P-MP-1

Lowering SCC is Not a Guessing Game

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5 W's & an H of Problem Solving

I keep six honest serving-men
(They taught me all I knew);
Their names are What and Why and When
And How and Where and Who

Kipling "The Elephants Child" 1902

- **Who ?**
- **What ?**
- **Where ?**
- **When ?**
- **Why ?**
- **How ?**

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All problem solving is best served by a systematic approach. For more than a century, the 5 W's and an H scheme from Rudyard Kipling's children story The Elephant's Child has been used as an outline for an investigative approach.

What are the right questions?

Who ?

- Dry Cows ?
- Lactating Cows ?
  - 1st lactation ?
  - Older cows ?
- Individual Cows ?

Where or When?

- Seasonal?
- Stage of lactation?
- During dry period?
- At calving?
- Location / Pen ?

What or Why?

- Mastitis pathogens?
- Bedding management?
- Cow prep?

How can we improve?

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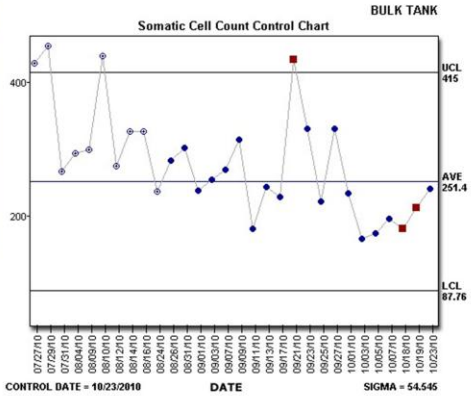
Step 1. What is the problem?



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We are going to be speaking today in the context of the current 400,000 SCC challenge we are facing as an industry BUT this approach is as valid for our efforts to reach all herd management or milk quality goals. The obvious place to start is consideration of the BTSCC of milk being shipped to the processor. All dairy producers will have this information. Unfortunately this is the only SCC information that many producers have. The BTSCC is not as good an assessment of herd mastitis as is the DHISCC because the high SCC cows will not be included. However, in spite of this weakness routine feedback of BTSCC does provide some general insight into the herd's milk quality/mastitis management. Summary analysis of these data provide a measure of both the mean BTSCC and the pickup to pickup variation. Both these measures can be useful in finding a starting point to begin SCC mitigation. Milk pickup to pickup variation is particularly indicative of process consistency. High variation indicates a lack of consistency while low variation indicates consistent application of mastitis/milk quality BMP. Because of the nature of BTSCC data, the BTSCC mean and variation are not entirely independent, but in our studies approximately 50% of the variation in BTSCC is explained by process variation. Benchmarking BTSCC mean and variation is helpful in differentiating whether the BTSCC mean is being influenced by poor procedures or inconsistent application of procedures.

Probability of a > 400,000 BTSCC during the next 30 days

Lukas et al JDS 91: 433-441, 2008

BTSCC VARIATION Between Milk Pickups (Sigma)	RANGE BTSCC AVERAGE (X 1000)					
	100-149	150-199	200-249	250-299	300-349	350-400
10 – 20,000	4%	6%	7%			
20 – 30,000	5%	9%	14%	31%	51%	81%
30 – 45,000	7%	13%	23%	45%	68%	>90%
45 – 60,000	17%	21%	33%	55%	73%	>90%
60 – 75,000		23%	40%	56%	75%	>90%
75–100,000		33%	44%	57%	80%	>90%
100-125,000				62%	77%	>90%
125-150,000					81%	>90%

Mean BTSCC of herds never over 400,000 = 171,000 ± 29,000

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If we know the current herd BTSCC mean and variation we can estimate the probability that this herd will have a BTSCC greater than 400,000 in the next 30 days. For example, the BTSCC plot for the dairy on the previous slide indicated that the dairy had a BTSCC mean of 251,000 with a pickup to pickup variation of 54,000. What is the probability that this herd will have a BTSCC >400,000 during the next 30 days? Based on this probability grid, there is a 55% chance of this occurring. Some of you may be asking, does that mean that to never go over the 400,000 BTSCC requirement, I need to have a BTSCC less that 250,000? That depends on how consistent you are at applying BMP. Notice the huge effect of variation.... herds with less than 250,000 BTSCC and also low variation have very little chance of going over the 400,000 level. In a study of 1500 Upper Midwest dairies with all their BTSCC tests for two years we asked the question... what was the average BTSCC for herds that in two years never had a single BTSCC >400,000? You can see that herds never violating the 400,000 had a BTSCC mean of 177,000 with a variation of 29,000. There is a more sophisticated version of this probability grid found on the U of M Dairy Extension website (URL shown on this slide). In addition to the 400,000 BTSCC level, this Excel spreadsheet using your last 20 BTSCC pickup tests will benchmark your variation compared to what is the “expected” variation for a given level of BTSCC mean also considering herd size and seasonal factors as well as give you the probability of going over several BTSCC standards during the next 30 days.

Could solve milk quality problem overnight

Win milk quality battle but still losing mastitis war

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If you don’t have any other SCC data /records, you still could solve the high BTSCC problem with a concentrated effort using a CMT paddle and a quarter milker to meet the milk quality expectation, BUT without good SCC records this is about as far as you can go. Although by merely identifying the high SCC cows/quarters to exclude from the bulk tank, you may temporarily win the milk quality battle but you will still be losing the mastitis war so to speak.

Step 2. Define the problem

To define the SCC problem you will need:

- DHI and/or on-farm herd records
- *Monthly* individual cow SCC tests
- Clinical mastitis records
- Farm observations
- Bulk tank and individual cow cultures

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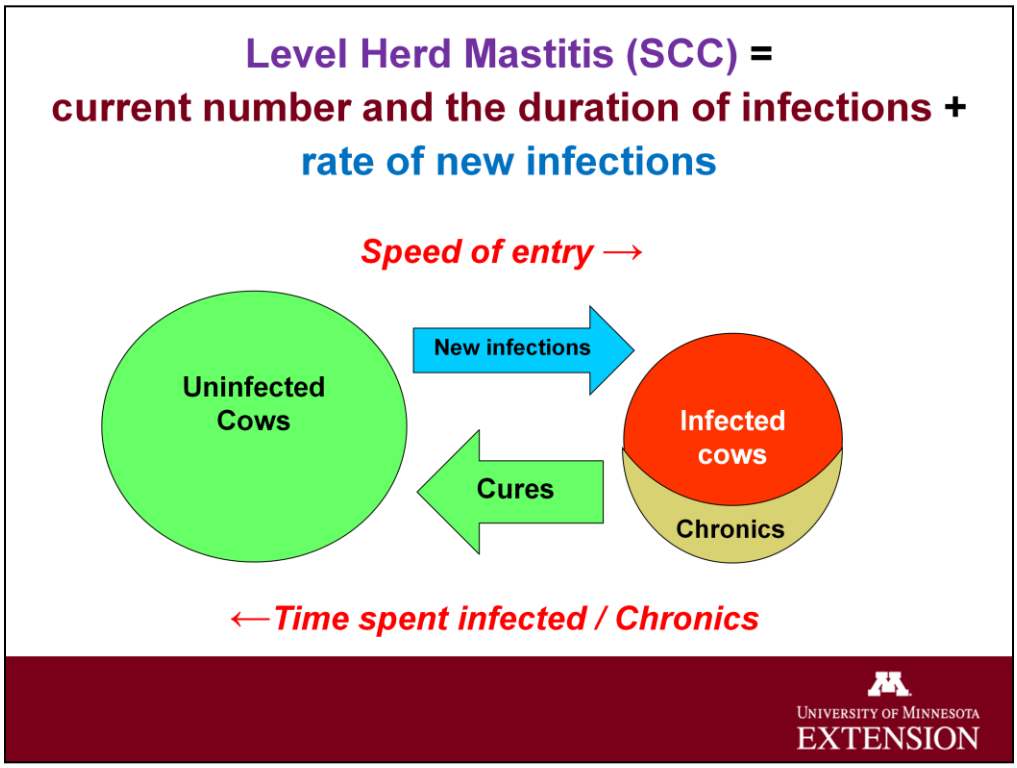
Successful mastitis/milk quality problem solving requires that we further define the problem. In order to do this, you will need.....



This diagram is helpful in visualizing herd mastitis/SCC dynamics. Number and duration of infections can be mediated by such management interventions like treatment (dry cow and lactational therapy), vaccination, and balanced nutrition to assure a competent immune system. Everything else we do in mastitis control is aimed at reducing new infections. New infection rate is the single best indicator of how our mastitis control programs are working. It is also important to pay attention to whether there is a buildup in chronically infected cows. The presence of large numbers of chronically infected cows will almost always result in an excessively high herd SCC.

SCC Benchmarks for Minnesota DHIA Herds

(Leuer & Reneau 2011)

SCC category	SCC Ave	% > 200	% NIR	% Chronic	RHA milk lbs	RHA Prot lbs	RHA Fat lbs
<200	157	16.4	8.1	8.3	23,186	706	865
200-299	251	24.7	10.5	14.2	22,275	681	831
300-399	350	32.9	12.5	20.4	20,610	636	780
>400	513	43.4	14.2	29.2	18,906	589	728

n = 1812 herds & 66,296 monthly DHIA records 2007-2010

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% >200 = % of cows with SCC >200,000; % NIR = % new infection rate; % chronics = % cows with 2 or more consecutive months with SCC >200,000

Previous to this study, benchmark thresholds were anecdotal based on personal experience, etc. and not based on careful analysis. With these data, dairies and their consultants can effectively benchmark individual herd SCC performance to more accurately determine herd SCC dynamics and more accurately prescribe appropriate and effective mastitis control intervention in order to reach the herd's SCC goals.

DHI Record Measures of Udder Health

- **% New infection rate estimate**
  - Definition = cows that begin lactation with >200,000 or during previous monthly test <200,000 and for current month >200,000
- **Herd SCC expectation**
  - **4-7% improving**
  - **8-12% maintaining**
  - **>12% increasing**
- **% of herd > 200,000 (< 20%)**

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DHI Record Measures of Udder Health
(continued)

- **% chronic infection for herd <200,000 (<10%)**
  - Definition chronically infected = cows with 2 or more months >200,000
- **Average Linear SCC (80% Herd LnSCC <4 & 90% heifers LnSCC 1-3)**

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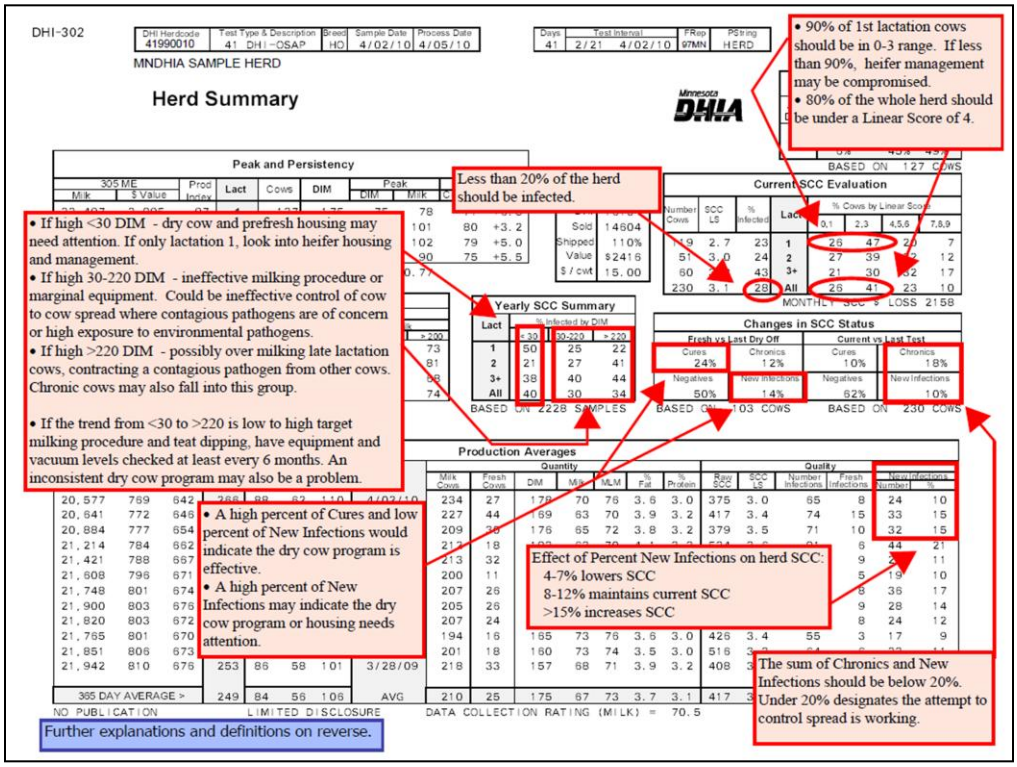

For any herd with DHI records being processed through DMRS in Raleigh, NC, the above herd summary #302 is available on request. Minnesota DHIA has developed an excellent factsheet to interpret the herd SCC information. The same or similar SCC measures can be found on the DRMS herd summary report #202 and other DHI record center reports.

Who? When? Where?

Yearly SCC Summary			
Lact	% Infected by DIM		
	< 30	30-220	> 220
1	14	4	5
2	9	5	9
3+	16	7	19
All	13	5	10

BASED ON 5411 SAMPLES

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This Yearly SCC Summary report (Herd Summary #302) summarizes the % of cows with SCC >200,000 by days in milk. It allows you look across the herd to see the pattern of when sub-clinical infections are occurring. Who…which lactation group?; When/Where… in which lactation do infections occur? The above example is a 500-cow dairy with an average annual DHISCC of ~75,000. Note that this summary includes 5411 test samples making the composite information pretty credible.

Effect of Season on Fresh and Current New Infections

(Leuer & Reneau 2011)

SCC Category	% Fresh NIR	Month	% Milking NIR	Months
<200	11.8	June	8.1	Jul, Aug
200-299	14.1	June	10.5	Jul, Aug, Sep
300-399	15.6	June	12.5	Jul, Aug, Sep
>400	15.7	June	14.2	Jan, Feb, Jul, Aug

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MN dry cow housing in April = wet conditions and higher teat exposure to mastitis pathogens

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Teat End Condition Jan/Feb

Chapped teat with very rough teat end

Excessive hyperkeratosis with rough and "cracked" teat end

Photos courtesy of IBA, Millbury, MA

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New Infection Rate Estimates

Production Averages													
	Quantity							Quality					
Date	Milk Cows	Fresh Cows	DIM	Milk	MLM	% Fat	% Protein	Raw SCC	SCC LS	Number Infections	Fresh Infections	New Infections Number	New Infections %
7/13/10	499	58	160	80	84	3.4	2.9	65	1.6	31	10	24	5
6/10/10	491	67	157	80	83	3.6	2.9	75	1.5	29	3	20	4
5/10/10	503	55	167	79	83	3.5	2.9	96	1.6	37	14	29	6
4/08/10	493	46	165	81	85	3.5	3.0	72	1.5	28		21	4
3/04/10	517	67	161	81	85	3.6	3.0	57	1.6	39	8	27	5
1/28/10	510	42	159	81	85	3.7	3.1	70	1.6	33	1	19	4
12/28/09	516	65	153	79	83	3.8	3.0	67	1.7	39	10	25	5
11/27/09	492	72	150	77	80	3.8	2.9	59	1.5	27	5	17	3
10/22/09	501	66	155	73	78	3.8	3.0	80	1.7	39	6	26	5
9/14/09	521	83	155	75	81	3.6	2.9	109	1.8	54	13	37	7
8/06/09	499	81	159	80	85	3.5	2.9	82	1.7	41	12	26	5
6/29/09	489	58	166	75	79	3.6	2.9	74	1.6	39	9	22	4
AVG	504	64	158	78	83	3.6	3.0	76	1.6	36	8	25	5

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The slide shows another section of the #302 Herd Summary report. Here we can see the trend of new infections in lactating cows across the year. Since both the number of fresh cows and the number of fresh cows with SCC >200,000 are also listed, one can also easily calculate the percent of fresh cow infections across the year.

Current SCC Evaluation

Current SCC Evaluation

Number Cows	SCC LS	% Infected	Lact	% Cows by Linear Score 0,1	2,3	4,5,6	7,8,9
203	1.4	5	1	65	26	9	
135	1.5	4	2	51	39	9	1
146	1.8	10	3+	49	38	12	1
484	1.5	6	All	56	33	10	1

MONTHLY SCC $ LOSS 0

Yearly SCC Summary

Lact	% Infected by DIM < 30	30-220	> 220
1	14	4	5
2	9	5	9
3+	16	7	19
All	13	5	10

BASED ON 5411 SAMPLES

Changes in SCC Status

Fresh vs Last Dry Off		Current vs Last Test	
Cures	Chronics	Cures	Chronics
10%	2%	2%	1%
Negatives	New Infections	Negatives	New Infections
82%	6%	92%	5%

BASED ON 290 COWS BASED ON 484 COWS

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The slide shows another section of the DRMS #302 Herd Summary. Most of the SCC measures needed to benchmark your herd can be found in this section of the herd summary report.

Test Day Bulk Tank – DRMS #421

Sum of Test Day Weights	1853
Bulk Tank Weight Reported	1923
Milk Price Reported	19.20
Value of Bulk Tank	356

Number of Milking Cows	33
Milk Per Cow	58
SCC Average	**280**

Barn Name	Milk	Cur. SCC	Prev. SCC	Value Adjusted by SCC	% of SCC in Tank	Without This Cow SCC	Without This Cow Income	Without This and Higher Cows SCC	Without This and Higher Cows Income
CHRISSY	93	3676	1056	16.62	**65.9%**	100	341.26	**100**	341.26
20	53	650	566	9.72	6.6	269	345.60	83	335.77
BECKY	71	400	38	13.33	5.5	275	342.14	69	321.80
SWISS	49	460	264	9.20	4.3	275	346.37	57	312.16
B34	53	174	38	10.28	1.8	283	345.60	53	301.74

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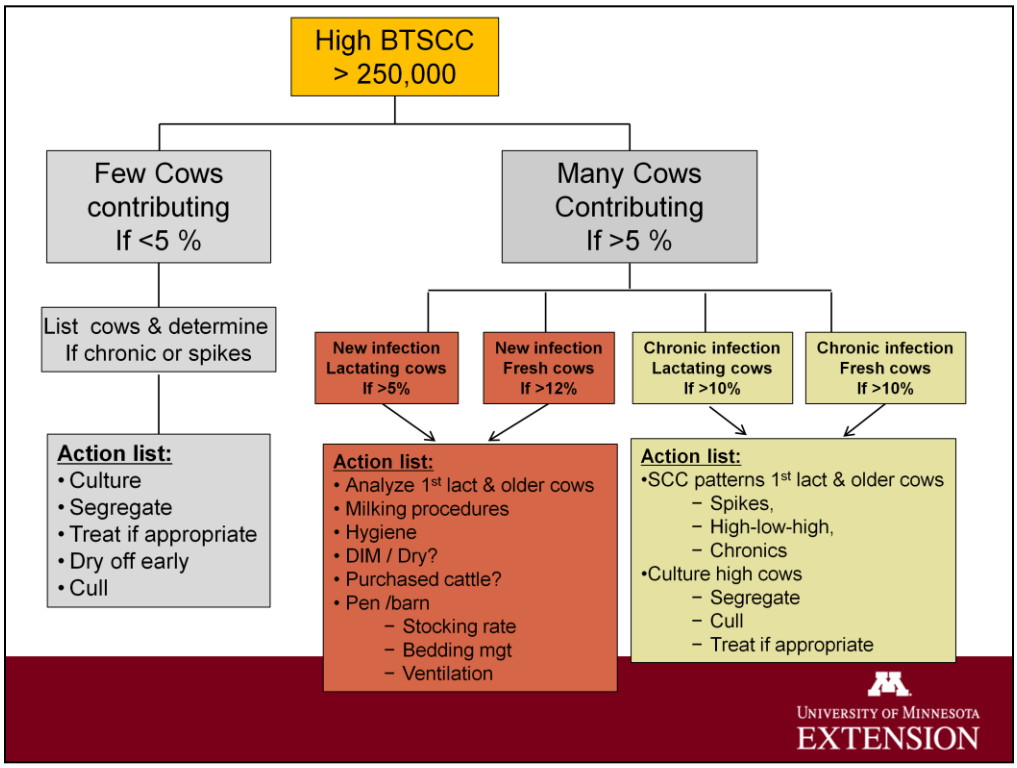
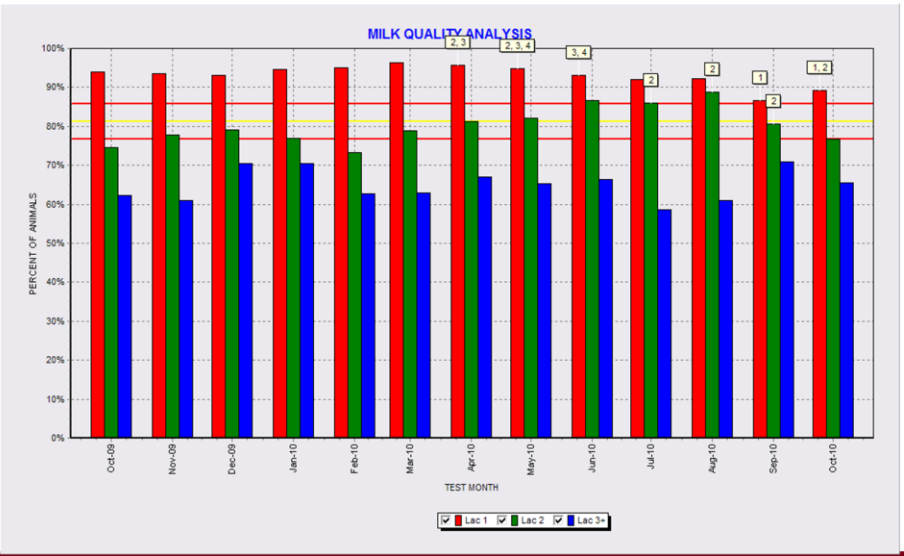
Understanding “which” cows are contributing to your high herd SCC is very important to solving the problem. This is why monthly individual cow SCC testing is important. This slide shows a DRMS #421 report of high SCC cows with their calculated individual contribution to the bulk tank. This particular list of “high SCC cows” is from a 500-cow dairy with an average annual DHISCC of 75,000. Note that even in this herd just a few cows will account for a relatively high percentage of the herd SCC. In this case, 5 cows accounted for 21% of the bulk tank SCC and without these 5 cows, the DHI herd SCC would have been 51,000 instead of 65,000. This list is also found on the DRMS SCC Flex report #371. Similar reports can be generated by other DHI record systems and by Dairy Comp, PC Dart, or any other on-farm dairy record software.



Using the SCC benchmarking table (slide#9) and the above SCC problem solving flow chart, you can develop an action plan for your farm. Is your high SCC problem an individual cow (just a few cows contributing) problem or is it more of a herd problem (more than 5% of cow contributing)? If it is a herd problem, is it a fresh cow problem or a lactating cow problem… or both? Using the answers to these questions, you are ready to better target which observations and sampling strategies make the most sense for your herd.

Herd Detective™ - % non-infected



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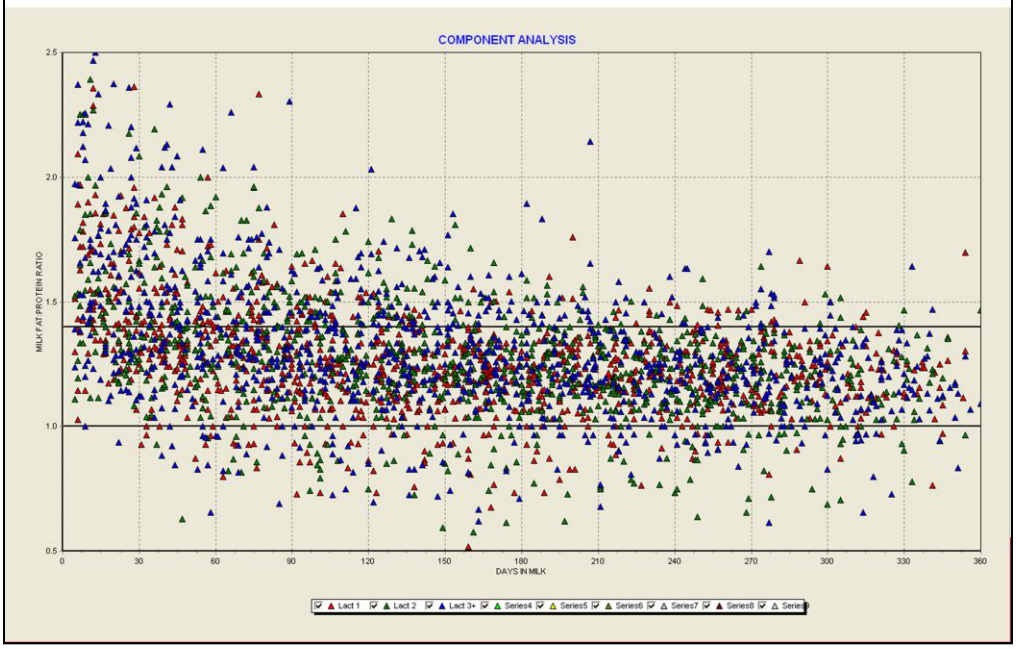
Herd Detective™ is a records analysis software sold by DRMS for further analysis of dairy records. This software allows dairy consultants to easily extract data from almost any records system (Dairy Comp, PC Dart, DHI Plus, Dairy Plan, Dairy Quest, Accu-Trak, Dairy Champ) and in a standardized way drill down into the herd data to help uncover herd problem areas. This slide shows one of the several graphs under the "Milk Quality" tab showing the percent of cow non-infected (less than 200,000 SCC) by month and lactation. This software also uses statistical process control charting to indicate with statistical certainty when a "real" shift is occurring in the data. For example, this graph indicates (using Western Electric run rules) that during the period from April-October, the 1st lactation cows in this herd had a significant SCC improvement. During July-September, 2nd lactation cows also significantly increased the percent of non-infected cows while 3+ lactation cows remained the same.

Herd Detective™ – Fat/Protein Ration on Transition Cows



This Herd Detective™ slide shows a scatter plot utilizing individual cow component analysis to plot the milk fat:protein ration by days-in-milk for the past year at this dairy. It is well known that when a high percentage of cows (>40% on any single test day) have a fat:protein ration >1.4, there is likely an underlying level of sub-clinical ketosis in the herd. This particular herd had more than 50% of all cows with high fat:protein ration at the first DHI test day. It is also well known that sub-clinical ketosis can impair normal immune system response and thus make cows more vulnerable to infection including mastitis. Since this herd has a very high percent of cows calving with high SCC, it is very likely that a transition cow feeding problem could be at least partially contributing to the herd milk quality/mastitis problem. This slide shows how this kind of problem solving software can help the dairy consultant illuminate the potential causes of herd problems.

Identify what are the bacterial causes

- Bulk tank milk cultures
- Individual cow cultures
- Bedding cultures

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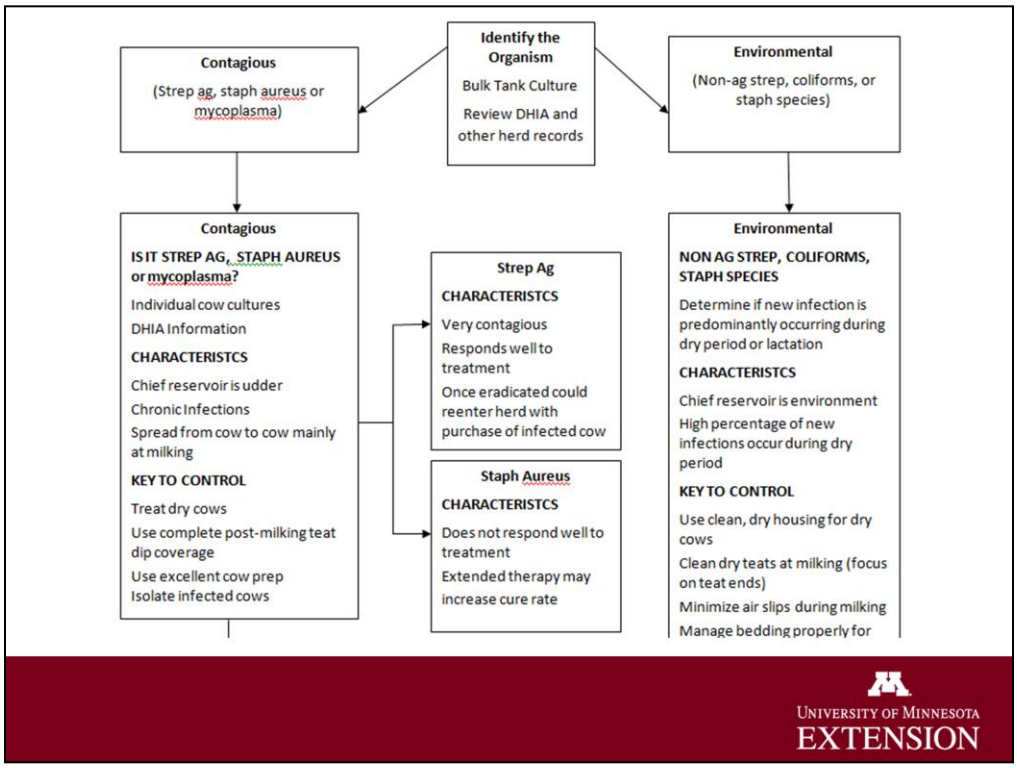
Knowing what types of bacteria (contagious or environmental mastitis pathogens) are responsible for mastitis infections on your farm will point you toward which mastitis management practices are most appropriate for your farm circumstances.



The above flow chart based on your bulk tank culture findings will also help to further direct your investigation. Effective solutions for contagious mastitis infections are generally different than for environmental mastitis pathogens.

With a gloved hand and a gallon zip-lock bag, take a representative sample from the bedding surface in the area of the udder on the back half of several stalls in a pen (usually every other or third stall), place the sample in a freezer and then transport the sample to the lab being sure that it is kept cool to avoid bacterial growth until the sample is cultured at the lab.

Farm Observations

- Cow hygiene
- Cow comfort and well-being
- Milking procedures

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In addition to dairy records, accurate farm observations will be helpful in putting all other information you are gathering into context. Everything makes a lot more sense after you “see” what the cows look like and how things are managed on the farm.

Step 3. Generate a list of possible causes

- Work with your dairy management TEAM
- Cause and effect diagram may be helpful in developing a "systems" perspective of what the problems are

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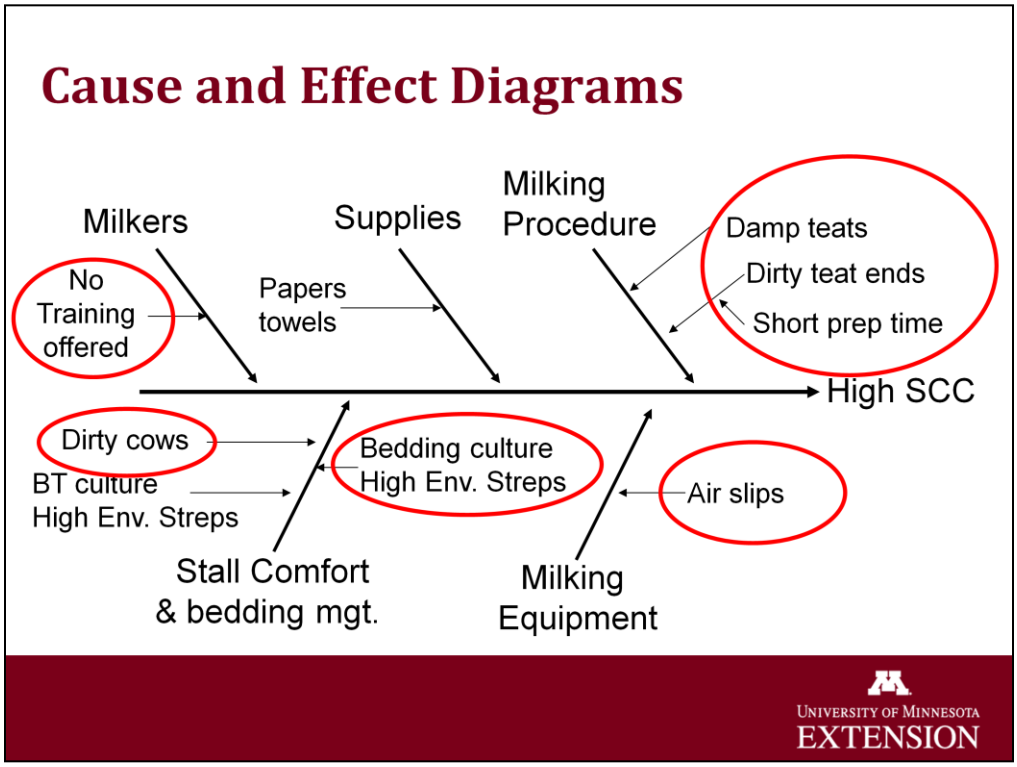
With all this information gathered you can now generate a list of the possible causes of mastitis on your farm. Work with your dairy management team (veterinarian, milking equipment and dairy supply technician, milk plant field rep, extension educator, nutritionist, and your farm staff). Get everyone involved. See Cause and Effect diagramming fact sheet QCF-4 Mastitis Problem Identification.



One way to facilitate this discussion is to utilize cause and effect diagramming. Drawing a cause and effect diagram can be helpful in getting a systemic picture of the issues on your dairy and how they may relate to each other

Step 4. Develop an Action Plan

- Decide on a practical plan and be specific!!!
  - Who will be responsible for implementing the plan?
  - Who will train employees?
  - When will the plan be implemented?

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Step 5. Carry out the plan

- Once the plan is initiated, stick to the plan! Give it chance to work
- Do NOT tinker with the plan unless THERE IS CLEAR EVIDENCE that the plan is not working

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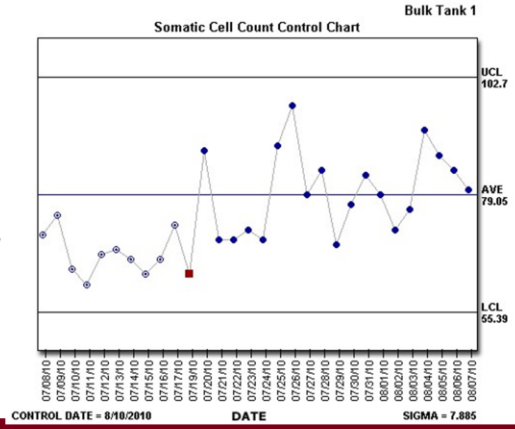
Step 6. Set up a plan to monitor progress

- BTSCC & DHI SCC
- NIR all cows (<7% goal)
- NIR fresh cows (<10% goal)
- % chronic (<10% goal)
- % herd >200,000 (<20% goal)
- Clinical mastitis rate (<2% per month) Monthly
- Bulk tank cultures

Use multiple monitors since no single monitor is perfect



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Not only are your dairy records an important tool for SCC/mastitis problem diagnostics, they serve as a means of “keeping score”. You should never develop an action plan that doesn’t also include how you will monitor the success or failure of the intervention (changes) you are implementing. Key monitors can tell us with certainty IF we are making progress. I suggest routine monitoring of the following SCC/mastitis measures to assess whether you are making progress or maintaining control. BTSCC is obviously a critical output monitor; however, I would not only recommend paying attention to the BTSCC mean but also the BTSCC variation. The variation will be the best measure of whether your processes are not only being effective but also are being consistently applied.

Step 7. Monitor progress and adjust plan as needed

- If progress is being made, continue
- If progress is not being made, then determine:
  - is it a failure of the plan?
  - is it a failure to implement the plan?
- Be patient since progress can be slow, especially if the problem is chronic Staph aureus infections

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Take-Home Messages

- SCC/mastitis problem solving requires team work and a systematic approach
- Dairy records serve as an important tool in SCC/mastitis diagnostics
- Monthly individual cow SCC tests are needed for an effective analysis
- Routine feedback is essential for SCC progress
- <250,000 SCC is possible for every dairy

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Emphasize the need for MONTHLY individual cow SCC testing and the need to “keep score” by using critical monitors for routine feedback.

In the Quest for Milk Quality Everyone Wins

Cows…….. comfort, health, productivity

Producers…… profit, personal satisfaction

Processors…….. product yield, self life

Consumers…….. confidence in food safety and wholesomeness

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The quest for milk quality is well worth the effort because EVERYBODY WINS – the cow, the producer, the processor and the consumer. With current consumer concern about food quality and safety as well as animal well-being, we need to emphasize achieving the production of high quality milk. I hope that this webinar has provided you with the information you need to help meet your milk quality goals.

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