Interrelationships between Housing and Herd Health

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■ Take Home Message

There are myriad interactions between housing and health, some well understood and others that we likely have not yet recognized. In this paper, discussion will be limited to lameness and udder health.

■ Lameness in Wisconsin

A University of Wisconsin-Madison lameness survey was carried out on 30 dairy herds – 15 stanchion/tie-stall and 15 free-stall, with a variety of stall bases. Each herd was visited twice, once in the spring/summer of 2000 and once in the winter of 2001. On both occasions, all milking cows were locomotion scored 1 through 4 with cows scoring 3 or 4 classified as lame.

The proportion of cows that were lame varied widely between herds from 7.9 to 51.9%, but scoring was consistent within a herd between the two visits. Mean lameness prevalence was higher during the winter at 24.8% than during the spring/summer at 21.8%.

On average, around 23% of dairy cows are lame on US dairy herds at any one time. This number is higher than previously reported in North America, but consistent with the findings in the UK over recent times. Eleven of the 30 dairy herds kept lameness treatment records and on average, there were 73 lameness treatments per 100 cows per year – three times the recorded prevalence for these herds.

What is the Cause of Lameness?

Types of lameness recorded by the eleven herds in the study are presented in Table 1. By far the most common cause of lameness in dairy cattle is the heel wart or papillomatous digital dermatitis. Sole ulceration was the second most

important category and white line disease the third. However, these last two conditions along with sole hemorrhages, toe ulcers, and to a degree, heel-horn erosions, are all considered to be part of a laminitis syndrome.

Hygiene and Lameness

Cattle housed in wet, manure contaminated conditions are more likely to suffer infectious diseases of the foot, such as interdigital necrobacillosis (foot rot), heel horn erosion (HHE) and papillomatous digital dermatitis (heel warts; PDD), (Bergsten, 1997; Cook & Cutler, 1995; Philipot et al., 1994; Wells et al. 1999) in a survey of a large number of dairy herds across North America, concluded that 43.5% of herds were affected with PDD. The authors experience in Wisconsin is that 85% of the herds are now affected and PDD is responsible for 53% of all lameness treatments.

The cleaner and drier we can maintain the foot, the lower will be the prevalence of PDD. In tiestalls, foot hygiene will be determined by:

- The frequency of scraping the manure from the exercise area
- The adequacy of bedding management and the moisture level at the rear of the stall
- Whether or not the manure gutter is cleaned before the cows exit the barn, or whether covered by a grate.

Electric cow trainers are commonplace in stanchion and tiestall barns throughout the Mid-west, yet they have been prohibited in Sweden since 1995 for welfare reasons. Bergsten and Pettersson (1992) found that trainers were beneficial in terms of improved hygiene and claw health and Alban et al. (1996) found that trainers decreased the risk of hock lesions. However, Oltenacu et al. (1998) showed an increased risk of silent heats, mastitis, ketosis and culling in 33 herds with trainers, compared with 117 herds without. Many things impact the welfare of our dairy cows and the authors experience with managing stanchion cows, would suggest that “humane” trainers are an integral part of maintaining clean stalls and reducing the rate of clinical mastitis, which is in disagreement with the finding from the latter Swedish survey. A study involving within-herd controls is required to shed more light on this issue.

Foot and leg hygiene in freestall barns is usually worse than in tiestalls (see Table 1), largely because of the quantity of manure present in the alleys and the frequency that the cows have to walk through it. Major factors influencing the degree of leg contamination in lactating cow pens are:

- Pen design – two rows or three rows of freestalls
- Frequency of alley scraping

- Stocking density in the pen
- Stall comfort and lying times

Table 1. Frequency of lameness types from 1395 lameness events recorded on 11 Wisconsin dairy herds. (Cook, 2002-a)

Type of Lameness	Proportion of Cases
Foot Rot	2.0
Heel Warts	52.6
Corns	1.2
Heel Horn Erosion	2.1
Sole Hemorrhage	8.4
White Line Disease	11.8
Sole Ulcer	21.1
Toe Ulcer	0.8

Two vs Three rows. A three row freestall pen with three crossovers, designed to house 100 cows, will have approximately 366 square meters of alleyway and crossovers. A two row freestall pen, also designed to house 100 cows tail to tail, with the same number of crossovers, will have approximately 450 square meters of alleyway area. That equates to 20% less surface area for the three row freestall for the same quantity of manure; approximately 4990 kg per day. Unless we scrape more frequently, the manure level in the pen will be deeper, resulting in dirtier feet and legs and an increased risk of PDD (Cook, 2002-b).

Frequency of Removal. Frequency and type of alley scraping will have a major impact on manure accumulation. Currently there are four main options:

- Slatted floors
- Flushing
- Manual scraping
- Automatic scrapers

Slatted-floor barns are common in Europe. A recent study suggested that cows have no preference for grooved concrete or a slatted area (Stefanowska et al., 2002). However, problems with pit ventilation in naturally ventilated Slatted-floor barns, freezing of manure on slats, and other issues suggest that slatted-floor barns will not soon be common in the US.

Flushing and manual scraping are usually performed when the cows are in the collecting yard for milking, hence normally 2 or 3 times per day. Guidelines for

the frequency of removal of manure based on hygiene and health assessments are unavailable. Data from seven dairies in Wisconsin, scraping between 1 and 4 times a day, would suggest that three times a day should be viewed as a minimum frequency for the control of infectious foot disease.

Automatic scrapers have the potential to keep freestall cow's lower limbs cleaner, only if they are operated continuously and over a short distance, so that cows do not have to walk through a large wave of manure as it progresses through the pen.

Overstocking. Overstocking will lead to more manure being deposited per square foot of alleyway and exacerbate existing problems, particularly in six row freestall barns, milked and scraped twice daily. It will also impact lying time and potentially increase the risk of laminitis if maintained over a long period. (Leonard et al., 1996).

Cow Comfort and Lying Times. There is a growing body of evidence that increased lying times have a beneficial effect on lameness prevalence and claw health, and obviously increased time spent lying down in a clean dry comfortable stall will mean less time walking up and down alleyways and lead to cleaner drier feet. However, there are surprisingly few studies that document lying times, claw lesions and lameness prevalence. Leonard et al., (1994) noted that decreased lying times and increased periods spent standing half in and half out of stalls with a more restrictive divider style, were associated with reduced claw health and Galindo and Broom (2000) showed that cows low in the hierarchy spent more than 45% of the time standing in alleys and suffered significantly more sole, interdigital and heel lesions.

Cook (2002-c) demonstrated that a stall usage index, measured as the proportion of cows in stalls that were standing either completely in or half in stalls one hour before milking, was significantly related to lameness prevalence in a recent Wisconsin lameness survey (Figure 1).

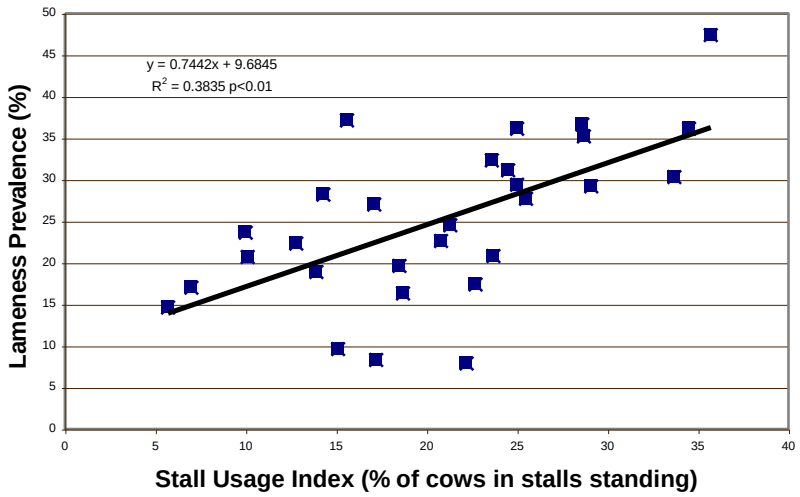

Figure 1. The relationship between stall usage index and lameness prevalence In Wisconsin freestall herds

Targets for appropriate daily lying time must come from studies of dairy cow behavior in an unencumbered environment. Singh et al. (1994), studying resting time for cows housed in deep straw bedded yards, suggested that 10 hours per day should be considered adequate lying time and more recently, Phillips and Rind (2001) recording lying times of cattle at pasture found lying times of 10.9 to 11.5 hours per day. A lying time of around 11 hours per day would therefore be considered an appropriate target for all cows. We believe that sub-optimal environments increase the proportion of cows which do not regularly lie down for at least 11 hours per day, and it is these “outlier” cows that are at risk of developing lameness and other health problems.

In the Wisconsin lameness survey, sand base stall housing achieved a significantly improved Stall Usage Index score and a lower prevalence of lameness (Cook, 2002-c) (Table 2).

Table 2. The effect of stall base on lameness prevalence, stall usage index and the proportion of cows with hock abrasions on 30 Wisconsin dairy farms

	Sand Stall Base Herds (n=8)	Other**Stall Base Herds (n=22)
Mean (SE) Lameness Prevalence		
Summer	13.6 (3.2)*	24.2 (2.0)*
Winter	16.9 (4.0)*	27.2 (2.3)*
Freestall Stall Usage Index (%)	15.0*	25.0*
Proportion of cows with hock abrasion (%)	5.4*	38.8*

* Denotes statistical significance across rows at P<0.05, one way ANOVA
** Other refers to stall bases made of bedded concrete, rubber mats and rubber filled mattresses

Lameness and Walking Surface

Rough walking surfaces have been shown to increase lameness prevalence (Faye and Lescourret, 1989) and excessive exposure to concrete may result in excessive wear of the claws. However, the benefits of installing rubberized walking surfaces in the feed alleys of freestall barns have yet to be proven. Vokey et al. (2002) found no overall significant effect of rubber alleys on claw lesions and lameness, but did highlight the many complex interactions between stall base type and walking surface. Use of such surfaces on return alleys from the parlor, and any other high traffic areas is recommended.

■ Environmental Effects on Udder Health

Figure 2 shows a hygiene scoring system developed and used on Milk Quality Control Investigations for over two years. It charts the degree of manure contamination in three main zones; the udder, the lower leg (rear only) and the upper leg and flank. The chart has evolved over time and a color version can now be downloaded at www.vetmed.wisc.edu/dms/fapm/forms.htm. Typically, all of the milking cows in a tiestall barn and 25% of the cows in each pen in a freestall barn are scored, along with dry cows and heifers.

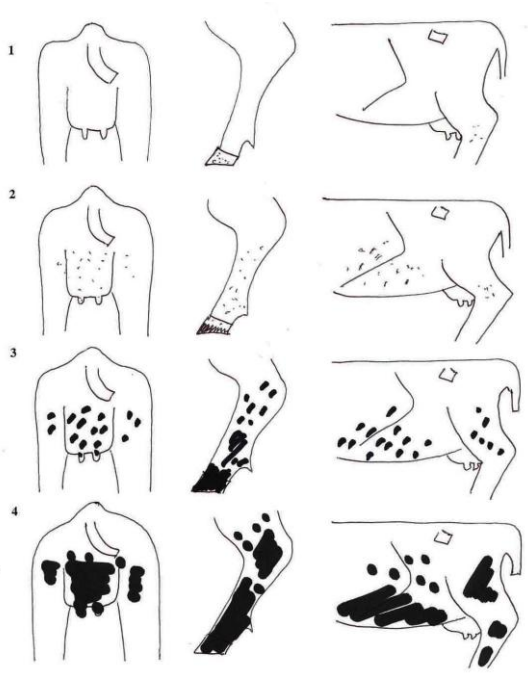

Figure 2. A chart for hygiene scoring cows on a scale of 1 - 4 for three zones of the body; udder, lower leg and upper leg and flank.

Benchmarks for Leg, Flank, and Udder Hygiene

Table 3 summarizes data collected from 27 Wisconsin dairy farms suggesting benchmarks for the proportion of each zone designated too dirty for freestall and tiestall herds.

The acceptable level of manure contamination of cattle appears to vary between countries and between regions within a country. As a veterinarian visiting the farm, it is difficult to tell a farmer that their cows are “too dirty” and that improved cleanliness is required. Use of a quantitative approach, rather than a qualitative opinion, is a more effective means of delivering the message and by scoring in zones we can give more structured advice on how to keep cows cleaner.

Table 3. Mean proportion of hygiene scores 3 and 4 for udder, lower leg and upper leg and flank zones for 27 Wisconsin dairy farms.

Barn Type	Proportion of Hygiene Scores 3 and 4		
	Udder	Lower Leg	Upper Leg and Flank
Mean Freestall herd	20	54	17
Best Zone Scores	5	24	6
Mean Tiestall herds	18	25	26
Best Zone Scores	0	9	5

Relationships between Udder Hygiene and New Mastitis Infection Rates

Data from milk quality control Investigations (Figure 3) made by the author, demonstrates a significant (R^2 = 0.42) relationship between the proportion of udders scoring 3 and 4 on each farm and a monthly mean udder new infection rate derived from somatic cell count analysis. These data confirm the significance of keeping cows and udders clean and lend support to the system of scoring presented.

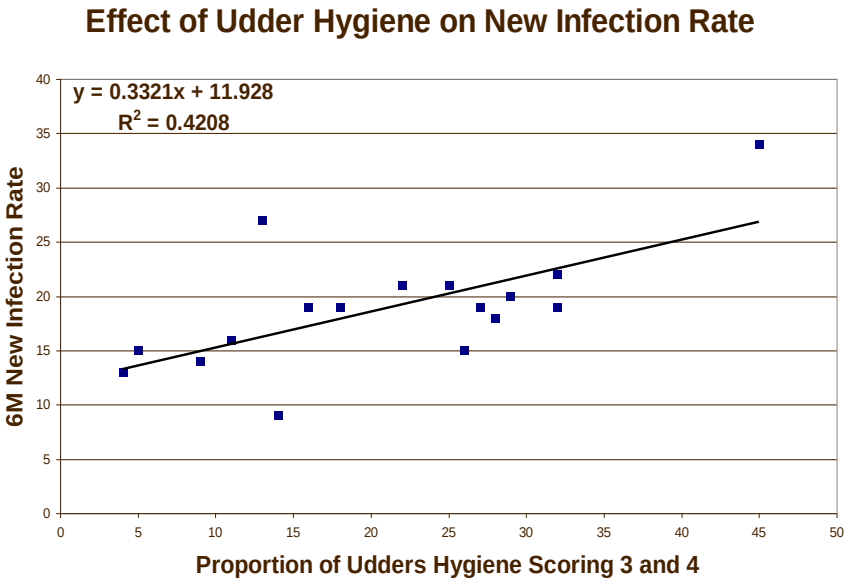

Figure 3. The association between udder hygiene score and monthly new infection rate on 17 Wisconsin dairy farms

Stall Bedding and Potential Pathogen Exposure

It is however, important to realize that the presence of large bacterial numbers at the teat end may not always be obvious. Bey et al., (2002) have described a commercially available method of assessing the number of bacteria in bedding samples and the author has personal experience of several instances where apparently clean bedding harbored many millions of potential udder pathogens, which may have contributed to new udder infections.

In general, the finer the bedding particle the more bacteria the material will be able to sustain once it becomes warm and moist. Bedding should not be stored at the front of the stall and scraped to the back as it will have incubated on the stall surface beneath the cow and will contain vast numbers of potential pathogens. Instead, we recommend more frequent application of bedding, once daily. Bedding additives aimed at controlling bacterial growth, such as hydrated lime need to be added to the stall daily as their length of action is little more than 24 hours.

Sand stalls should receive fresh bedding every 7 days. Flatten the bed each milking with the flat side of a garden rake. Sand which clumps in the hand when compressed, and stays in a ball as it is thrown from hand to hand for more than

2 or 3 throws contains too much organic matter and should be removed from the stall.

■ Conclusion

The environment in which we place the dairy cow has an impact on hygiene status, lying time and in some situations, it may be responsible for trauma and injury. If our dairy cows are to have longer and more productive lives, we must improve the environment in which we keep them in order to reduce levels of lameness and mastitis. Use of well managed sand bedded stalls in both tiestall and freestall barns carries distinct benefits in terms of foot and udder health. In the author's opinion, these health benefits far exceed any extra expense incurred by manure handling. Stall design and mattress surfaces are improving, but further development is needed if they are to compete with the health benefits of sand.

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