# The Role of Hygiene in Efficient Milking

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## Take Home Message

- Environmental mastitis is the primary cause of mastitis on many dairy farms today and can result in both subclinical and clinical mastitis
- Exposure to environmental pathogens occurs when cow udders contact moisture, mud and manure in housing areas
- The hygiene of housing and animals is a strong indication of management priorities on a dairy farm
- Udder hygiene scoring should be routinely performed and <15% of cow udders should score 3 or 4
- Risk factors for dirty udders and increased exposure to mastitis pathogens include:
  - Overstocking
  - Loose consistency of manure
  - Frequency of renewal of bedding and grooming of stalls
  - Cleanliness of cow walkways
  - Frequent access to outside areas
- Bedding management is the critical control point for exposure
  - Bedding needs to be dry, changed frequently and used abundantly

## Introduction

Over the last 15 years, dramatic changes have occurred in the dairy industry. Herds throughout the world have adopted highly effective management strategies that have allowed them to efficiently produce large volumes of high quality milk. Modern cows are different genetically than cattle of years past and are housed and fed using different systems. Continuing trends of reduced herd numbers and increased herd sizes have resulted in specialization of labor and management of groups rather than individual cows. Many recommended mastitis control practices have been widely adopted and there has been considerable success in the control of contagious mastitis. As a result, the prevalence of mastitis caused by Staphylococcus aureus and Streptococcus agalactia has steadily declined (Makovec and Ruegg, 2002). In spite of this progress, clinical mastitis continues to be a problem for numerous farms. In many herds most mild and moderate cases of clinical mastitis are caused by environmental pathogens (Figure 1). The most common environmental mastitis pathogens are coliform bacteria (such as *E. coli* and *Klebsiella* spp.,) and environmental streptococci (such as *Streptococcus uberis* and *Streptococcus dysgalactia*). Cows often come in contact with environmental pathogens in areas other than the milking facility (such as housing areas, pastures or walkways). When the teats and udder are wet and dirty, large numbers of these bacteria have the opportunity to infect the udder. Environmental contamination with manure is also important. It is not uncommon for dairy cows to shed dangerous bacteria (Salmonella spp, *Campylobacter jejuni* etc.) in their feces and contaminated milk can be harmful if it is consumed before pasteurization. Proper hygiene is vitally important to control these organisms and the objective of this paper is to review the role of hygiene in food safety, milk quality and efficient milk production.

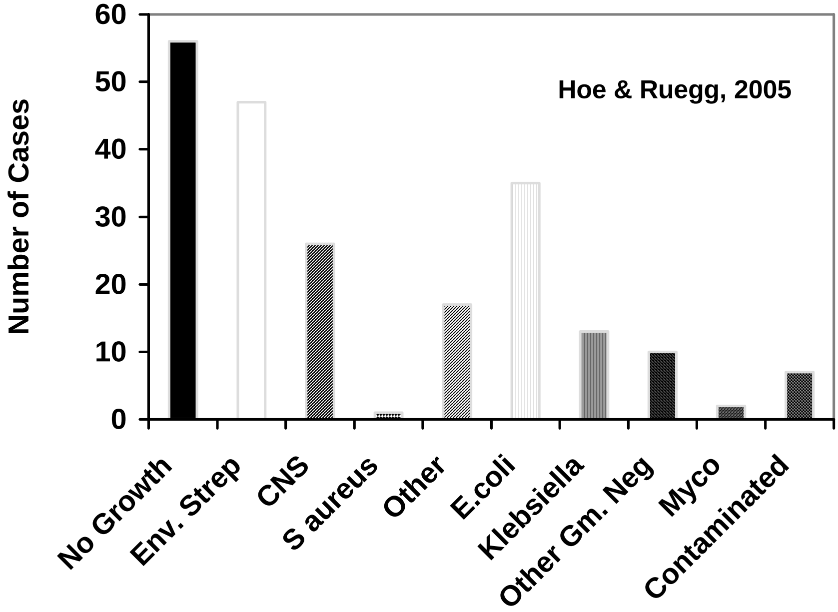


**Figure 1. Bacteria isolated from mild and moderate cases of mastitis (n-217) on 4 farms.**

## ▪ Facility Hygiene

On many farms, the people that work in the milking parlor have the primary responsibility for mastitis control while other workers are responsible for stall maintenance and feeding. It is important to recognize that many opportunities for exposure to mastitis pathogens occur outside of the milking facility and all workers that have the ability to influence exposure should share accountability for mastitis control. Exposure to moisture, mud, and manure in cow housing areas can influence the rate of clinical mastitis. Rapid movement of animals for handling or milking often results in splattering of manure. Overcrowding results in excessive deposition of manure in housing areas that are designed for fewer animals. Manure handling, type of bedding and maintenance of cow beds all have major influences on hygiene. There is ample evidence that the cleanliness of housing areas has a major influence on the rate of clinical mastitis (Table 1).

**Table 1. Relationship between hygiene of housing and mastitis.**

| Study & Location | Herd Type | Outcome |
|---|---|---|
| Elbers et al., 1998, The Netherlands | 171 herds, 53 cows/herd, loose housing & tie stalls | Herds that did not disinfect maternity stalls had 1.6 times more clinical E. coli mastitis |
| Barkema et al., 1999, The Netherlands | 274 herds, 75 cows/herd, free-stalls | Use of effective stall dividers reduced risk of clinical E. coli mastitis by 1.3 times |
| Bartlett, et al., 1992. USA | 48 herds | Herds with below average sanitation of bedding had 14-70% more coliform mastitis (dependent on prep) |
| Schukken, et al., 1990. The Netherlands | 125 herds, 50 cows/herd, SCC<150,000 cells/ml | Clinical mastitis was increased 1.9 times as the percentage of dirty stalls increased |
| Schukken, et al., 1991. The Netherlands | 125 herds, 50 cows/herd, SCC<150,000 cells/ml | 74% of clinical coliform mastitis prevented by cleaning manure from stalls |

The amount of subclinical mastitis is also influenced by environmental hygiene. Hygienic practices on herds with higher SCC values are generally poorer than hygienic practices on herds with lower SCC values (Barkema, et al., 1998). Bedding was dryer (76% versus 68% dry matter) for herds with bulk tank SCC of ≤283,000 cells/ml as compared herds with higher SCC values (Hutton et al., 1990). A number of differences in facility hygiene were identified for herds categorized on SCC value (Barkema, et al., 1998). Dirty milking parlors were found for 15% of herds with SCC <150,000 cells/ml but for 31% of herds with SCC >250,000 cells/ml (Barkema, et al., 1998). Herds with SCC > 250,000 cells/ml also had a higher proportion of stalls containing >10% manure (19% versus 12%) , cleaned stalls less frequently (1.6 versus 2.2 times/day), used less bedding on stalls and used more straw bedding (22% versus 12%).

Bedding management is a primary determinant of bacterial numbers on teat ends (Bey, et al., 2002; Hogan et al., 1989, Zdanowicz, et al., 2004). Organic bedding sources tend to support more bacterial growth as compared to inorganic sources but significant exposure to Streptococci spp. and Klebsiella spp. may occur with sand bedding. The presence of large numbers of bacteria in bedding (>$10^6$ cfu/gm) often results in outbreaks of clinical mastitis caused by environmental pathogens. High amounts of organic matter and moisture in bedding can support large numbers of bacteria. Sand bedding that is low in organic matter usually has the lowest bacterial populations but anything that increases moisture content or the amount of organic matter in bedding will increase growth and exposure to mastitis pathogens. Sand bedding often falls out of stalls and requires frequent renewal. This should be considered an advantage of sand because as the dirty sand is removed, it requires the application of fresh, clean sand. Devices that keep sand in the stalls should be discouraged as they allow the build up of organic matter that support bacterial growth.

When cows are housed using mats or mattresses the primary purpose of bedding is to absorb moisture in the critical area that contacts teats (back third of the stall). The bedding in this area should be the cleanest bedding in the stall and should be applied fresh to the rear portion of the stall on a daily basis. Bedding should NOT be supplied initially to the front of stalls. For mattresses, optimal bedding management includes removal of manure on a frequent basis from the rear portion of the stall, application of fresh bedding and weekly removal and replacement of all bedding from the entire stall surface.

Excellent hygienic standards for housing and milking centers should be a goal of all dairy farms. Dirty facilities increase the risk of mastitis and exposure to other pathogens. Clean, well-kept facilities not only reduce mastitis but they help to instill pride in workers and are tangible evidence of commitment to quality.

## ▪ Animal Hygiene

The use of high concentrate diets has been associated with looser feces and reductions in cow and facility cleanliness (Ward, et al., 2002). Several studies have identified relationships between cow cleanliness and measures of milk quality (Barkema, et al., 1998, Reneau et al., 2003, Schreiner and Ruegg, 2003). In one study, clipping hair from all cows was performed more frequently (84% versus 62%) for herds with low bulk tank SCC as compared to herds with high SCC (Barkema, et al., 1998).

A scale of 1 (cleanest) to 5 (dirtiest) was used to score 5 separate areas of cows and was compared to linear somatic cell scores (SCS) obtained from the same animals (Reneau et al., 2003). Cleanliness of the tail head, flank and belly were not associated with SCS but SCS of cows with cleaner udders and lower rear legs was lower than SCS of cows with dirtier udders and legs, indicating that dirty cows had a higher prevalence of subclinical mastitis (Reneau et. al., 2003). This study highlights the importance of maintaining cleanliness of areas that can contact the udder.

Udder hygiene scores (UHS) can be easily and efficiently obtained during milking using a visual scoring system (Figure 2). This system was used to repeatedly score 1250 dairy cows housed in freestalls on 8 Wisconsin dairy farms (Schreiner and Ruegg, 2003). Cows were categorized as “clean” (UHS of 1 or 2) or “dirty” (UHS of 3 or 4). About 20% of the cows received scores categorized as “dirty.” Somatic cell counts and the rate of intramammary infection were both higher for animals categorized as “dirty.” Significantly more environmental and contagious mastitis pathogens were recovered from milk samples obtained from cows with dirty udders as compared to cows with clean udders. Dirty cows reduce efficiency in the milking parlor and increase exposure to mastitis pathogens. Hygiene scores of udders should be routinely performed as a quality control measure just as body condition scores are performed to monitor nutritional management. Each cow with an UHS of $\geq$3 has an increased risk of mastitis. Therefore, when a 4-point scale is used, the ideal goal is zero cows with dirty udders (UHS of 3 or 4).

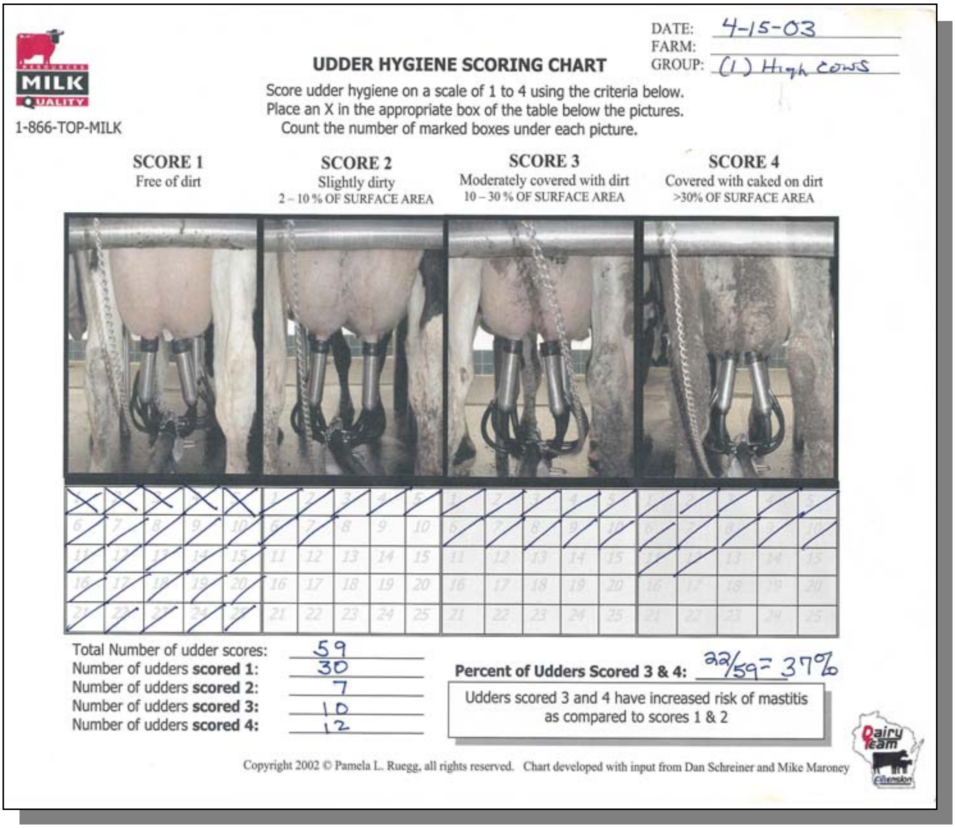


**Figure 2. Udder Hygiene Chart –available at http://www uwex.edu/milkquality/PDF/UDDER%20HYGIENE%20CHART.pdf**

Udders become dirty as a consequence of a number of management decisions. We evaluated risk factors for "dirty udders" on 79 commercial Wisconsin dairy farms (Salgado and Ruegg, data unpublished). The farms included 11,200 lactating cows housed in both freestalls (n = 51 herds) and stall barns (n = 28). There was no difference in the proportion of clean UHS (77%) based on type of facility. The frequency of renewal of bedding was 1-3x/day (37%), 1-3x/week (45%) and 1-3x/month (18%)and the frequency of grooming stalls was 2-4x/day (76%), daily (19%) or infrequent/never (5%). Access of cattle to outdoors ranged from never out (51%), 2-8 hours per day (25%) to >8 hours per day (24%). For animals housed in stallbarns, the risk of dirty udders was increased 1.5 times when stalls were cleaned <2x/day, 4.5 times when stall beds were dirty, and >10 times when a large proportion of the cows had loose manure. For animals housed in freestalls, the risk of dirty udders was increased 1.8 times when organic bedding materials were changed less frequently than daily, 4x when stall beds were dirty, >10 times when a large proportion of the cows had loose manure, 2.5 times when cows had access to outdoors and >10 times as barns were increasingly overstocked. This data indicates the importance of focusing on housing management to control environmental mastitis.

## ▪ Tail Docking and Hygiene

Many farmers and consultants perceive that tail docking results in improvements in animal cleanliness and udder health. To date, these perceptions have not been scientifically validated. Tucker et al. (2001) evaluated the effect of tail docking on cow cleanliness and SCC in a single herd, housed in freestalls, over an 8-wk period. Tails were either docked or left intact. Cleanliness scores (using a 4 pt scale) were recorded for available animals on a weekly basis by counting manure in a grid placed on the midline of the back (2.5 inches in front of the base of the tail) or on the rump (1.5 inches from midline). Udder cleanliness was scored twice during evening milking using the same grid applied to the back of the udder (above the teats) and separately by counting the number of teats that contained obvious debris. There were no differences in cleanliness scores for any of the measured areas between docked and intact animals. No differences in SCC or udder cleanliness were identified. The authors concluded that there was “little merit to adopting” tail docking.

A study with more animals and for a longer duration was conducted to determine the effect of tail docking on SCC, intramammary infection and udder and leg cleanliness in eight commercial dairy herds housed in freestalls (Schreiner and Ruegg, 2002). Lactating dairy cows (n = 1,250) were either docked or served as a control cow. Milk samples, somatic cell counts and hygiene scores were collected for eight to nine months. The prevalence of intramammary infection was determined for each of the five occasions when milk samples were obtained. Udder and leg cleanliness were assessed during milk sample collection using a standardized scoring method. At the beginning of the study, there were no differences in lactation number, daily milk yield, SCC, or days in milk between docked and control cows. At the end of the study 76 (12.16%) and 81 (12.96%) of cows had been culled in the docked and control groups, respectively. There were no significant differences between groups for somatic cell count (Figure 1) or udder or leg hygiene scores (Figure 3). The rate of subclinical mastitis caused by contagious, environmental or minor mastitis pathogens was not affected by tail docking (Table 1). This study did not identify differences in udder or leg hygiene or milk quality that could be attributed to tail docking.

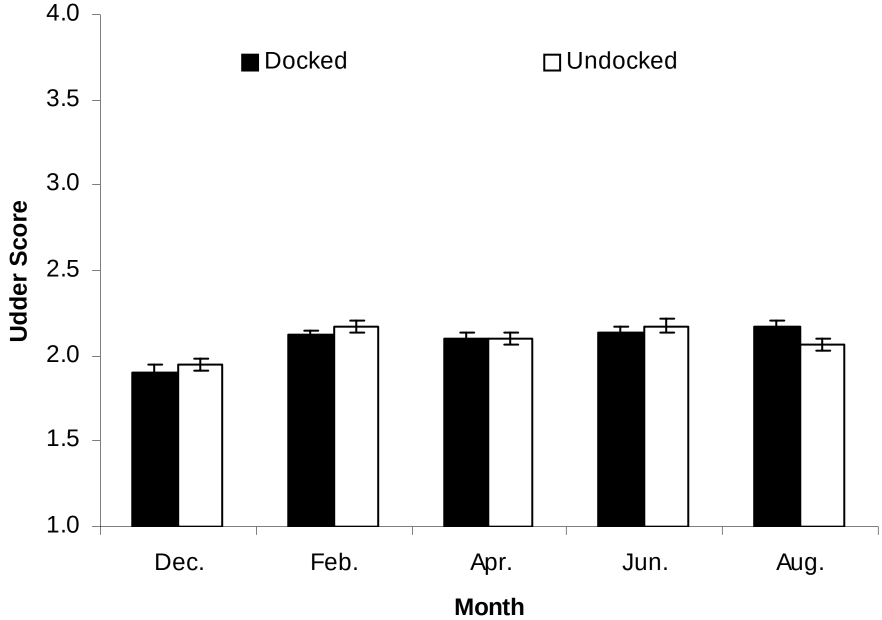


**Figure 3. Udder hygiene scores for docked and control cows.Scale is 1 (cleanest) to 4 (dirtiest).(from Schreiner and Ruegg, 2002. J Dairy Science 85:2503-2511).**

## ▪ Conclusion

Control of mastitis and production of high quality milk is dependent upon maintenance of excellent hygienic standards. Current production systems have created some new challenges for maintaining cow and facility hygiene. Increased emphasis on monitoring animal and facility hygiene will be necessary to minimize the development of environmental mastitis and to ensure that milk continues to meet consumer demands.

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