



## New York State Cattle Health Assurance Program Mastitis Module *Mastitis: Background, Management and Control*

### **Introduction**

Mastitis remains one of the most costly diseases of dairy cattle in the US despite extensive research and control efforts. However, basic changes in the structure of the dairy industry, continued application of new research discoveries and an emphasis on food safety have improved milk quality. Continued improvement in milk quality and the reduction of lost profits from mastitis is based on the continued application of science to the identification of risk factors at various levels including the pathogen, the cow, the herd and the farm environment. The milking system and milk harvesting procedures also present a variety of risks for new infection. The development and application of Standard Operating Procedures (SOP's) provides more uniform application of milking procedures.

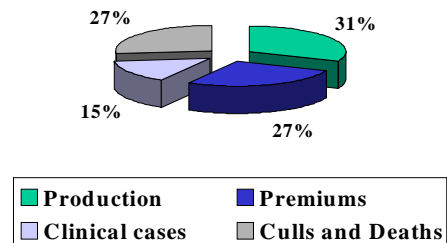
### **Economics**

Mastitis is the most costly disease of dairy cattle with losses due to discarded milk, early culling, drug costs, veterinary costs and increased labor. There is also an inherent loss of production and a significant decrease in quality of milk that results in decreased cheese yield and a shorter shelf life of fluid milk. The level of mastitis in the herd also impacts milk components. Lactose, fat, solids-not-fat, and casein are reduced while whey proteins, chloride, sodium, pH, free fatty acids and somatic cell count are increased. All of these factors have a negative effect on milk quality and ultimately on dairy products.

Current estimates of the economic losses incurred by dairymen average \$225/cow/year. 70% or more of the

economic losses are due to subclinical mastitis and its associated production losses. Additional costs are from clinical cases and losses due to early culling and death.

**Figure 1. Approximate distribution of costs**



The losses from subclinical infection are often difficult for the producer to appreciate because they are associated with decreased milk production and quality. Most cases of subclinical mastitis are associated with contagious organisms (*Strep agalactia* and *Staph aureus*) or environmental organisms such as *Strep uberis* and *dysgalactia*. Total milk losses in quarters with subclinical infection range from 10 to 26%.

### **Epidemiology of Mastitis**

Mastitis is a complex disease problem. It involves the intricate interaction of microorganisms host factors (age, stage of lactation, etc.) and the environment.

It is necessary to categorize the bacterial causes of mastitis as contagious or environmental in order to better understand the disease process.

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### Micro organisms associated with the two main types of mastitis

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#### Contagious Mastitis Organisms

*Streptococcus agalactiae*  
*Staphylococcus aureus*  
*Streptococcus dysgalactiae*  
*Mycoplasma sp.*

#### Environmental Mastitis Organisms

*Streptococcus sp.*  
*Streptococcus uberis*  
*Escherichia coli*  
*Klebsiella sp*  
*Enterobacter sp.*  
*Serratia sp.*  
*Proteus sp.*  
*Pseudomonas sp.*  
*Corynebacterium sp.*  
Yeasts, Mold and Fungi  
*Prototheca*

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**Contagious mastitis organisms** often involve the transmission of infection from a carrier to a susceptible animal primarily during the milking process. Reduction in the number of new infections is a major goal of any contagious disease control program. This is accomplished by means of optimizing milking procedures and hygiene and post milking teat dipping. Eliminating existing infections is accomplished with treatment during lactation and/or dry off or by means of culling. Separation of infected animals from susceptible animals, particularly during the milking process is also an effective means of reducing exposure to infection. Most contagious organisms cause new infections early in lactation (within 60 days of calving).

**Environmental mastitis organisms** are opportunistic and can infect the mammary gland when the environment is contaminated with these organisms to the point where they can gain access to the teat cistern. There is a wide range of microorganisms that can invade and infect the udder, however Coliforms and environmental streptococci are the most important. Severity and duration of infection are dependant upon the type and strain of organism involved as well as a number of host factors that may include metabolic and nutritional status, existing disease, age and stage of lactation. Sources of

environmental exposure include manure, bedding, water, dirt, mud and feed. Adequate use of clean, dry bedding is crucial to minimizing exposure to environmental mastitis. This is particularly critical during the dry and transitional period. Frequent cleaning and application of new bedding to the maternity are has also been identified as a means of preventing new environmental mastitis infections. Milking procedures, properly functioning milking equipment and pre and post milking hygiene can also influence the number of new infections.

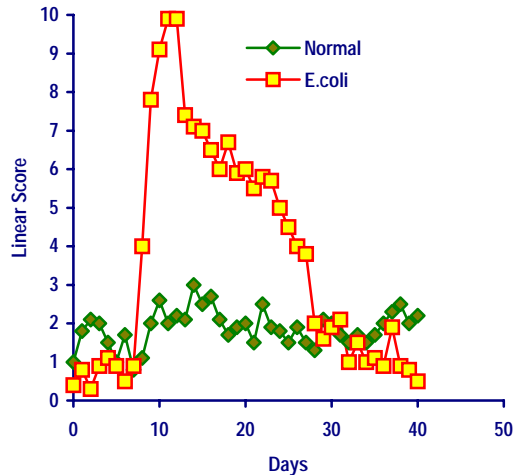
*'The number and types of mastitis pathogens present in a herd depend upon the level of exposure to those organisms and the effectiveness of control measures'*

#### The Cow's response to infection

After bacteria come into the mammary gland, the immune system recognizes the pathogens and attempt to remove this intramammary infection immediately. Regardless of the type of bacteria that cause the initial infection, immune cells move rapidly from the blood stream into the infected quarters. If the bacteria are destroyed, recruitment of cells into the mammary gland is ceased, and only a mild

inflammatory episode will be required to restore health. The cell count response of a cow with a successful response is shown in the figure below.

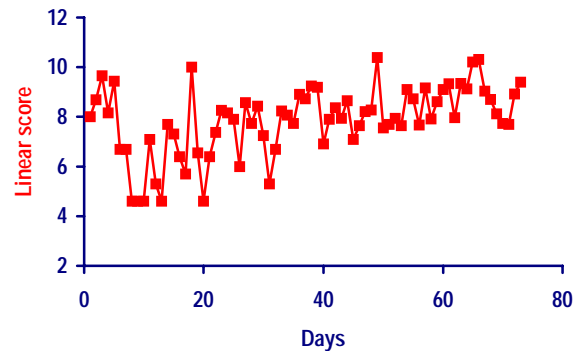
**Figure 2. Somatic cell count pattern in the successful response of the mammary immune system to an incoming bacterial infection.**



Occasionally, the defense mechanisms of the infected mammary gland loses the battle with bacteria, and bacteria multiply. A more serious response with systemic clinical signs may occur. Body temperature increases, cells are mobilized, blood flow increases, and in some extreme situations a massive response occurs that leads to systemic shock-like symptoms. In other cases, a more chronic response may occur, bacteria multiply and the immune system is continuously activated.

Chronic infections result in long term high somatic cell counts in milk. It has been suggested that intra-cellular survival of bacteria is essential in the pathogenesis of such chronic infections. In the Figure below, such a chronic increased somatic cell count pattern is shown.

**Figure 3. Typical somatic cell count pattern of a chronically infected cow**



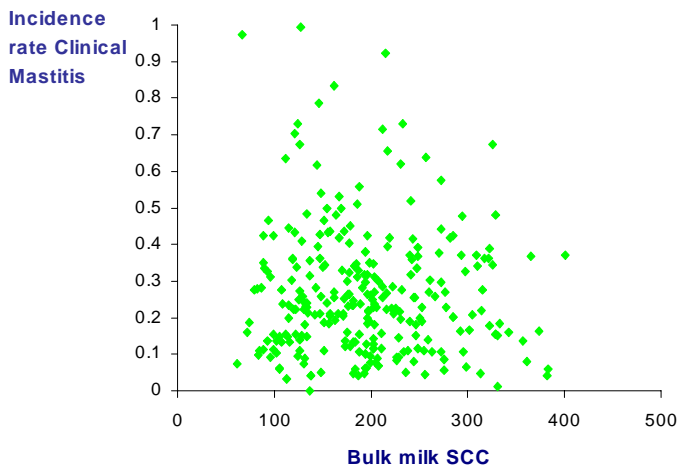
It is important to distinguish between these two types of immune responses to an infection. In most situations, we only need to intervene with treatment or other measures if a more chronic infection occurs. Using individual cell count measurements, it is possible for every producer to distinguish between these two types of infection.

### Herd cell count levels and clinical mastitis

There appears to be somewhat of a negative correlation at herd level between the types of responses that was discussed above. When the number of chronic infections in a herd is low, the bulk milk somatic cell count is usually also low. Herds that have very few cows with chronic infections appear to have more acute short-term infections.

Recently, it was reported that there was an increase in herd level incidence of clinical mastitis with a decreasing bulk milk SCC. A slight increase in clinical mastitis in herds with a low bulk milk SCC was shown (see figure), also a greater proportion of clinical cases with systemic signs of illness were observed in herds with a low bulk milk SCC compared to herds with a higher bulk milk SCC.

**Figure 4. Relationship between bulk milk SCC and clinical mastitis incidence**



Hence, irrespective of bulk milk cell count levels, mastitis and mastitis control remains a very important issue on every dairy farm. This NYSCHAP module is specifically designed to work on mastitis prevention in all herds. Clearly risk factors in herds with low or high cell counts will be different, and a tailored program will need to be designed for each farm.

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## **Diagnosis**

Clinical mastitis is most commonly diagnosed by examination of the udder and the observation of abnormal milk during the milking process. Newly developed tools such as electrical conductivity sensors are available to aid in the diagnosis. Subclinical mastitis is usually diagnosed with the aid of individual cow somatic cell scores, available through DHIA. There are also other tools available such as the CMT paddle, or more recently developed sensors. When milk is sampled from cows affected with mastitis and submitted for bacteriological culture, information on the most important microorganisms that cause mastitis in the herd becomes available.

### *Individual cow samples*

Milk cultures of clinical quarters, fresh cows, high SCC, chronic infections or the entire herd will provide a wealth of information concerning udder health and provides a basis for attacking the problem. Combining data from milk cultures and SCC information provides you with a herd inventory of mastitis pathogens, a picture of their distribution and an indication of the relative importance of each pathogen within the herd. This information can be used to identify risk factors and critical control points for control program development. It will also serve as a guide for developing realistic short and long term milk quality goals and provide the means for monitoring progress towards those goals

### *Bulk Milk Cultures*

Sampling the bulk tank milk is a simple, inexpensive means of determining the presence of mastitis pathogens in a herd. This culturing method does have its limitations and is best suited for the identification of contagious mastitis pathogens and for monitoring the presence of pathogens over time. In no way does the presence of a pathogen or the relative numbers of a specific pathogen present on

the plate indicate the prevalence of infection within the herd. Bulk tank culture results not only reflect the mastitis pathogens present in a herd but also identify those organisms may contaminate milk from the teats of cows milking environment or milking equipment. For that reason BTC can also be used to evaluate milk quality, milking methods and procedures and overall level of hygiene of milk collection and storage on the farm.

### **Risk Assessment**

Depending on the main type of mastitis organisms present in the herd, the strategy to reduce the amount of mastitis or prevent the occurrence of more new infections may be radically different. The NYSCHAP mastitis module offers a series of risk assessment tools that are specifically designed to deal with each type of mastitis organism. The most important preventive and therapeutic actions that the producer should consider are summarized by type of farm (high cell count versus low cell count) and by each group of micro organisms. Depending on the farm specific goals and farm specific problem situation, a risk assessment will be done and a specific herd plan will be developed.

### **NYSCHAP Mastitis Module**

The NYSCHAP mastitis module follows the flow of the NYSCHAP management circle. Farms specific goals, risk assessment, herd plan, implementation and follow-up will be discussed with the dairy producer and a team of health specialists. Key members of the team include the staff on the dairy, the regional State Veterinarian, the practitioner and, in this situation, a Quality Milk mastitis expert. Participation in the NYSCHAP mastitis module provides you with all advantages and recognition of a NYSCHAP producer. In addition, NYSCHAP mastitis module participants will receive six free bulk milk cultures on an annual basis.

### **How to Enroll in NYSCHAP**

To enroll in NYSCHAP, contact your herd



veterinarian. They will then make arrangements with the regional field veterinarian from the Department of Agriculture and Markets. For additional information, contact one of the sources below:

To enroll or contact a state field veterinarian, call NYS Division of Animal Industry at 518-457-3502.

For diagnostic testing services or information, call the Diagnostic Lab at Cornell University, 607-253-3900.

For mastitis testing or information, call Quality Milk Promotion Services at the following locations:

- Central Laboratory, Ithaca, 607-255-8202
- Northern Laboratory, Potsdam, 315-265-6227
- Eastern Laboratory, Cobleskill, 518-255-5681
- Western Laboratory, Geneseo, 716-243-1780

For general information call the NYSCHAP coordinator, at 607-255-8202

Visit the NYSCHAP website at:  
<http://nyschap.vet.cornell.edu> or email us at [nyschap@cornell.edu](mailto:nyschap@cornell.edu)

