Mastitis: The Canadian Perspective

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Take Home Messages

- *Staph. aureus* is present in nearly all Canadian dairy farms, while *Strep. agalactiae* may be at the brink of extinction in Canada.
- Reducing *Staph. aureus* is an important tool to reduce BMSCC
- Management on most Canadian dairy farms is good, but there is still quite some room for improvement
- *Staph. aureus* is the most frequently isolated bacteria in clinical mastitis cases.

Introduction

The NMC has a recommended mastitis plan with 10 areas of attention (NMC, 2004) that is generally considered as the standard for mastitis management. A number of studies in Canada investigated management practices on dairy farms (Spicer et al., 1994; Sargeant et al., 1997; VanLeeuwen and Keefe, 1998). However, these studies did not focus much on mastitis management. Therefore, compliance to these 10 management areas by Canadian dairy farms is unknown.

Bulk milk culture can be used to determine whether a herd is infected with contagious mastitis bacteria, such as *Staph. aureus, Strep. agalactiae* and *Mycoplasma*. If contagious mastitis bacteria are found in the bulk milk, it is very likely that in the herd one or more cows are infected with this bacteria. Finding environmental bacteria such as *Escherichia coli* and *Streptococcus uberis* in the milk does not necessarily mean that cows in the herd are infected with it. High numbers of *Strep. uberis* in the bulk milk are, however, an indication that problem cows are present and infected with this bacteria.

Although several studies in the US and Europe have estimated what percentage of dairy herds are infected with *Staph. aureus* and *Strep.*

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agalactiae, only a few studies on this have been performed in Canada. The percentage of Canadian dairy herds infected with *Strep. agalactiae* ranged between 6% in Alberta (1993), 18% in PEI (1994) and 43% in Québec (1992) (Guillemette et al., 1992; Schoonderwoerd et al., 1993; Keefe et al., 1997). In a study on Ontario dairy farms, 58 out of 59 bulk milk samples were *Staph. aureus*-positive, while 92% of the herds had at least one *Staph. aureus* culture-positive cow (Kelton et al. 1999).

Many studies have been conducted on dairy farms to find risk factors for mastitis. However, management of dairy farms differs among countries due to different environmental circumstances. In Canada, no studies have been conducted to investigate the risk factors of having contagious mastitis bacteria in the bulk milk.

The most recent study on the distribution of bacteria in clinical mastitis was performed in Ontario from 1993 to 1995 (Sargeant et al., 1998). In this study, coliforms were the most frequently isolated bacteria. Because this study was performed in only one of the Canadian provinces with a significant dairy industry, and since then bulk milk somatic cell count (SCC) decreased in most of the provinces, we initiated a study to determine how often clinical mastitis occurs per lactation and what specific bacteria are involved in Canadian dairy herds.

The objectives of this study were:

- to estimate the compliance of recommended mastitis preventive management practices on Canadian dairy farms;
- to estimate the percentage of dairy herds that have an infection with contagious mastitis bacteria;
- to evaluate the association of management practices with the isolation of contagious mastitis bacteria from bulk milk from Canadian dairy farms;
- to estimate what bacteria play the largest role in clinical mastitis in Canada.

The Bulk Milk and Management Practices Study

Herds were randomly selected and stratified per province. After being selected, producers were invited by mail to participate in this study. Producers that did not respond were contacted by telephone four weeks later.

A questionnaire was designed based on the 10-point recommended mastitis management plan as described by the NMC (NMC, 2004). After the questionnaire was sent, a second copy was sent to non-responders three

months later. Producers that still did not respond after the second questionnaire were contacted by telephone.

For every province, the provincial dairy laboratory was contacted to collect the bulk milk samples of the selected farms. The 10 provincial dairy laboratories stored the bulk milk samples of the selected farms in the freezer. Once the batch was collected, samples were sent on ice by overnight courier to the Atlantic Veterinary College (Charlottetown, Prince Edward Island, Canada) for bacteriological culture.

■ Number of Canadian Dairy Herds with Contagious Mastitis Bacteria in Their Bulk Milk

The percentage of herds that had *Staph. aureus* or *Strep. agalactiae* in a single bulk milk sample was on average 42% and 1%. The estimated percentages of herds in Canada that had a bulk milk sample positive for *Staph. aureus* or *Strep. agalactiae* at least once were 76% and 3%. No *Mycoplasma* was found. Bulk milk prevalence of *Staph. aureus* was highest in the three Maritime provinces, Prince Edward Island, Nova Scotia and New Brunswick (Figure 1). Three of the four western provinces, Manitoba, Alberta and British Colombia had the lowest prevalence of *Staph. aureus* isolations in bulk milk.

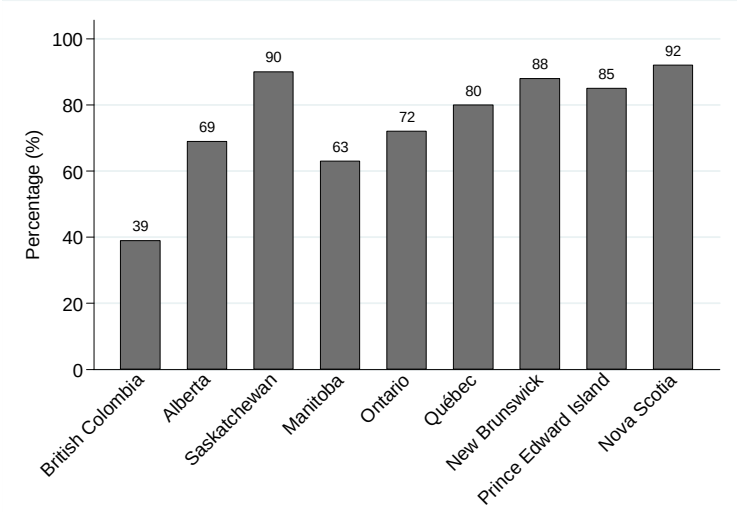

Figure 1 Percentage of *Staph. aureus*-positive herds per province

Staph. *aureus*-positive bulk milk was most often found in tie-stalls (84%), while 65% of free-stalls and 50% of herds with a straw-pack were positive. These percentages were obviously significantly different.

▪ Adoption of Mastitis Preventative Management Practices in Canada

Table 1. Adoption (%) of mastitis management practices in 278 Canadian dairy farms.

Management practice	Tie-stalls	Free-stalls	All
Pre-milking teat dip or spray	48*	61	54
Dry udder before attaching	81	87	84
1 cow per cloth / towel for pre-milking treatment	89	85	87
Wear latex gloves (at least sometimes)	50*	73	62
Post-milking teat disinfection	94	98	95
Milk clinical mastitis cows last or with separate cluster	86*	33	59
Collect milk sample of clinical cases most of the time	16	16	16
Treat clinical mastitis with antibiotics most of the time	79	80	80
Treat at least 97.5% with dry cow treatment	68	79	73
Use CMT more than once a month	26*	48	38
Thinks it is important to important to cull Staph. aureus-positive cows	64	57	60
Milking equipment checked at least once a year	77	79	77
Uses computer for cow records	16*	49	32
Uses permanent records for clinical mastitis cases	48	49	48
Clips or flames udders	76*	46	59

*Percentages were different between tie- and free-stalls at P<0.05.

At this moment, 278 (96%) of the 291 questionnaires have been returned by the participating farmers. The compliance to a selected number of management practices is compared between tie-stall and free-stall barns (Table 1).

The distribution of barn types for the lactating cows over 9 Canadian provinces with a significant dairy industry is summarized in Figure 2. Overall, the percentage of tie-stall and free-stall dairy farms in this study is 42 and 45%, respectively, approximately the same. In the most western provinces, British Colombia and Alberta, lactating cows are predominantly housed in

free-stalls. In Québec, the province with the largest dairy industry, however, 90% of the farms have a tie-stall to house the lactating cows.

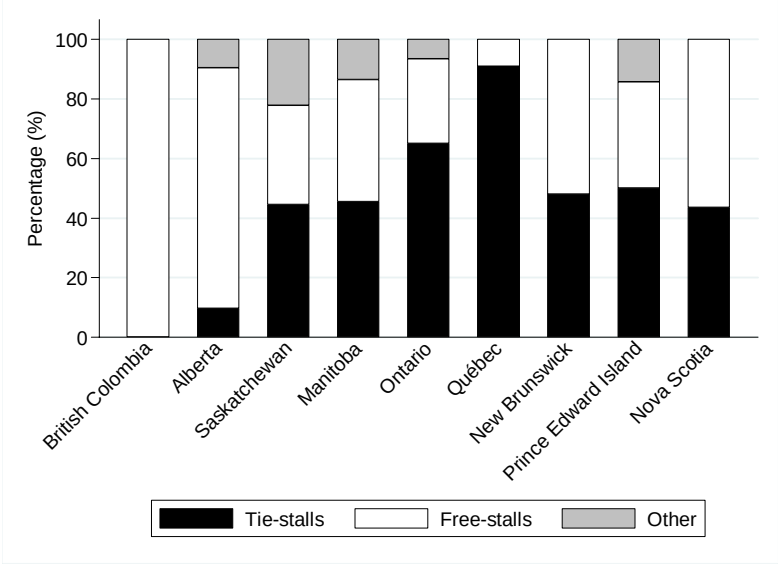

Figure 2 Distribution of barn type per province

■ Management Practices That Were Related To Presence of *Staph. Aureus* In The Bulk Milk

Some management practices had a significant association or a tendency to be associated with the isolation of *Staph. aureus* from the bulk milk (Table 2). *Staph. aureus*-negative farms tended to practice blanket dry cow treatment more often (more than 97.5% of all cows were treated with dry cow products) than *Staph. aureus*-positive farms.

Table 2. Management practices that were associated with the isolation of Staphylococcus aureus (SAU) in the bulk milk

Management practice	*SAU pos*	*SAU neg*	
	(%)	(%)	*P*-value[1]
Milk clinical mastitis cows last or with separate unit	36	52	0.012
Mark a clinical mastitis cow with more than one mark	54	68	0.032
Vaccinate against mastitis	19	32	0.022
Dry cow treatment > 97.5% of cows	68	78	0.06
Takes samples of high SCC cows[2]	73	60	0.029
Uses computer for cow records	21	42	0.001
Uses straw as bedding material	63	48	0.017
Uses shavings or sawdust as bedding material	29	41	0.049
Uses sand as bedding material	1	6	0.045
Clip or flame udders[3]	65	50	0.022
Purchases cows	56	45	0.10
Ration balanced more than 3x a year	57	70	0.042

[1] P-value is a statistical measurement of significance. The lower the P-value, the less likely a difference occurred by chance.

[2] Taking samples happens probably more often on farms that have already problems.

[3] Tie-stall farms more often clip or flame udders. Tie-stalls have more often *Staph. aureus* in their bulk milk.

Another practice, like the purchase of cows on the farm, could introduce contagious mastitis bacteria in your herd. In our study there seems to be a tendency that *Staph. aureus*-positive herds purchased more often cows than *Staph. aureus*-negative herds.

■ Distribution of Pathogens From Clinical Mastitis

A total of 125 dairy farms were recruited to participate in a clinical mastitis project. Producers were recruited trough Canadian Quality Milk advisors and veterinary practices in 10 provinces. To participate farmers had to collect milk samples of each case of clinical mastitis on their farms and fill in an extensive questionnaire about mastitis management practices. Milk samples were stored in a freezer and collected approximately once a month by the Quality Milk co-ordinator or their veterinarian. The collected samples were sent by overnight courier to the Atlantic Veterinary College. The submitted milk samples were categorized in “no growth”, “mixed growth or contaminated”,

and containing bacterial pathogens. At the moment of writing this article, 2,299 milk samples were cultured (Table 3).

Table 3 Distribution of clinical mastitis pathogens from 10 provinces of Canada (n=2,299)

Pathogen	Frequency of all samples	Frequency of all isolates[1]
No growth	37.3 %	-
E.coli	9.3 %	17.4 %
Klebsiella	4.4 %	8.3 %
Staph. aureus	10.6 %	19.9 %
Strep. agalactiae	0.1 %	0.3 %
Strep. dysgalactiae	5.4 %	10.1 %
Strep. uberis	0.9 %	1.7 %
Other strep. species	4.3 %	8.1 %
Mixed growth / contamination	9.4 %	-

[1]No growth and mixed growth/contamination excluded.

■ Discussion

This study is, to our knowledge, the first nationwide Canadian study that focussed on the adoption of mastitis management practices and distribution of mastitis pathogens. Most farmers implement the recommended mastitis management practices, but an important management practice such as blanket dry cow treatment, which is proven to be effective against mastitis, is only implemented on 71% of the farms. Recommended mastitis management practices were most frequently implemented in herds that house their lactating cows in free-stall barns. This was most likely the reason why herds in tie-stall barns more often were *Staph. aureus*-positive than free-stall herds. Both the distribution of tie-stall and free-stall barns and the proportion of *Staph. aureus*-positive herds varied considerably among provinces. This indicates that extension and education should be tailored per province and barn type.

The proportion of *Staph. aureus*-positive herds (76%) was as high as expected. This proportion agrees with earlier studies where it ranged from 31 to almost 100% in North America (Kelton et al., 1999; Khaitsa et al., 2000; Jayarao et al., 2004).

The proportion of *Strep. agalactiae*-positive herds has decreased considerably in recent years (Keefe, 1997; Pitkala et al., 2004). The proportion of 3% in this study was based on a weighted, stratified prevalence calculation and represented 3 farms. The real percentage of positive herds, however, may be slightly higher because frozen milk samples were used.

No *Mycoplasma* were found in the bulk milk of these 291 dairy herds. However, the samples were stored frozen which most likely influenced the recovery of *Mycoplasma* negatively (Biddle et al., 2004). For this reason, on this batch and the other three batches of samples, a *Mycoplasma* PCR (a method that can also detect dead *Mycoplasma)* will be used to provide a better estimation of the herd-level *Mycoplasma* prevalence.

Staph. aureus-positive herds practiced certain recommended management practices more often (for example taking milk samples of high SCC cows). This could be explained by the possibility that these farmers had already a *Staph. aureus* problem on their farm. Other management practices are more associated with barn type. For example straw is used more often in tie-stall barns as bedding material than in free-stall barns.

Conclusions

Adoption of most of the recommended mastitis management practices is good. However, significant improvements can be achieved, since significant associations with the isolation of *Staph. aureus* in the bulk milk were still found. The percentage of *Staph. aureus*-positive herds was as high as expected, but varied among provinces. The percentage of *Strep. agalactiae*-positive herds was low, confirming a declining trend. In clinical cases of mastitis, *Staph. aureus* was the most frequently isolated bacteria.

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