WISGRAPH®: QUANTIFYING THE CONTRIBUTION OF NON-LACTATING COW UDDER INFECTION TO THE OVERALL INTRAMAMMARY NEW INFECTION RATE ON WISCONSIN DAIRY FARMS.

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Introduction

Traditionally, individual cow somatic cell counts (SCC) have been used to identify cows for treatment, segregation, or culling based on counts above a certain threshold – usually defined at around 200,000/ml. This threshold has been used by a number of authors to achieve optimum sensitivity and specificity for the determination of udder infection and non-infection (Dohoo & Leslie, 1991; Schepers et al., 1997). The SCC has also been monitored within sub-groups of cows, grouped by parity, lactation number and days in milk to further assist herd management decisions (Reneau, 1986). The concept of using sequential SCC data to determine rates of new infection and cure between tests has been described by Schukken and Kramer (1997). Stewart et al., (1995) have used scatter graphs to monitor new infections, cures and chronic infections using monthly SCC data and recently Day (2001) described the use of scatter graphs to monitor new infections and cures during the non-lactating period.

It is clear that the non-lactating period is an extremely important time for the occurrence of new intra-mammary infections – particularly with environmental pathogens (Todhunter et al., 1991; Bradley and Green, 2000; Bradley and Green, 2001). A low cost method of monitoring this period, using SCC measurement immediately before and after the non-lactating period would be very useful, obviating the need for expensive, costly bacteriology. Work by Barkema et al., (1999) and Sheldrake et al; (1983) suggests that the 200,000/ml SCC threshold may be used on all milk samples taken after the 4th milking *post-partum*. To date, there are no reported benchmarks derived from a large number of dairy herds to set targets for new infection and cure rates using these data.

This paper describes the use of an Excel® spreadsheet template to summarize individual cow SCC data collected over the current and previous six monthly tests and describes benchmarks for a range of udder infection parameters used to monitor infection dynamics during the lactating and non-lactating period.

Materials and Methods

Individual cow SCC data may be downloaded from AgSource Cooperative Services, responsible for most of the Dairy Herd Improvement (DHI) recording in Wisconsin, using DairyNet® software. The SCC data for the current and previous six months can be stored in an Excel® template called WisGraph®, developed at the University of Wisconsin-Madison, and a number of udder infection parameters calculated (Table 1) using 200,000/ml as the SCC threshold determining infection and non-infection.

Table 1. Definitions of udder infection parameters used in WisGraph®

Parameter	Definition
Weighted Mean Herd SCC	Mean Somatic Cell Count (SCC) of the cows in the herd on test, weighted by milk production of each individual cow
Infection Prevalence Rate (%)	Proportion of infected cows (SCC>200,000) in the herd
Herd New Infection Rate (%)	Proportion of new infections (SCC>200,000) at the current test in cows which were uninfected (SCC<200,000) or non-lactating at the previous test
Fresh Cow Contribution to Herd New Infection Rate (%)	Proportion of first test new infections (SCC>200,000) in cows and heifers, which were uninfected (SCC<200,000) or non-lactating at the previous test.
Dry Cow New Infection Rate (%)	Proportion of dry cows <200,000 at the last SCC test before dry off that calve with a first test SCC >200,000
Heifer New Infection Rate (%)	Proportion of first lactation heifers with a first test SCC >200,000
Dry Cow Cure Rate (%)	Proportion of cows infected at the last test of the prior lactation (SCC>200,000) that calve with a first SCC test <200,000

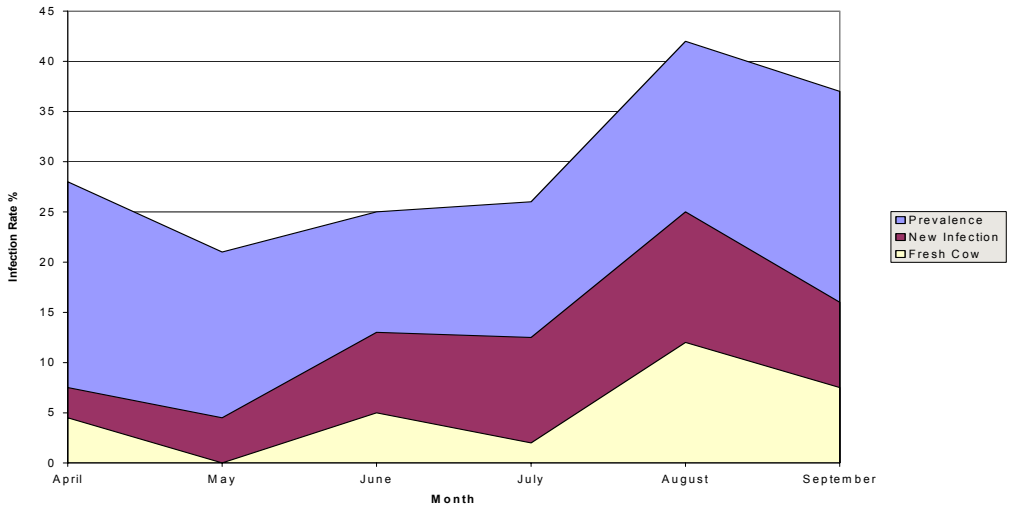
Between February 1999 and January 2001 a total of 303 Wisgraph® downloads were collected into a database including only those farms with a minimum of 35 cows, with a maximum of 37 days between DHI tests. Herds included those visited as part of a herd investigation, a group of herds used in two research trials, and a group of herds randomly selected by weighted six month mean SCC to achieve a wide spectrum of herd mean SCC.

A subset of 145 herds was selected by weighted six month mean SCC to represent the spectrum of herds on DHI test in Wisconsin. Mean (Standard Error), 10^{th}, 25^{th}, 75^{th} and 90^{th} percentiles and range were calculated in Excel® for heifer new infection rate, dry cow new infection rate and dry cow cure rate, for all milking cows and heifers in each herd, in order to determine benchmarks for non-lactating period udder infection and cure rates.

Results

Figure 1 shows an example herd WisGraph® charting the variation in infection prevalence, new infection rate and the contribution of new infections resulting from cows and heifers freshening with a first test SCC > 200,000/ml. The graph demonstrates a consistent trend seen in many herds, with a rise in new infections and prevalence, driven by an increase in fresh cow infections during the late summer months.

Figure 1. Monthly infection prevalence rate, new infection rate and fresh cow contribution to the new infection rate for an example 45 cow herd



Mean (range) heifer new infection rate was 21.3% (0 to 58%) with the cut-point for the 10th percentile of herds at 8.0%. Similarly, mean (range) dry cow new infection rate was 22.4% (0 to 71%), with the 10th percentile cut-point at 9.0%. A level of 10% is suggested as a target for both parameters. Considerable variation in new infection rate was present even at weighted herd SCC less than 200,000/ml. The number of cows and heifers freshening with a first test SCC >200 000 was therefore not merely a function of poor mastitis control.

Mean (range) dry cow cure rate was 62.9% (20 to 100%), with a 90th percentile cut-point of 83%. Target dry cow cure rate is therefore recommended to be 80%. Variation in cure rate was wide and correlated poorly with dry cow new infection rate on the same farm, suggesting that low cure rate was not solely due to a high rate of new infections during the dry period, following cure of the original infection. Table 2 summarizes these data and includes suggested target and interference levels for each udder infection parameter.

Table 2. Non-lactating period new infection and cure rate data, with target and intervention levels for 145 typical Wisconsin dairy herds.

	Mean (SE)	Range	Percentiles				Target	Intervention
			10th	25th	75th	90th		
Heifer New Infection Rate (%)	21.3 (0.9)	0 - 58	8	14	28	36	10	15
Dry Cow New infection Rate (%)	22.4 (0.9)	0 - 71	9	16	30	35	10	15
Dry Cow Cure Rate (%)	62.9 (1.2)	20 - 100	45	53	73	83	80	70

Discussion

WisGraph® has proven a simple, quick and easy tool for the monitoring of udder infection dynamics in both lactating and non-lactating cows within a herd. By monitoring new infection rate as well as prevalence of infection we can determine whether a high herd SCC is due predominantly to a high rate of new infections or to a high rate of chronically infected cows and a low new infection rate. Further, if the rate of new infection is high, WisGraph® indicates whether these infections are occurring predominantly within the lactating cow group, or in the recently fresh group of cows and heifers, suggesting that the udder infection was acquired during the non-lactating period.

The finding that 21.4% of heifers and 22.3% of cows freshen with an udder infection at first test on the average Wisconsin dairy lends support to the bacteriological studies by Todhunter et al., (1991) and Bradley and Green (2000), on a small number of herds in both the US and Europe. These data confirm that infection during the non-lactating period is a significant problem. The large variation in infection rates seen between herds even at low herd SCC, and our current knowledge of the significance of non-lactating period udder infection, suggest that although the last test of the previous lactation and the first test of the current lactation may be several days from the actual days of dry off and calving, SCC analysis either side of the dry period and at first test in heifers, can reflect non-lactating period udder infection dynamics. On farm factors responsible for this variation require further investigation.

Evidence from a large number of herds studied suggests that the increase in SCC seen during the late summer months in North America (Dohoo and Meek, 1982) is driven by an increase in new infection rate, which results from an increase in the proportion of cows and heifers freshening with an udder infection.

The WisGraph® analysis provides the milk quality investigator with the necessary information to target the group of cows at greatest risk for mastitis. An action plan may then be implemented on the farm, which will yield the greatest impact on milk quality.

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