single source, while in the remaining 14% of the pens (17/123) cattle originated from a mean of 2.5 different sources. Mean entry weight for all the cattle was 729 pounds (331 kg), 778 lbs (354 kg) for yearlings and 601 lbs (273 kg) for calves.

There were 1269 initial cases of pneumonia among the cattle in the study population for a cumulative incidence of 6.3%. Individual pen cumulative incidence varied from 0 to 80%. Weekly populations at risk were generated from the data and weekly incidence density rates for initial pneumonia were calculated. Incidence density rate varied among pens and over weeks from 0 to 27.7 cases of pneumonia per 100 animal weeks at risk. Incidence density rates calculated by week and across pens were highest in week one and decreased in following weeks. The highest individual pen incidence density rate occurred in week 6

In the final multilevel model mixed sex groups (RR=3.5) were at increased risk for initial respiratory morbidity. Cattle from multiple sources (RR=1.9) and arriving from increased distance (RR=1.0009) were also associated with increased initial respiratory risk. Increasing entry weight was associated with decreased morbidity risk (RR=.995). No specific vaccination practices were associated with increased or decreased initial respiratory morbidity in the final model.

Discussion:

Respiratory disease is a major cause of disease and economic loss in US feedlots. The pattern of respiratory disease in this study is consistent with that seen in other studies with the majority of disease occurring in the early part of the feeding period (Smith 1998). Losses result from treatment and labor costs, decreased weight gain and death loss. Identification of risk factors for increased disease is a valuable tool for feedlot management decision making. Reliable information on the impact of risk factors on expected morbidity rates for groups of cattle is useful in planning labor needs and discount or premium pricing.

Increasing transport distance was associated with increased morbidity incidence in this study. In contrast, Ribble et al (1995b) found no difference in

respiratory mortality in calves shipped longer distances. In this study pens that contained mixed groups of steers and heifers were at increased risk for respiratory morbidity compared to all heifer or all steer pens. Pens that contained cattle that originated from multiple sources were also at increased risk for respiratory morbidity, presumably due to increased exposure and stress. A similar relationship has been reported between level of pre-transit mixing and mortality (Ribble et al, 1995a). Entry weight and calf age at entry to the feedlot was associated with morbidity incidence. Calves were more likely to experience morbidity than yearling cattle. Yearling cattle may experience less stress in the transition to the feedlot and may have a more mature immune system compared to younger more recently weaned calves.

We were not able to show any effect of vaccination on morbidity rate. Most pens of cattle were vaccinated against viral respiratory pathogens on arrival and most received a modified live vaccine. The limited number of pens that did not receive vaccination may not have provided adequate power to detect any effect. While vaccination of incoming feedlot cattle against respiratory disease is commonly practiced, little clinical trial data are available to support the use of respiratory vaccines in cattle (Perino et al, 1997)

Results of this analysis suggest that mixing of steers and heifers in a single pen, mixing of cattle from multiple sources, increasing transport distance and decreasing entry weight increase risk for respiratory morbidity. If these practices cannot be avoided then adequate labor should be available to manage increased morbidity and purchase price should be adjusted to account for the increased morbidity.

References:

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