POPULATION MEDICINE NEWS

Epidemiology, Preventive Medicine, Public Health
Production Medicine, Computer Applications in Vet Med

August 31, 1992 5(18)

Other People's Money

The considerations, difficulties and impacts of veterinary decision making for a livestock enterprise are an order of magnitude beyond those for individuals. *"If one sees a livestock operation as a large number of individual animals, it is difficult to justify the time and effort necessary to solve a disease outbreak. The economic value of each individual is small. One draws a different conclusion, however, if the livestock operation is seen as a single entity --a business-- whose health and continued existence are dependent on the success of the investigation. The cost of failure goes beyond cold cash."*[1] Senior veterinary students, Stephanie Garlichs, Hank Greenwald, Mike Paros, Gina Lewis and Shauna Vanderhoof, in the Field Disease Investigation Unit struggled with such decisions in a recent herd outbreak investigation led by Dr. John McDonald.

As is common in herd investigations, the initial history was limited. The herd owner reported an elevated somatic cell count of 300,000 for the past 4-5 weeks, up from a historical range of 150,000-200,000. Eight cows were in the hospital string with unresponsive clinical mastitis. Affected cows did not appear clinically sick; they had no febrile response, depression, or feed refusal. Initially one quarter was seen infected with obvious flakes, and infection spread to all 4 quarters within 2-3 days. Twenty thousand colony forming units/ml of mycoplasma-like organisms were found on culture of bulk tank milk.

Do these findings indicate a mycoplasma mastitis outbreak? Not necessarily, *Acholeplasma laidlawii* has been frequently found from samples both from cows and bulk tanks and is indistinguishable on culture plates from mycoplasma[2]. Thus, our first step was to examine the hypothesis that the problem was one of contagious mastitis. We began by examining records, sampling the hospital string to identify the likely pathogens, evaluating milking machine function and identifying milking time hygiene practices which would suggest the manner of spread.

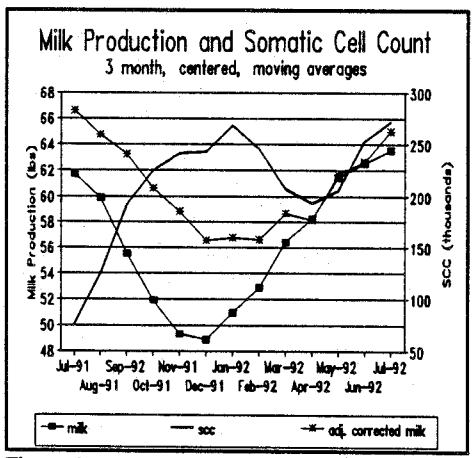

Figure 1. Milk production, adjusted corrected milk (adjusted for fat and days in milk) and somatic cell count trends over the past year.

Milk production, which had decreased during the fall and winter months, was increasing. Somatic cell count (SCC) had increased from < 100,000 to almost 300,000 during the past year. Clinical cases had high SCC, and with one exception, were mycoplasma positive (figures 1&2) while *Mycoplasma* sp. were not isolated from the bulk tank milk. Milking equipment function was found to be adequate but, milking hygiene was not sufficient to prevent transmission.

What is a reasonable solution, keeping in mind that the owner bought this herd a year and a half ago from a retiring dairyman, has replaced most of the cows and continues to bring in springing heifers. What is published about mycoplasma mastitis? How infectious is it? What is the prognosis for infected herds?

The results of a literature search revealed that mycoplasma has been reported as a relatively rare cause of mastitis. A California study reported a nearly 4% herd prevalence based on a statewide survey of bulk tank milk (BTM)[2], while reported prevalence within herds varied from 0.1 to 6.4%[3]. In a New York statewide survey, 2.3% of bulk tank samples and 11.7% of individual cow samples within positive herds were mycoplasma positive.[4] Reportedly, "a typical mycoplasmal mastitis epizootic is described as a recognizable syndrome with rapid spread within a herd, severe loss of production in affected cows, prolonged course, poor-to-nil response rates. These attributes, leading to heavy economic loss in affected dairies, make this form of mastitis of great concern to both the industry and the veterinary profession."[5]

What is the epidemiology of mycoplasma

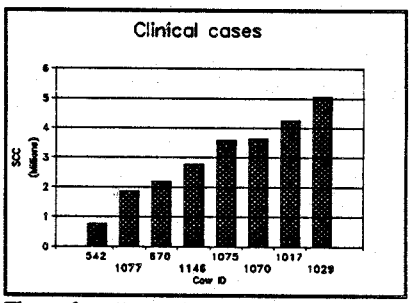

Figure 2. All cows in the hospital pen, except for 1077, were culture + for mycoplasma.

mastitis? How did the outbreak start? What are control options?

Control measures that have been uniformly recommended included: immediate segregation and culture of cows with clinical mastitis, control of fomite transfer such as milking machines through use of pre-dipping, backflushing, and post-dipping, single-use syringes or discontinuance of intramammary therapy, careful disinfection of hands during milking and treatment, and segregation of new stock until found to be culture negative.[6,7,8] Proper functioning of milking machines has also been considered critical, especially if vacuum fluctuation is evident.[7] Recommended monitoring procedures include monthly or biweekly BTM culture to detect carriers early in outbreaks.[9]

In a review of mycoplasma mastitis Bushnell summarized "a vet may discover that during the initial 2-3 months of clinical mycoplasma nearly all of the cows with detectable mycoplasmal infection have been culled or are exhibiting signs of persistent mastitis with typical mycoplasma-induced secretions. At this stage of infection, it is highly probable that few, if any, nonclinical shedders remain in the milking strings or in the dry cows unless they have been contaminated during dry-off therapy. In this situation,

the threat of disease may be limited to the cows that are found to be clinical."[8] Thus, one option is to do nothing but improve milking hygiene and culture clinical cases. On the other hand, several experts we consulted highly recommended whole herd culture.

How expensive is mycoplasma culture? Using culture, can we reliably identify all infected animals? What happens if we don't?

Mycoplasma culture, in addition to that for routine mastitis pathogens, costs a minimum of $10/sample at Washington Animal Disease Diagnostic Lab. It requires special media and incubation times of 3-7 days due to the organism's slow in vitro growth.[8] Not only were we faced with the nagging reality that culture costs alone for this 273 cow herd would be close to $3,000 but we were concerned about transmission while waiting for results, if milking hygiene practices were inadequate.

Is this outbreak endemic or epidemic? Do we really need to culture all cows to identify shedders? Do we really need to identify all shedders to control the outbreak? Is it possible to identify all shedders without multiple whole herd cultures? How good is bulk tank milk culture to monitor success of milking hygiene improvements? And if bulk tank culturing is adequate to detect infected cows the whole herd culture misses, why not just use bulk tank culture in the first place?

BTM culture is useful for herd screening and routine surveillance;[4] unfortunately it is not fool proof. Jasper points out that one subclinical cow may shed large numbers of mycoplasma, providing a positive BTM result, while latent infections may intermittently shed low numbers that are undetectable on BTM or even quarter-sample culture.[7] In a survey of 50 California herds, Gonzales found 2 herds with mycoplasma positive BTM culture that had 1/307 and 2/548 of cows infected on 4 quarter composite culture. However, in one herd BTM culture was negative yet individual samples detected 36/1,326 infections.[10] Brown tried to minimize expense by pooling samples containing milk from 10 cows. Unfortunately, 21/153 samples were positive so two whole herd cultures were necessary.[9] The accuracy of BTM culture compared to individual cow cultures, in what we assumed was a naive herd just recently exposed to mycoplasma for the first time, led to some lengthy discussions (see textbox).

Recommendations in order of importance:

1. Milking parlor techniques
   a. Manually backflush with disinfectant solution (50 ppm iodine) between cows.
   b. Have milkers wear disposable gloves and disinfect hands between cows.
   c. Leave pre-spray on each teat for at least 30 seconds.
   d. Forestrip (prime) with pre-spray still on the teats, taking care to avoid all hand contact with the milk.
   e. Wipe each cow's teats with a single use towel.
   f. Continue post-spray application on teats.
2. Initial culturing options (choose one)
   a. Culture all cows in the herd individually, and segregate all Mycoplasma positive cows into a subherd to be milked last and/or cull. Repeat the culture on all negative cows in one month if the bulk milk is positive or new clinical cases occur.
   b. Culture all cows by combining 10 cows' samples per culture (a positive result will necessitate individual cultures).
   c. Culture those cows with SCC > 500,000 and/or those showing signs of clinical mastitis
   d. Culture only clinicals
   e. Monitor bulk tank milk biweekly
3. Herd monitoring procedures
   a. Culture bulk milk weekly for the next 3 months, then monthly.
   b. Culture all fresh cows and all new cases of clinical mastitis.
   c. Quarantine and culture all herd additions, do not add to herd until culture negative.
4. Control
   a. If a large number of Mycoplasma-positive cows are detected on first herd culture, establish a Mycoplasma string to be housed separately and milked last.
   b. If economically feasible, cull all Mycoplasma-positive cows.

A spreadsheet cost analysis was attempted, only to point out that numerous assumptions were needed, many of which made us uncomfortable. The assumptions made for the what-if table analysis were 1) culture results are 100% sensitive and 100% specific; 2) transmission potential is 1, that is one infected cow will infect one and only one susceptible; 3) reduction in transmission by changes in milking time hygiene could be made in the absence of whole herd culture; 4) clinicals are removed from the herd immediately after detection. These assumptions are simplified, but provide a starting point for discussion. Figure 3 shows a break-even graph derived from our what-if table.

Initially, the recommendation for whole herd culture seemed to be a straight forward solution; however, realities of the economic impact of this recommendation and the imperfect sensitivity kept haunting us. How can we make appropriate assumptions to assess the economic impact of our recommendations? The following questions remained unanswered: 1) Is this truly a naive herd, with no latent infections? 2) Will all shedders become clinicals? 3) Are milking time practices in place to shut down transmission? 4) If they are not, of what value is a whole herd culture that probably won't detect all infected udders? 5) With a week-long turn around time for mycoplasma culture results, how many cows will become infected before subclinicals are identified? 6) How reliable is bulk tank culture? In an upcoming issue we will consider a model that promises to simplify our decision.

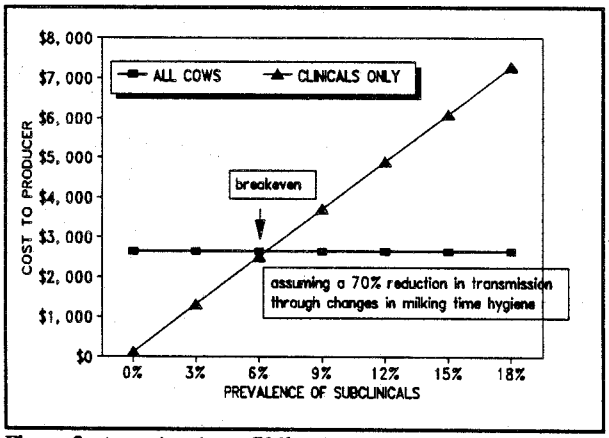

Figure 3. Assuming that a 70% reduction in transmission could be produced by changes in milking time hygiene, >6% prevalence of clinicals would be required to justify whole herd culture.

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POPULATION MEDICINE NEWS is produced by the Washington State University Field Disease Investigation Unit, Pullman, WA 99164-6610 (509-335-0711) and is supported in part by the WSU Cooperative Extension Service. Viewpoints expressed are not necessarily those of the University or its Administration. This newsletter may be copied by anyone. Editors: Dale Hancock and Susan Holler.