



Potential Change in Performance-based Dairy Farm Inspection Frequency Resulting from Increased Reporting Frequency for Bulk Tank Unpasteurized Milk Somatic Cell Count Results

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ABSTRACT

Wisconsin dairy processors report monthly the Somatic Cell Count (SCC) for milk from each of their Grade A producers. These results affect assigned on-site dairy farm inspection frequency (every 3–12 months). Processors generally determine SCC much more often than monthly. Basing inspection frequency on monthly SCC results may penalize producers for occasional problematic days. We evaluated whether assigned farm inspection frequency would change if all (not just monthly) SCC results were considered. All Grade A dairy producer SCC results for 2007 and 2008 ($n = 5400$ and $n = 7193$, respectively) were obtained from two Wisconsin dairy processors, along with the state-assigned inspection frequency. Only 12% of producers inspected every 6 or 12 months would have been assigned more frequent inspection, 30% of producers inspected every 6 months would have had a 12-month inspection frequency, and 92% of producers inspected every 3 or 4 months would have been assigned inspection every 6 or 12 months if all available SCC results were considered and other criteria were met. Use of all available SCC results in assigning farm inspection frequency is unlikely to result in an increased inspection workload.

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TABLE 1. Frequency distribution of number of bulk tank Somatic Cell Count (SCC) results obtained for individual Grade A Wisconsin dairy producers supplying milk to two processors during 2007 and 2008

Number of SCC Results	Number of Producers (%)	
	2007	2008
1 – 10	15 (0.3)	14 (0.2)
11 – 20	8 (0.1)	36 (0.5)
21 – 30	37 (0.7)	60 (0.8)
31 – 40	267 (4.9)	318 (4.4)
41 – 50	3054 (56.6)	4082 (56.7)
51 – 60	95 (1.8)	122 (1.7)
61 – 70	58 (1.1)	108 (1.5)
71 – 80	81 (1.5)	93 (1.3)
81 – 90	811 (15.0)	1031 (14.3)
91 – 100	77 (1.4)	124 (1.7)
101 – 200	667 (12.4)	920 (12.8)
201 – 300	77 (1.4)	97 (1.3)
Greater than 301	153 (2.8)	188 (2.8)
Total	5400	7193

INTRODUCTION

The Somatic Cell Count (SCC) of milk is used to indirectly monitor inflammation of the bovine mammary gland. Bulk tank milk SCC is a measure of mammary disease or mastitis in a dairy herd and is related to a number of dairy product quality issues, such as cheese-making yield, and fluid milk shelf life and sensory attributes (2, 3, 4). The SCC is used by dairy regulatory programs as a general indicator of the hygienic conditions of milk production on farms. The United States (USA) has a regulatory limit for SCC of 750,000 cells per ml of milk (5), while the European Union has established a limit of 400,000 cells per ml (1). Individual dairy processors may set more stringent SCC standards for farms supplying them with unpasteurized milk.

Dairy processing plants in Wisconsin are required to report, at least monthly, the bulk tank SCC results for a sample of unpasteurized (raw) milk obtained by the milk hauler at each Grade A farm. These results must be reported to state regulatory officials. Grade A raw milk cannot have SCC greater than 750,000 cells per ml. Consistent failure

to produce milk meeting this standard can result in progressive regulatory actions that may eventually include permit suspension.

In Wisconsin, the monthly SCC results are used, along with Standard Plate Count (SPC), beta-lactam drug-residue test results, bulk tank milk temperature, and on-site farm inspection results, in assigning the frequency of on-site farm inspection for dairy producers. This system of assigning farm-inspection frequency, called the Performance Based Farm Inspection (PBFi) program, is described in Appendix P of the Food & Drug Administration's Grade "A" Pasteurized Milk Ordinance (PMO; 1). Under the PBFi system, Grade A dairy producers are inspected 1–4 times per year. A producer's PBFi category assignment is re-evaluated quarterly, based on performance over the preceding 12 months. Farm inspection frequency can thus change during a given year if there are occasional reported SCC results that exceed established limits.

Dairy producers inspected once every twelve months (Category 1) must have no SCC results exceeding 500,000 cells per ml. Dairy producers inspected

once every six months (Category 2) effectively cannot have more than 30.8% of their samples with an SCC result above 750,000 cells per ml (four samples exceeding the limit out of 13 samples: the 12 monthly samples, plus a non-violative follow-up sample taken when two of the past four samples exceed the limit). Other factors, including multiple warning letters or permit suspension in response to high SCC results, can lead to producers being assigned to Category 3 (inspection every four months) or Category 4 (inspection every three months).

It is possible that basing PBFi categorization on monthly SCC results could unfairly penalize Wisconsin dairy producers if the monthly reported results happen to be from occasional problematic days. Basing PBFi categorization on a larger number of SCC test results may more accurately portray the producer's milk quality and sanitation practices.

Dairy processing plants typically test producers' milk more often than monthly, but only the monthly scores are reported to the state regulatory agency. Dairy processing plants use this larger volume of data to evaluate their producers, ensure that the milk received at

TABLE 2. Frequency distribution for percentage of bulk tank Somatic Cell Count (SCC) results for individual Grade A Wisconsin dairy producers not exceeding specified maximum levels (cells per ml) in 2007 and 2008^{a, b}

Regulatory limit (cells/ml)	% of tests not exceeding limit	% of producers in listed category
750,000	0 – 19	0.1
	20 – 39	0.3
	40 – 59	1.0
	60 – 79	3.3
	80 – 99	21.8
	100	73.5
500,000	0 – 19	3.5
	20 – 39	4.3
	40 – 59	6.6
	60 – 79	10.1
	80 – 99	32.2
	100	43.3
400,000	0 – 19	10.9
	20 – 39	8.1
	40 – 59	9.4
	60 – 79	12.9
	80 – 99	31.4
	100	27.3

^aLimits are 750,000 cells per ml for milk in the USA, 500,000 cells per ml for Wisconsin Performance-based Farm Inspection category 1, and 400,000 cells per ml for the European Union.

the plant meets quality standards, and calculate the milk price paid to the producer. The present study was undertaken to determine if a Wisconsin Grade A dairy producer's PBFI category would improve if all SCC results were considered – not just the monthly results. In essence the research questions were 1) "Assuming all other test results and farm inspection results are unchanged, would a dairy producer's PBFI categorization worsen (more frequent inspection) if all available SCC results were considered?", and 2) "Assuming that the other factors considered in PBFI categorization were suitable, would a dairy producer's PBFI categorization improve (less frequent inspection) if all available SCC results were considered?"

MATERIALS AND METHODS

We obtained all Grade A dairy producer SCC results for 2007 and 2008 ($n = 5400$ and $n = 7193$, respectively) from two Wisconsin dairy processors. The identity of each individual dairy producer was withheld by the processors to ensure confidentiality. We also obtained the state-assigned PBFI frequency category for each producer at the end of 2007 and 2008. These categorizations were used as "point estimates" of PBFI frequency category. Frequency distributions were developed for the number of SCC tests performed on milk from individual producers in each year (Table 1), and the percentage of SCC test results for individual producers in each year that did not exceed three different standards (Table 2): the USA maximum of 750,000

cells per ml, the PMO-Appendix P PBFI Category 1 maximum of 500,000 cells per ml, and the EU maximum of 400,000 cells per ml. The individual producers were then sorted according to the state-assigned PBFI category at the end of each year. Within each state-assigned PBFI category, individual producers were grouped into revised PBFI categories based on the following decision-making algorithm (Table 3):

1. What proportion of the producer's SCC results were > 500,000 cells per ml?
 - a. If 0, then the producer is in revised Category 1.
 - b. If not 0, then go to question 2.
2. What percentage of the producer's SCC results exceeded 750,000 cells per ml?

TABLE 3. Performance Based Farm Inspection (PBFI) category for Grade A Wisconsin dairy producers assigned by the state at the end of 2007 and 2008, based on monthly reported bulk tank Somatic Cell Count (SCC) results and other factors, and revised PBFI category obtained by inclusion of all SCC results for 2007 or 2008. Revised PBFI categorization was done with the assumption that all criteria besides SCC were met (see text for details on PBFI categorization and criteria)

Year	State-assigned PBFI category (no. of producers)			Revised PBFI category (no. of producers)		
	Category			1	2	3 or 4
2007	1	1951	(36.1%)	1373	578	0
	2	2922	(54.1%)	867	1996	59
	3 or 4	527	(9.8%)	146	337	44
2008	1	2535	(35.2%)	1730	804	1
	2	3819	(53.1%)	1134	2617	68
	3 or 4	839	(11.7%)	207	565	67

a. If ≤ 30.8 , then the producer is in revised Category 2.

b. If > 30.8 , then the producer is in revised Category 3 or 4 (depending on other criteria).

The percentages of producers who would have a revised PBFI category higher than their state-assigned category (assuming other factors used in PBFI categorization would allow an upgrade), equal to their state-assigned category (assuming no change in the other factors), or lower than the state-assigned PBFI category were then calculated for each year.

RESULTS AND DISCUSSION

In 2007 and 2008, over half of the producers for whom results were submitted had 41–50 SCC test results (Table 1). The next largest groups of producers had 81–90 and 101–200 SCC test results per year. The number of SCC test results submitted is likely a function of farm output (number of milk loads picked up for processing in a year) and the processor's proprietary policies on how frequently each producer's milk is tested for SCC.

The data (Table 2) clearly showed that the milk samples rarely exceeded the USA regulatory limit for SCC (750,000 cells per ml). Mean SCC scores for 2007

and 2008 were approximately 323,000 and 320,000 cells per ml, respectively, and 73.5% of producers had no test results in excess of 750,000 cells per ml. A lower, but still substantial, proportion of producers (43.3%) had no SCC results above 500,000 cells per ml and, without consideration of other factors used in PBFI categorization, would have been eligible for PBFI Category 1. During the entire period of 2007 and 2008, 27% of producers never had an SCC result exceeding the EU standard of 400,000 cells per ml. At the end of 2007, 36% of producers were in state-assigned PBFI category 1 and 54% were in PBFI category 2 (Table 3). At the end of 2008, 35% were in PBFI category 1 and 53% were in PBFI category 2.

If the changes in PBFI categorization had been made only on the basis of all available SCC results, 37 and 39% of producers could have been placed in a different revised PBFI category at the end of 2007 and 2008, respectively (Table 3). For the two years studied, 25 and 26% of producers had overall SCC results that, assuming all other categorization factor criteria were met, could have warranted less frequent on-site farm inspection, i.e., assignment to Category 1 instead of Category 2 or Category 2 instead of Category 3 or 4. The other categorization factor criteria address proper

milk cooling, absence of detectable drug residues, effective cleaning and sanitization of milking equipment, proper labeling and handling of cattle medications, a bacteriologically safe water supply, and the adequate construction, maintenance, and cleaning of the milking barn (or parlor) and milk house. Producers who would have been assigned a less frequent on-site inspection category based only on SCC results therefore had not met at least one of these criteria.

The results also showed that for 63 and 61% of producers in 2007 and 2008, respectively, using all available SCC results would not have resulted in a change in inspection frequency (no change in PBFI category), assuming there was no change in other PBFI categorization factors. Only 12% of producers had overall SCC results in either year that would have warranted more frequent inspection. Notably, only a small proportion (8%) of producers in state-assigned Category 3 or 4 would have been categorized this way if overall SCC results were the only criteria for categorization. These results suggest that high SCC results usually are not the sole reason for a producer being assigned PBFI Category 3 or Category 4.

The first research question addressed in the present study was "Assuming all other test results and farm inspection results are unchanged, would

a dairy producer's PBFI categorization worsen (more frequent inspection) if all available SCC results were considered?" Since the results show that only 12% of state-assigned Category 1 and 2 producers would have been assigned a more-frequent-inspection PBFI category in 2007 or 2008 if all available SCC results had been considered, the answer to this question would be "Generally, no." The second research question was "Assuming that the other criteria considered in PBFI categorization were met, would a dairy producer's PBFI categorization improve (less frequent inspection) if all available SCC results had been considered?" The answer to this question would be "Generally, yes." Of state-assigned PBFI Category 2 producers in 2007 or 2008, about 30% would have been moved into PBFI Category 1 if all available SCC results had been considered and other criteria had been met. A very high proportion (92% in both 2007 and 2008) of producers in state-assigned PBFI Category 3 or 4 would have been re-categorized into PBFI Categories 1 or 2 if all available

SCC results had been considered and other criteria had been.

In summary, these findings suggest that use of all SCC results, rather than just monthly reported results, would allow far more opportunity for a producer's PBFI category to improve than for it to worsen. Use of all available SCC results could therefore lead to a reduction in the number of on-site farm inspections conducted by regulatory officials. The resources that could be saved in Wisconsin, with its > 11,000 Grade A dairy producers, could be substantial. These resources could be redirected to oversight of food processing establishments making products that are more frequently implicated in foodborne illness outbreaks and/or those establishments in which there is no processing step analogous to pasteurization that reliably destroys pathogenic microorganisms.

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