

2010

CATTLE LAMENESS CONFERENCE

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Topics are:

- **EU LaneCow and other studies**
- **Healthy Feet project**
- **The UK situation**
- **Mobility scoring in practice**

Wednesday 14th April 2010

**School of Veterinary Medicine and Science
University of Nottingham
Sutton Bonington Campus
Loughborough
Leicestershire
LE12 5RD**

CLC 2010

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GENERAL INFORMATION

TIMETABLE of EVENTS

09:00	ARRIVE / REGISTRATION / COFFEE and POSTER DISPLAY	
09:30	CHAIRPERSON'S INTRODUCTION: Jon Huxley, University of Nottingham	
09:40	Analysis of national data on lameness in dairy cows	Mike Coffey SAC, Edinburgh
10.20	Questions and Discussion	
10:35	COFFEE and POSTERS	
Session 2 Chairperson: Nick Bell, University of Bristol		
INTRODUCTION TO SESSION 2		
11:05	Locomotion, preference and hygiene on alternative flooring surfaces - research and experiences from EU Lamé Cow and other studies	Christer Bergsten Skara, Sweden
11:50	The Healthy Feet Project: Promoting the uptake of husbandry advice to reduce lameness in dairy cattle	David Main University of Bristol
12:30	Questions and Discussion	
12:50	LUNCH and POSTERS	
Session 3 Chairperson: Brian Pocknee, The Dairy Group		
14:00	INTRODUCTION TO SESSION 3 and VOTING ON POSTERS	
14:05	No lame cows - is it possible? Experiences from the Healthy Feet Project	Nick Bell University of Bristol
14.45	Mobility scoring on farm – The team approach	Mark Burnell & Jon Reader Synergy Farm Health, Dorset
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15:45	TEA and DEPART	

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 UK
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¹ Quality Milk Management Services (QMMS) Ltd., Unit 1, Lodge Hill Industrial
 Park, Westbury-sub-Mendip, Wells, BA5 1EY, UK; ² School of Veterinary
 Medicine and Science, University of Nottingham, Sutton Bonington Campus,
 Sutton Bonington Leicestershire LE12 5RD, UK; ³ SUM-IT Computer Systems
 Ltd, Samuel House, Chinnor Road, Thame, OXON, OX9 3NU, UK
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¹ Zinpro Animal Nutrition, Boxmeer, The Netherlands; ² Zinpro Corporation,
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¹ The Royal Veterinary College, Hawkshead Lane, North Mymms, Hatfield,
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 Dorset, DT2 0LD, UK
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 Sarah Voss¹, Nick Bell² & Jon Huxley¹
¹ School of Veterinary Medicine and Science, University of Nottingham, Sutton
 Bonington Campus, Loughborough, Leicestershire, LE12 5RD, UK; ² University
 of Bristol, Division of Farm Animal Science, Department of Clinical Veterinary
 Science, University of Bristol, Langford, Bristol, BS40 5DU, UK

CHAIRPERSON'S INTRODUCTION

On behalf of the organising committee I would like to welcome you to the inaugural **Cattle Lameness Conference** and to the University of Nottingham's School of Veterinary Medicine and Science.

Lameness in cattle is an increasingly important issue for the industry; the organising committee firmly believe that it is currently one of the most significant problems affecting the health, welfare and productivity of the national herd. Recent research work from around the UK suggests that between 25 and 30% of dairy cows are identifiably lame on any single day of assessment and that the situation is worse than a decade ago. Those of us with an interest and expertise in the field cannot and should not shy away from this situation. Solving this multi-causal, multi-factorial problem will not be an easy task; nor will there be any quick fix solutions. It is vital that we start to research, devise and implement evidence based controls which deliver cost effective improvements to the industry now.

The absence of a UK forum to share latest research findings and disseminate best practice on this subject was notable in its absence. To address this deficit we have instigated today's conference to gather interested parties in a forum which will facilitate knowledge sharing and discussion. For the inaugural event we have put together a programme of high quality UK speakers with national and international reputations in their fields. They including Prof Laura Green (University of Warwick), Prof Stuart Carter (University of Liverpool), Dr Becky Whay (University of Bristol), Dr Chris Brown (ASDA) and Mr Chris Watson (The Wood Veterinary Group). We are grateful for their time and enthusiasm. Please take the opportunity to question them during the periods we have allocated for questions and during breaks; I am sure they will be happy to discuss their papers with you.

We are hugely indebted to our sponsors for sharing our vision for this inaugural event and their generous financial support. Representatives from all the companies are with us today, I am sure they will be happy to talk to you during the event.

We are grateful to Barbara Hepworth (Division of Animal Health and Welfare, School of Veterinary Medicine and Science) for administrative support and the hard work she has put in to CLC, in addition to her regular role within the School.

Finally we are indebted to you as delegates, without your attendance the conference would not exist. We really hope you enjoy the day and you find it a useful forum. We have deliberately left plenty of time during the day for discussion and networking and we have opted for a buffet lunch to allow delegates to circulate. We would welcome and value your feedback, please tell us what you liked about this inaugural event and what we can improve for the future. Feedback forms are available for this purpose or alternatively please talk directly to any of the committee during or after the event.



Jon Huxley
Cattle Lameness Conference Chairperson, University of Nottingham
On behalf of the CLC Organising Committee

FURTHER INFORMATION

Organised by:

University of Bristol
The Dairy Group
University of Nottingham



The Dairy Group



Organising Committee

Chairman: Jon Huxley
Conference Secretariat: Emma Palfreyman
Web site: Nick Bell
Editor: Brian Pocknee

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Nick Bell, University of Bristol
Brian Pocknee, *The Dairy Group*
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PAPERS

ASSESSING THE FEASIBILITY OF USING FARMER RECORDED LAMENESS/FOOT HEALTH DATA FOR THE PURPOSES OF GENETIC IMPROVEMENT.

T. Pritchard, M. Coffey, R. Mrode, K. Moore, E. Wall

BACKGROUND

Genetic improvement is sustainable, cumulative and cost effective. Once obtained, it can be added to thereby accumulating benefit over generations. The cost of obtaining it is usually simply based on a choice of bulls which may differ in semen price. However, benefits are often in orders of magnitude greater than the difference in the price of the semen. Thus genetic improvement in lameness must be a high priority for all concerned due primarily to its effect on the cows welfare, but also because of the wastage of cows causing environmental impact, increased management costs and reduction in profitability. Finally, the culling of cows for lameness reduces the opportunity for genetic improvement in other traits since involuntary culling may now exceed 25% in many herds.

EXPANDING INDICES PROJECT

An industry consortium has come together to fund a project at SAC under the Sustainable Livestock Production LINK Programme to expand the traits in the national index £PLI to make it broader and to incorporate more traits known to influence profitability. The project has already produced a national calving ease evaluation (published first in January 2010) and is currently developing a mastitis index expected January 2011. As part of that project, genetic parameters of all traits will be recalculated to allow them to be included in £PLI. The reason for that is that we need to know how traits are correlated to each other in order to work out their relative economic value (the weight used in £PLI).

Data on many of the relevant traits are available as they are part of routine genetic evaluation systems or data extraction procedures have been developed as part of the project. However, there is little routine farmer recording of lameness data, meaning that a genetic evaluation for lameness cannot be routinely performed. Analysis of mastitis records showed that farmers do also have the option to record lameness/foot health as a separate health event in milk recording organisation (MRO) databases. The objective of this work was to explore the feasibility of utilising these data to help estimate genetic parameters and to provide feedback on future recording processes to facilitate genetic evaluation of lameness.

Data were extracted for lameness and foot health, as recorded voluntarily by the farmer. A lameness event recorded within 30 days of a previous lameness event in the same lactation was classed as the same lameness episode. Please note that the descriptions following are based on an unedited data file (i.e. no data restrictions have been applied as would be the case in performing genetic parameter estimation).

Overall, a total of 89,988 lactations for 75,453 animals (3,438 herds) were extracted from MRO databases. Table 1 shows the distribution of lameness episodes across lactation. As with many production and fitness traits, the highest number of records are in lactation 1, with numbers reducing as lactation number increases. This does not suggest that there are more cases of lameness in lactation 1 but rather a function that there is more recording of lactation 1 cows. Table 2 shows that there tends to be one or two episodes of lameness per

lactation per animal, with very few cows experiencing multiple episodes of lameness per lactation.

Table 1. Number of lactations with lameness/foot health records

<u>Lactation Number</u>	<u>Count</u>
1	23,558
2	20,370
3	18,543
4	15,741
5	11,776

Table 2. Number of lameness episodes within a lactation

<u>Lactation Number</u>	<u>Count</u>
1	74,975
2	11,971
3	2,442
4	505
5	83
6	10
7	2

Analysis of the data showed that the number of recorded cases has been rising in recent years as well as the number of herds actively recording the trait. This indicates that this uptake of voluntarily recording of such events has been increasing. Table 3 shows the percentage of cows that are lame/have foot problems, within herds (and year) that are actively recording lameness. This shows there has been a rise in the incidences of this farmer recorded trait over recent years. The incidences across MROs were relatively consistent. These data suggest that there is some scope to utilise farmer recorded data on cases of lameness. However, it should be noted that only initial edits have been place on these data. It is thought that the recorded data is likely to be treatments rather than observations of lameness. The difference between what farmers treat as lameness and what researchers and veterinarians would score as lameness is a matter for debate and further study.

Table 3. Percent incidence of lameness/foot problems as recorded by farmers

<u>Year</u>	<u>% incidence</u>
2000	3.37
2001	3.48
2002	4.56
2003	5.95
2004	6.93
2005	7.93
2006	8.84
2007	9.00
2008	10.92

Disease in dairy cattle is multifactorial with animals often having more than 1 disease (e.g. lameness leads to reduced feed intake and negative energy balance and then infertility). Locomotion (a proxy for lameness) is also correlated to mastitis as shown it table 4. Thus it appears that reducing lameness will also have a beneficial effect on other diseases.

Table4: Heritability estimates and genetic correlations of MAST, SCC and Locomotion

	h^2	MAST	SCC
MAST	0.05±0.01(1)		
LOC	0.11±0.01(2)	- 0.29±0.13	-0.19±0.10

CONCLUSIONS

Farmers are recording data on lameness in national databases. Although early days yet, it may be possible to use these data to aid genetic selection. The process of using data for genetic evaluations has in the past led to an increase in recording. The recording of disease is the only way of reducing it. All encouragement must be given to farmers and appropriate incentives provided by those who would benefit from it e.g. supermarkets, milk buyer etc. It should not be used as a stick with which to beat livestock keepers. This is even more important as genomic tools become available that will lead to increases in rates of gain in other traits that are negatively correlated to lameness. The advent on genomics has paradoxically led to the need for more phenotypes not less. In the age of the genotype, the phenotype is king.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the statistical help of Dr Sue Brotherstone and funding under the Sustainable Livestock Production LINK Programme, the Scottish Government, CIS, Cogent, DairyCo, Genus, Holstein UK and NMR.

*Proceedings of the Cattle Lameness Conference (2010) Sutton Bonington
University of Bristol, The Dairy Group and University of Nottingham*

NOTES

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University of Bristol, The Dairy Group and University of Nottingham*

LOCOMOTION, PREFERENCE AND HYGIENE ON ALTERNATIVE FLOORING SURFACES – RESEARCH AND EXPERIENCES FROM EU LAMECOW AND OTHER SWEDISH STUDIES

Christer Bergsten

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SUMMARY

- There is an association between exposure of cows' feet to hard, abrasive flooring and laminitis-related claw diseases causing lameness.
- There is an association between exposure of cows' feet to unhygienic flooring and infectious claw diseases causing lameness.
- Increased availability comfortable lying reduces exposure of claws to poor floor conditions.
- Cow tracks, as an indicator of cow walking comfort, were improved with a rubber surface on top of both solid and slatted concrete floors.
- Cows clearly prefer to stand and walk on rubber compared to concrete floors.
- Differences in floor abrasiveness may alter wear and growth that can affect lameness.
- Drier alleyways, by effective drainage of urine and manure, reduce the risk for infectious claw diseases.
- Gradual accommodation of the animals to new floors can reduce the risk for some claw disease.
- Improvements of flooring systems and their management are mandatory to obtain the highest possible animal well-being and performance by reducing lameness and claw disorders.

INTRODUCTION

The ongoing process to larger dairy units and the introduction of automatic milking systems will increasingly emphasize the importance of reducing risks for lameness since immobile animals will not fit into a system with low labour input. Despite much effort to reduce lameness world-wide, treatments of lameness do not seem to subside. For a long time it has been a general assumption among researchers that the environment of the cows' feet is of primary concern for the outcome of lameness. Herd problems with digital dermatitis (DD) exploded during the 1990's and was blamed as the cause for most lameness problems. Today we know that despite these undisputable DD problems, a great deal of lameness is caused by laminitis-related claw horn lesions such as sole ulcer, white line disease etc. For these claw lesions the physical or traumatic environment is of highest importance. Our experience from the late eighties clearly showed that solid rubber mats in tie stalls reduced the occurrence of laminitis-related sole haemorrhages and sole ulcers (1,2). At that stage it was not possible to determine if this was an effect of standing on a soft surface, lying more due to the improved rubber mat comfort or a combination of the two. Fortunately new funding allowed us to test new types of rubber mats on cows' walking comfort and preferences, as well as flooring systems influence on claw conformation and claw disease. The research entailed model studies as well as full-scale experimental and field studies with the aim to predict future flooring requirements for cows' well-being and performance. The main elements were to study: locomotion patterns,

cow preferences, hygiene, claw conformation and horn quality, weight distribution between and within claws, lameness, and claw disorders. In this paper the locomotion pattern and preference studies are described and some general aspects on cow comfort are discussed.

LAMINITIS

Laminitis is the underlying cause of many claw disorders and lameness. Laminitis is the name of a complex of claw disorders which we can see in the foot and that often shortens the longevity, reduces the production capacity and causes suffering for animals. Laminitis refers to a non infectious inflammation of the claw corium (lamellar corium, etc.) harming the horn production. Laminitis has both a metabolic (nutritional) and bio-mechanical (traumatic) background. It is believed that the metabolic component loosens the attachment of the claw bone inside the horn capsule. Provided that the metabolic load is the same, exposure of the cow's feet to hard flooring and improper loading triggers the process (3). Due to loading and counter pressure from the ground the corium between the claw bone and sole horn is squeezed and blood and blood serum leak out and are absorbed in the growing horn. These hemorrhagic spots are weak points for further environmental damage and are identified as sole and white line haemorrhages, sole ulcers, double soles and white line disease.

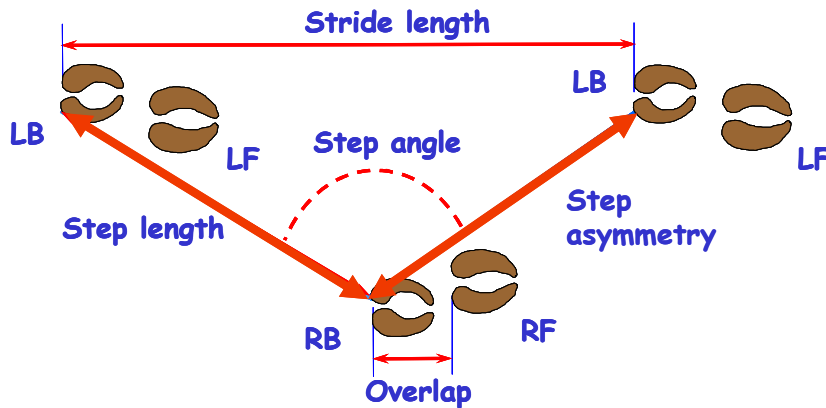
FLOORING IN DAIRY BARN

In all types of dairy barns concrete has been the one and only material used for constructing floors for all purposes; lying, standing, walking, and milking. Concrete is a very good material in many aspects such as engineering, durability and cost. However, concrete as a material is not a given formula because of many differences in compounds and quality; as well, concrete wears and changes with time. Concrete can also be modified to reduce slipperiness by grooving before or after casting. There is no doubt that concrete will continue to be the base for floor construction in the future. But, we already see the development of many different materials to lay on top of concrete for different purposes. Examples are different mats and mattresses for cubicles and rubber mats for alleyways of different quality with the purpose to improve cow comfort and performance. **In the following have tested different grooving of concrete, mastic asphalt, slatted concrete, solid rubber and slatted rubber mats.**

TRACING COWS WITH FOOT PRINTS

A new method where the animals' footprints were tracked, measured and analyzed was developed and locomotion patterns for different flooring types were tested in different dairy herds (4). The track way analysis was also one way of indicating lameness when Canadian researchers evaluated several methods detecting lameness in a recent study (5). In our first experiment (4), the cows were tested on five surfaces: solid concrete, slatted concrete, solid rubber mats, slatted rubber mats and finally packed sand. For each surface a 10 m long, straight walkway was prepared with a thin layer of slurry mixed with lime powder (except for sand). After milking, the cows were kept in a group and individually walked through each surface in one test run. The measurements of the foot-prints were made manually from four consecutive strides on each floor type, using a ruler and an angle-meter (Figure 1). The time of passing each test course was measured to estimate the walking speed of the cow. Cows' locomotion score was also assessed using the Sprecher (6) method, whether the back was arched when standing and walking.

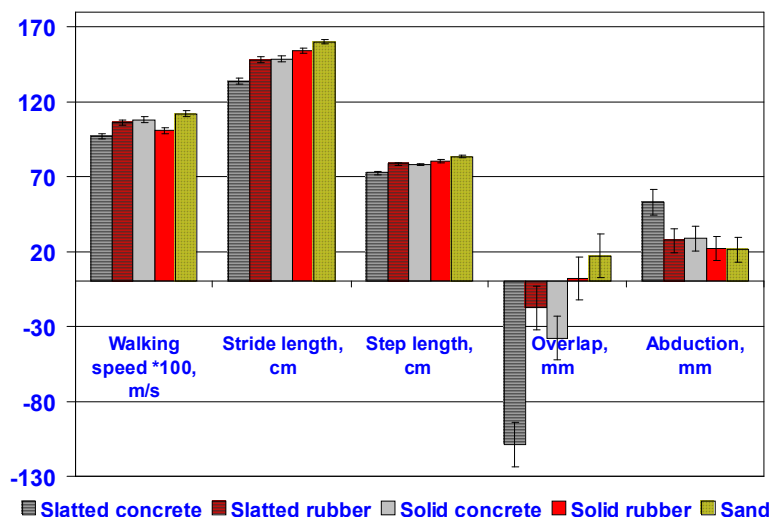
Figure 1. Track way measurements



The results showed that healthy cows walked more efficiently on rubber mats than on concrete floors and both stride and step length increased significantly compared to a concrete surface (Figure 2). The gait pattern was worst for most parameters on relatively worn concrete slatted floors while natural sand and rubber mats gave the best figures. The speed of cows was lowest on the slatted concrete floor in comparison with the other floor types. On the concrete slatted floor the strides were shortened and the overlap was considerably "more negative" than on the other surfaces. In comparison with slatted concrete, the cows increased their speed, prolonged their strides and steps, and had a higher overlap when walking on the slatted rubber flooring. Cows took longer strides on solid rubber mats than on slatted rubber mats. Other track way elements did not differ significantly between the two types of rubber flooring.

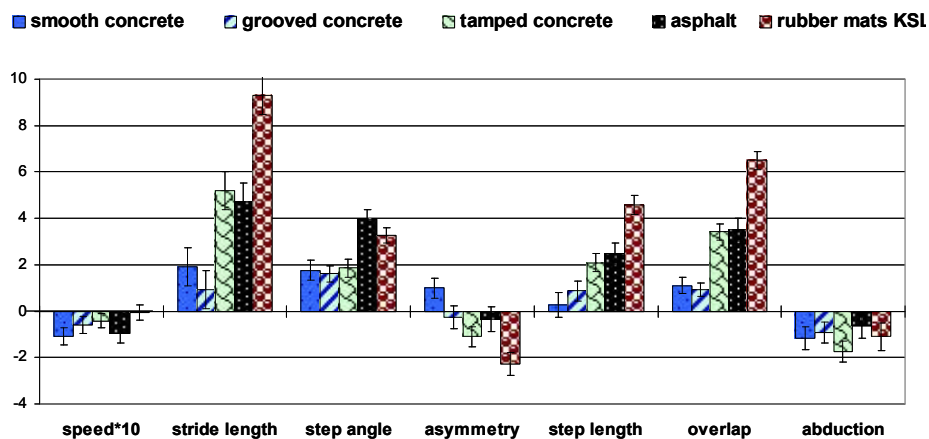
Although no severely lame cows were present, most cow track way parameters were more pronounced by lameness. Moderately lame (score 2, arched back when walking and standing) cows walked slower than non-lame (score 0) cows, and had a shorter stride and a shorter step length than non-lame and mildly lame (score 1; arched back walking) animals. Moderately lame cows also had a larger negative overlap than non-lame cows. Cows with mild lameness had a positive overlap in contrast to non-lame and moderately lame cows but did not differ significantly from non-lame cows in speed, or stride and step length. Thus slatted concrete resulted in the greatest impairment of gait of slightly lame cows but there was only a very small, non-significant difference between lame and non-lame cows on sand and rubber flooring.

Figure 2. Results of track way analysis of five different parameters when a cow walks on five different floorings



In a second experiment the floor's slipping resistance was judged by the same track way analysis. Slatted concrete and five solid floors (smooth concrete, diamond grooved concrete, hexagon stamped concrete, mastic asphalt and solid rubber mat) of different material and friction were tested after three weeks of accommodation (7). The results showed that all the solid floors had a better locomotion result than the slatted concrete flooring (Figure 3). Steps were also less asymmetrical on solid floors. The mastic asphalt surface demonstrated significantly higher static and dynamic friction than concrete floors, and elastic rubber mats revealed the highest friction properties. The rubber mats resulted in the longest stride and step length. Strides and steps on smooth and grooved concrete were shorter and closer to that of slatted concrete floor than those obtained on the other floors. Step asymmetry was expressed most on the smooth concrete floor and least on the rubber mats. There was no evidence of flooring influencing step abduction.

Figure 3. Differences in locomotion between tested solid floors (filled columns) and slatted concrete (baseline)



LONG TERM INFLUENCE OF DIFFERENT FLOORING SYSTEMS

In a three year project 150 heifers were studied from approx. 12 months of age throughout their first lactation in a commercial dairy herd (8). Claw conformation, locomotion and claw and leg lesions were regularly studied at trimming when housed and at pasture. During the winter housing period before calving heifers were allocated to either concrete cubicles (hard) or deep straw bedding (soft), both with a scraped concrete alley. Heifers on hard flooring had higher growth and wear rate of claws and a higher prevalence of sole haemorrhages and dermatitis than heifers on deep straw bedding. Heifers on hard flooring thereby developed more overgrown claws and heel horn erosion. Leg lesions in the heifers were only observed in the cubicle system. **All heifers were grazed for 4 months from May and at trimming in September no differences between groups regarding any observed traits were no longer seen.** Before their first calving in autumn they were all housed in a cubicle system with soft mattresses. Half the animals from each group from the previous heifer housing period were allocated to either concrete slats or rubber slatted flooring in the alleys. After a 4 months lactation period during the winter housing season, the most prominent finding was 3.6 times higher risk for lameness, 2.2 times higher risk for sole haemorrhage and sole ulcer and 2.8 times higher risk for white line haemorrhage in animals on concrete slats compared to those on rubber slats (Table 1).

Table 1. Claw lesions and lameness in first calf heifers on concrete in relation to slatted rubber

Claw Disease	OR	CI 95%	P_{LR}
Heel horn erosion	0.49	0.22 - 1.09	0.08
Dermatitis	1.06	0.44 - 2.52	0.89
Haemorrhages of sole	2.19	1.00 - 4.97	0.05
Haemorrhages of white line	2.82	1.28 - 6.43	0.01
Lameness	3.64	1.33-11.09	0.01

Although not significant, animals coming from deep straw bedding had a higher prevalence of sole haemorrhages and sole ulcers than those from the cubicles, especially when moved to the concrete slats compared to rubber slats. Soft floors are beneficial for cows' claw and leg health but heifers changing from a soft to a hard flooring system need a longer acclimatization period and trimming of overgrown claws.

Ongoing studies are investigating a new type of alley rubber mat that has an abrasive superficial layer of carborundum to increase wear of the claws and reduce slipperiness.

WHAT IS THE COW'S OPINION OF WALK WAYS?

The preference for hard (concrete) and soft (rubber) flooring was tested group-wise in a 300 cow commercial organic dairy herd (9). Firstly, the preference for soft, extra soft or solid concrete flooring was tested when cows were standing in the holding pen before milking. Secondly, the walkway from the parlour to the cubicles was alternatively equipped with slatted or solid rubber mats or with slatted concrete flooring. The holding pen and walkway were divided lengthwise in two equal parts and each floor type was tested during four days on the left, followed by four days on the right side of the holding pen and the walkway, respectively. Control treatments were made with concrete flooring on both sides. All behaviour was recorded by video. In the holding pen, the number of cows on each floor was assessed every seventh minute. On the walkway to the cubicles after milking, the number of cows walking on respective floor type or changing between them was assessed continuously from the video.

Dairy cows preferred to stand and walk on rubber flooring compared to concrete flooring. A slightly higher preference for extra soft rubber compared to soft rubber when standing and for solid rubber compared to slatted rubber flooring when walking was observed. When the space per cow increased in the holding pen during milking the proportion of cows choosing rubber mats versus concrete floor increased. With more than 7m² per cow the preference for soft and very soft rubber mats versus concrete flooring was similar and over 70% in comparison to the concrete control. The number of animals choosing soft flooring versus concrete on the walkway increased gradually over time and on the 4th test day it reached almost 80% preference for solid and slatted rubber mats (Figure 4).

Figure 4. Cows showed 80% preference for walking on twenty millimetres thick rubber mats (Gummiwerk Kraiburg Elastik, Germany) compared to concrete.



HYGIENE, HYGIENE , HYGIENE

It is no doubt that hygiene of stalls and floors are of highest importance for infectious claw diseases. In cubicles the hygiene shall be optimized by adopting the space for the cow. If the stall is too short or the neck rail placed to low or too far backwards the cow will involuntarily stand half in with the back feet in the dirt of the alley. Moreover if the alleys are not kept clean the exposure of dirt, nutrients, humidity and chemicals may be too much for the feet to resist even if they are naturally very well protected. Controlled studies have clearly showed the benefit of a clean foot environment to reduce dermatitis and heel horn erosion (10,11).

DISADVANTAGES OF RUBBER FLOORING

Certainly, rubber flooring is a more expensive solution, but the question is if there is a return on investment due to reduced lameness, decreased treatment costs, better fertility and increased feeding activity, this not including animal wellbeing. From our experiments we could see that claw wear was much less on rubber than on a more abrasive flooring like new casted concrete or mastic asphalt. However, claws seem to adapt to different floors such that less wear is compensated by less growth, and more wear from an abrasive flooring results in more growth (12). Thus there may be no dramatic differences between old concrete flooring with low abrasiveness and rubber flooring. It is probable that the higher prevalence of heel horn erosion on deep straw bedding only is an effect of lower turnover rate of claw horn growth compared to cubicles, because the occurrence of dermatitis of the claws was higher in the cubicle system. The higher occurrence of heel horn erosion on slatted rubber mats was associated with less draining area compared to the concrete slatted flooring. This problem can be solved by scraping of the floors with a specific truck or automatically with a cleaning robot or automatic scrapers on top of the slatted floors.

CONCLUSIONS

Compared to the cow's natural environment when grazing, today's confined dairy systems hardly achieve requirements for comfortable lying, standing and walking; and hygiene is

often poor. A higher risk for lameness and leg injuries is found in large and high producing herds especially when housed in a concrete system (13). There is no indication that production demands will decrease in the future and tomorrow's management systems must thus be planned for even higher outputs than today

Claw injuries are influenced by over-exposure to hard, abrasive and unhygienic floors, while leg injuries, such as hock and carpus injuries, are related to difficulty in lying and rising and prolonged uncomfortable lying on hard, abrasive and unhygienic floors in the stalls. In present studies the track way measurements clearly showed the animal's reaction on different floorings, which can be interpreted as a very important indication of the wellbeing for both healthy and lame cows. The studies presented in this paper did not show any significant improvement on track way measurements on concrete flooring with different kind of grooves, most probably because all concrete floors compared were relatively newly casted and the cows were walking in a straight line at a sedate pace without a high risk of slipping. However, mastic asphalt flooring with its higher friction was associated with a more efficient gait. Mastic asphalt will keep its higher friction permanently but our preliminary results showed an over-wear of claws that could be detrimental. Softer and more resilient flooring materials like rubber might be future alternatives in alleys for dairy cows. Feed stalls (Fig. 5) equipped with rubber mats are another alternative to improve comfort and hygiene for the feet. Moreover the choice of softer flooring is interesting because it is supposed to decrease the risk for claw lesions and lameness. Hard floors and management changes before calving seem to be important factors in the development of subclinical laminitis expressed as sole lesions. It is obvious that animals can adapt to harsh conditions if they get sufficient time for acclimatization. It is therefore recommended to make changes from softer to harder foundations either months before calving or alternatively to keep animals on soft ground until a few weeks after calving, before introducing them to concrete floors. We should also take into account that harsh abrasive surfaces disturb the balance between outer and inner digits of the rear feet, resulting in an asymmetry between them and a disposition for claw injuries and lameness. Further investigations are in progress.

Figure 5. Cow standing in elevated, divided feed stalls with rubber mats reducing competition and improving foot hygiene and comfort



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Mike Coffey

THE HEALTHY FEET PROJECT; PROMOTING THE UPTAKE OF HUSBANDRY ADVICE IN TO REDUCE LAMENESS IN DAIRY CATTLE

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BACKGROUND

Promoting a reduction in the levels of lameness in the UK is an important priority for the UK dairy industry. Whilst further studies are still needed to better understand some aspects of cattle lameness, a significant body of knowledge is already available that could and should be implemented at a farm level. Previous work has developed a risk assessment approach that promoted the development of farm specific action plans based on farm specific risk factors (1). However, an important finding from this work was that even though the advice on how to reduce lameness was valid, many farmers did not implement it when it was provided in a traditional advisory style. Better methods for promoting uptake of existing knowledge are, therefore, needed to promote reductions in lameness.

INTERVENTION STUDY OUTLINE

The need to encourage farmer uptake of lameness-related advice led to a relatively large scale intervention project; the Healthy Feet Project. The project was supported by Tubney Charitable Trust and the initial partners were Milk Link, Long Clawson, OMSCO, Freedom Food and Soil Association Certification. The project also went on to work with an even greater number of industry stakeholders to insure wider application of the findings from the project. The project team developed a range of tools to promote on-farm implementation of lameness prevention activities using the principles outlined below. For each principle the project team developed specific methodologies applicable to UK dairy farms. An intervention study involving 140 intervention and 87 control farms was then initiated to examine the effect of this approach. Dairy farms were recruited via direct contact or via the relevant milk companies. A team of four researchers with a good understanding of lameness then undertook a four year programme of visits, follow up telephone contact and group meetings on those farms receiving the intervention. The effect of these interventions on husbandry changes and lameness will be available at the end of the four-year study period.

INTERVENTION APPROACHES

The key primary focus for the project was to promote the uptake of actions / activities likely to reduce lameness or to refine existing lameness reducing activities to increase their effectiveness. These actions were based on existing knowledge of risk factors known to influence lameness and on advocating the early treatment of lame cows. Although mobility scoring and formal risk analysis are valuable tools for promoting lameness improvement, it was considered critical that these management tools did not become the primary focus of the initiative. It is clear that when management tools are introduced without consideration of the target audience some resistance is inevitable. This has been seen with health planning initiatives which have been variably received by UK farmers (2). So the project did not concentrate on insisting that farmers agree with the results of a lameness assessment which was considered confrontational. It was thought more important to

provide an identification list of cows that were likely to benefit from treatment rather than present an overall prevalence figure. Similarly for the risk assessment process, even though formal evaluation tools were available, the dialogue with producers did not concentrate on explaining risk assessment process or detailed finding on farms. The risk assessment web site (www.cattle-lameness.org.uk) was, therefore, only advocated for use by those farmers and their vets/advisors with a particular interest.

Since the primary focus was on promoting an uptake of lameness relevant activities, the project team developed a social marketing approach suitable for UK dairy farmers. Social marketing (3) involves the application of marketing principles to an area of social benefit, in this case animal welfare. Farmers in the UK often work alone on their farms, they have very limited contact with others and their days involve completing a lot of repetitive, routine tasks. So social marketing for farmers needed to include more contact with individuals than would normally be expected; this contact was delivered through the four researchers visiting each farm at least once a year.

The key elements of the social marketing "type" approach used in the project are outlined below:

a) Recognizing the Benefits and Barriers to Change

Farmers are more likely to take action if they perceive **benefits**, although, this change may be limited by any perceived **barriers**. For every desired change in behaviour there will be both perceived benefits and perceived barriers. A potential benefit may include believing that the change will save time, offer economic benefit, or perhaps contribute to making other tasks on the farm easier. For example, keeping the feet of cows clean in order to reduce infectious lameness may also result in cleaner udders and faster milking times. A potential barrier to achieving cleaner feet might include a lack of appropriate equipment, for example the yard scraper may be inefficient and need repair, modification or replacement or a perceived lack of time to increase the frequency or diligence of yard scraping.

It was important that the project team who were promoting behaviour changes understood the details of the possible benefits and barriers as perceived by the farmers. It was also essential that the project team members encouraged implementation of changes on farm by using phrases and quotes that made sense to the farmers they were speaking to. This was achieved by inviting farmers to a series of focus groups where their ideas and the language they used was listened to very carefully.

b) Facilitating Farmers to Plan Their Own Changes

Farmers are more likely to implement management or routine that result from their own ideas, i.e. a "farmer-owned approach". A good facilitator will not provide unsolicited advice, i.e. **they will not tell the farmer what to do**. The goal should be helping the farmer to generate solutions that are appropriate to his or her own farm. Members of the project acted as facilitators and walked around the farm with the farmer asking questions about particular aspects of the farm which were likely to be risk factors for lameness. During this walk round the farm the facilitator addressed barriers to change presented by the farmer by encouraging him or her to weigh them against potential benefits. The facilitator also shared the experiences of other farmers by describing actions they had taken, and offered contact details of other farmers (with their permission) that had found ways of tackling a similar problem. At the end of the facilitated visit, before leaving the farm, the facilitator compiled a summary of the changes the farmer had identified as being possible to make into an action list including notes on who would be responsible for implementing each change (the farm manager, herdsman, tractor driver etc) and when the change was going to be

implemented along with a space to tick when the change had been introduced. This list was then left with the farmer for the coming year.

c) Establishing Lameness Prevention Activities as a Normal Behaviour or "Norm"

Farmers are more likely to change behaviour if they know others have done the same. Establishing "norms" is the process for reassuring farmers that others are also making changes i.e. that it is normal behaviour to make changes to reduce lameness. The project brand "Healthy Feet Project" and its use in all communications ensured that all the participants are aware they belong to a larger project in which others are involved and that they had a group identity they could be proud of. Norms were also created through describing what changes other farmers had made on their farms. This helped to address perceived barriers but also acted to reassure each farmer that others were also making changes and overcoming problems. The activities of other farmers were relayed using verbal descriptions, photographs of what they had changed (with their permission) and a regular newsletter which featured case examples of farms where changes had been implemented.

d) Encouraging Commitment to the Project

Commitment is the key for sustaining behaviour change. There are various techniques to encourage more positive commitment. Within the lameness project all participating farmers were given a jacket lapel badge and a car sticker of the project logo and they were encouraged to display them. Although this is a relatively small act, by showing others that they were part of the project they were more likely to go on to implement the more challenging changes. Further areas where commitment was promoted was through asking farmers to put their signature on the action plan which is drawn up during the facilitation visit and through asking their permission to show others photographs of their farms (with their names clearly identified on them)

e) Providing Prompts as Reminders to Implement New Activities

Prompts act to remind people of agreed activities and help sustain the new behaviour. Although peoples' intentions to change a particular practice or habit are generally good, new activities can easily be forgotten or slip from mind, especially when they involve making changes to existing routines or when people find themselves under time pressure. Within the project a catalogue of suppliers of equipment, services and materials that were commonly needed when making lameness reducing changes was presented to the farmer at the time when the facilitated action list was generated. The catalogue was intended to prompt picking up the telephone and placing an order or booking a service etc. as a common stalling point for action was farmers saying they didn't know where to buy a material, for example wood shavings to spread on cows beds to increase their lying comfort; the catalogue overcame this.

FUTURE APPLICATION

The approaches advocated in this project have been validated for other disciplines as reviewed by Whay and Main (2009; 4). It, therefore, seems reasonable to advocate their application to the UK farming environment. However, as with all new ways of working the devil will be in the detail and it is hoped that such management tools will be further developed and refined in the future. In particular it is hoped that advisors working with farmers reflect upon their methods of working. A farmer-owned approach is not only much more likely to be effective but recognises that farmers hold skills and knowledge about farming that most veterinary surgeons and advisors will never be able to duplicate.

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NO LAME COWS - IS IT POSSIBLE? EXPERIENCES FROM THE HEALTHY FEET PROJECT

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SUMMARY

The dairy industry faces constant criticism over its welfare record, with repeated references to lameness. Significant steps have been taken to improve the industry awareness of lameness and various initiatives are underway. However, without a well defined vision for success, the industry is liable to lose focus and direction. This paper examines whether the aspiration of a state of 'zero-lameness' on farm is realistic given what we know from the science and experiences on-farm.

CAN ANY AMOUNT OF LAMENESS EVER BE CONSIDERED ACCEPTIBLE BY THE INDUSTRY?

Within the last 12 months there has been a succession of high profile reports on the welfare of dairy cattle highlighting the urgent need to address lameness. These include the European Food Safety Authority report (1), the FAWC opinion on the welfare of the dairy cow (2) and FAWC Farm Animal Welfare in Great Britain report (3). The FAWC opinion proposed 5% lameness as a threshold for intervention while the EFSA report suggested a figure approaching 10% of cattle with locomotor disorder should trigger intervention. Legislative guidance in the cattle welfare codes remains vague on levels deemed acceptable, specifying severely lame animals require immediate treatment, with those that fail to respond being referred to the vet or culled. Animal Health have received guidance that should lameness levels be found to exceed 5%, single farm payments can be penalised. These sources suggest a low prevalence is perhaps tolerable, and many would say realistic in dairy farming systems, but they do not indicate whether a zero-prevalence should be the aspiration for the industry.

Farmers are rightly concerned about the critical welfare reports and the potential damage they may have on their industry. Interestingly, a survey of opinion gathered from 227 farmers participating in the Healthy Feet Project found 10% of farmers that responded felt a single lame cow in the herd constituted a problem (unpublished data). The median prevalence of lame cows deemed a problem was 5%. Given the difficulty with reliably measuring true incidence rate and duration of lameness at this point in time, we can exclude these measures from the debate, but these measures may become useful with current advances in screening methods. The limitation to the discussion regarding acceptable levels of lameness is that 'lameness' is a subjective term that is commonly used for a condition with a spectrum of severity yet it is rarely defined precisely.

HOW SHOULD THE INDUSTRY DEFINE AND SO BENCHMARK LAMENESS?

The difference in interpretation of the term lameness is well illustrated by the consistently lower estimates of lameness by farmers compared with independent researchers (4-6). In order to unite the industry and find consensus, there was a clear need to standardise terminology and improve farmer awareness of lameness on farm using this terminology.

The DairyCo Mobility score has moved the industry forward with an *increased* degree of objectivity with materials to aid standardisation. It may have side-stepped the question 'what is lameness' but offers the industry a measure of foot health based on a practical lameness screening tool, thereby reducing the confusion and sense of criticism generated by the term 'lameness'. Work done at Bristol would suggest the correlation between farmer estimates of lameness prevalence and the prevalence of 'score 3' (very lame) cows is much closer than other measures of prevalence assessed using veterinary and researcher definitions of clinical lameness (6). Therefore, should the 'score 3' cows be the initial focus of attention for the industry given farmers are key stakeholders?

The DairyCo Mobility score was launched in the autumn of 2008 and consequently relatively little research has been conducted using this score. Therefore, it remains unclear at this stage how significant the welfare compromise might be for 'score 2' and 'score 1' animals relative to 'score 3' which we know are severely compromised. This is an exciting area of research which is on-going.

There is a strong argument to support a move to a more lesion-based approach to managing lameness. There is no clearer indication that the cow is experiencing some level of pain and suffering than the presence of a foot lesion known from clinical experience and research to be painful (7). The limitation with this approach is that cows identified in the early stages of lameness may be suffering from acute inflammation of the corium that may take several weeks to manifest as a lesion on the sole surface, whether it is haemorrhage or ulceration. None-the-less, for benchmarking the industry progress, 'zero-sole ulcer' or 'zero-white-line-lameness' may be useful concepts, albeit meaningless to the lay person. The 'zero-lesion' concept becomes more complicated when endemic conditions such as digital dermatitis and the sole haemorrhage/claw overgrowth complex are considered. It may also ignore some other important causes of lameness such as foreign body penetrations and hock injury. Mobility scores must remain the simplest approach for addressing the range of problems and uniting the industry in improving foot health at this current time. Future work on lesion monitoring and automated lameness scoring should provide the industry with good alternatives to mobility score that demonstrate increased objectivity. Examples of these approaches include the lesion database developed as a bull selection tool in Sweden (Bergsten, Cattle lameness conference 2010) and various automatic lameness detection approaches ({Mottram, 2010 #2847; Rajkondawar, 2006 #2319; Walker, 2010 #2849; Song, 2008 #2850})

WHAT ARE THE CURRENT LEVELS OF LAMENESS IN THE UK AND IS ZERO LAMENESS A REALISTIC ASPIRATION?

The inconsistency with which studies have measured lameness means comparisons over time have to be made with great caution. Farmer reported treatments would appear to have stabilised or possibly decreased in recent years (12; 13). However, when incentives or recording encouragements are used, a much higher incidence rate is reported (14-16). Lesion incidence rates may be more reliable, but again, there are likely to be differences between studies using passive and active screening methods.

Lameness prevalence studies would more strongly suggest a rise in prevalence which is much more consistent with veterinary and farmer experiences in the field. Clarkson *et al* 1996 reported a prevalence of 20%, while Whay *et al* 2002 reported a prevalence of 22%. The prevalence of score 2 and 3 cows on the Healthy Feet Project was 36%, although the range was 0-79% and the top 25% had fewer than 1% cows that were score 3 (17). Thirty six farms out of 227 had no 'score 3' cows and one farm had no 'score 2' cows (11 farms

had fewer than 5% 'score 2' cows). The conclusions we can draw from this sample of farms is that zero-lameness prevalence is achievable, albeit by the minority of herds, although less so if we consider 'score 2' as lame.

COULD THE SHORTENING OF LAMENESS DURATION USING SCREENING (E.G. MOBILITY SCORING) AND TREATMENT REDUCE LAMENESS TO ZERO-PREVALENCE?

A 6 month randomised control trial was conducted to compare the treatment of 'score 2' cows within two weeks of going lame with conventional detection and treatment strategies. This study was conducted at Bristol using four herds with a total of 1000 cows, between September 2008 and April 2009. Lame cows at the start of the study were excluded and the remaining cows were randomly allocated into intervention and control groups. The herds were mobility scored every fortnight to identify new cases of lameness with the intervention group receiving foot paring according to Dutch 5 step principles (18) and treatment by a veterinary surgeon following a standardised treatment protocol. 'Score 3' cows were excluded from the study and given immediate treatment. This study found the majority but not all of treated cows in the intervention group improved within two weeks of treatment while most of the control group did not. In a separate analysis of the lame cows, approximately half of lame cows treated by the farmer were lame 100-200 days prior to treatment on the farm and the majority were lame 100 days following treatment. This is consistent with milk yield losses reported by Green *et al* 2002 who modelled milk yield loss up to four months before and five months after farmer treatment. This intervention study is on-going and is due for completion in 2011.

While these results are extremely encouraging, there may be limitations in our detection and treatment methods that mean cure rates are never 100%. Further work is required to identify which 'score 1' and 'score 0' cows require treatment to prevent progression to the clinically lame state. This could be a route to the 'zero-lameness prevalence' state. More importantly, more work is required to reduce the risk of foot lesion development or progression without the need for treatment.

IS THERE ANY RELATIONSHIP BETWEEN LAMENESS AND LAMENESS RISK THAT WOULD SUGGEST LAMENESS CAN BE ENTIRELY PREVENTED?

Lameness is a complex, multifactorial disease involving at least 18 primary disorders of the foot and several secondary disorders (Table 1). Conditions of the upper limb may account for 1% of lameness (14).

Table 1 Primary and secondary disorders of the bovine foot and the internationally agreed nomenclature* (19)

Primary lesions	
1.	White line lesion (also called: white line separation, white line disease)*
2.	Sole ulcer*
3.	Sole haemorrhage (also called: sole bruising)*
4.	Toe ulcer (also called: toe necrosis)*
5.	Wall ulcer
6.	Corkscrew claw
7.	Horizontal fissure (also called: hardship grooves)
8.	Vertical fissure (also called: sandcrack)
9.	Axial fissure (also called: axial wall fissure)
10.	Thin sole
11.	Foreign body penetration
12.	Heel ulcer
13.	Heel haematoma
14.	Interdigital hyperplasia (also called: interdigital growth, interdigital fibroma)
15.	Digital dermatitis
16.	Interdigital dermatitis
17.	Heel erosion
18.	Foul (also called: foul-in-the-foot, foot rot, interdigital necrobacillosis)
Secondary lesions	
19.	Double sole
20.	Deep digital sepsis
21.	Coriosis (also called: claw capsule distortion)

The most common lesions found at treatment are sole ulcer, sole bruising, white line and digital dermatitis (20; 21) and the risk factors for these lesions are mostly well described, and numerous, well in excess of 100 (22). The approximate linear relationship between risk and lameness prevalence in first-calved heifers has been demonstrated and the intercept of the regression line passes near to zero suggesting as on-farm risk approaches zero, lameness prevalence approaches zero (23). However, what is poorly understood is how risk factors interact to increase prevalence or severity of lameness (24) and whether a sequence of events or conditions are necessary for lesions to become established. Even more concerning is the lack of data on what level of risk reduction and intervention strategies are cost-effective, which is a major barrier to improvement (6).

A concept that is greatly under-used in veterinary epidemiology is that of the protective factor. Commonly reported in human medicine, the protective factor may explain the absence of lameness on farms that present with numerous risk factors. These are often reported as interventions; for example, the use of straw yards and fresh calving groups in the period four weeks before calving through to eight weeks after calving for the prevention of sole ulcers and reduction of sole haemorrhage (25) or the use of high dry matter diets for the prevention of claw horn disease (26). The exercise of highlighting the attributes of the farms without disease would seem obvious, yet is rarely done. It may turn more focus on genotype and certain management systems. Identification of the latter has been the approach advocated by one commercial animal health risk management programme (myhealthyher.com). Work is underway to identify protective factors and establish the cost-benefit of these management systems.

WHAT ARE THE PRIORITIES FOR THE FUTURE IF THE STATE OF 'ZERO LAMENESS' IS TO BE ACHIEVED?

In the two FAWC publications from 2009 that reported on dairy cow welfare, the following extracts appear particularly relevant to the identification of future priorities:

'Farmers play a central role in ensuring acceptable standards of welfare. Some problems, e.g. lameness in dairy cattle and broiler chickens, are best tackled by improvements in management and careful choice of breeding stock. Education and training of stockmen, driven by a desire for self-improvement, the demands of assurance schemes, or incentive payments by processors in the food supply chain, are all means to implement change and are as powerful as the legislative stick.' **FAWC report 2009**

'Certainly, the low profitability of dairy farming has compromised investment and maintenance on many farms which, in turn, may have hindered progress in reducing the incidence of lameness, mastitis and metabolic diseases.' **FAWC opinion 2009**

In order for the industry to progress, the conditions conducive for change need to be created. Historic surveys indicate the risk of lameness has greatly increased over the last 50 years (14; 21; 22), and returning to low risk production systems could be one approach, although clearly this would not be universally popular or economically viable. Furthermore, it would need to be driven by the retailers. Investing in scientific research in order to mitigate lameness risk with improved monitoring and intervention strategies (on the back of randomised control trials) is one other longer-term approach. However, the shortage of research funding could hamper advances. Dissemination of current research and concepts in best-practice (health planning) has been shown to have very limited short-term impact when used in isolation (22). However, coupled with approaches to improve implementation, modest improvements can be made (Main, Cattle Lameness Conference 2010). Again, implementation of best-practice would appear to be a long-term intervention requiring careful consideration of the numerous barriers to improvement perceived by farmers (6), especially financial and time pressures (Leach poster, Cattle Lameness Conference 2010). The author believes the urgency with which change is required means there is no better time for the sector to create and agree the necessary incentives.

CONCLUSION

Zero-prevalence lameness is achievable and we can learn much from these commercial farms about the mitigation of lameness risk. Recent figures for lameness prevalence would suggest the increase in lameness over the last 50 years means improvement is likely to require input from several quarters. If current levels of production are to be maintained it will require innovation (research and commercial development), better implementation of best practice (knowledge exchange, marketing of ideas and quality assurance), better identification of protective factors but perhaps above all else, commercial incentives for all farmers within the industry to improve. With stronger commercial drivers farmers will be confident to prioritise investment in the improvement of cattle welfare and so that the zero-lameness state becomes more than just an aspiration for the visionary or minority farmer. Improved foot health has benefits for the whole industry: the cow, farmer and retailer, and indirectly to those who work with them.

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MOBILITY SCORING ON FARM – THE TEAM APPROACH

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SUMMARY

This paper will discuss the practicalities and challenges involved with routine mobility scoring on farms and how mobility scoring can be used as part of a routine lameness management programme. The role of the team approach within this will be examined and how paraprofessionals and veterinarians can work together to provide vital information and advice to the farmer.

INTRODUCTION

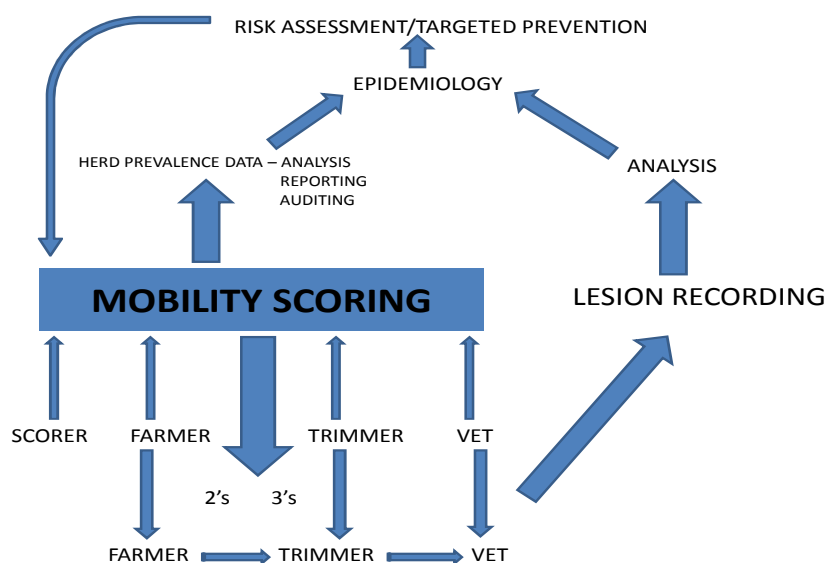
There is little doubt that lameness is a major factor in reducing performance on many dairy farms, at least through reduced reproductive efficiency, milk production and increased culling. The financial costs of lameness have been reviewed recently (41) with the average cost to a UK herd being estimated at approximately £7,500 pa or 0.97 ppl. What should be more concerning are the welfare implications of lameness and quite rightly the spotlight of milk buyers is now focusing more and more on this issue. The FAWC welfare update of 2009 summarised that lameness incidence had not changed in the last decade and the report recommended that this needed to be tackled with some urgency (13).

Attempts at assessing and benchmarking lameness on farms has traditionally been difficult because of the definition of a 'lame cow' and recording compliance; indeed on many farms it seems that day to day contact with such animals can lead to a degree of 'lameness tolerance', where only the worst cases are considered lame. Locomotion scoring, once primarily the preserve of researchers has now been developed into a standardised easy to use 'tool' renamed Mobility Scoring (DairyCo) and provides a simple way of assessing herd lameness prevalence. It can be used for auditing and monitoring progress over time on both individual and groups of farms as well as a proactive lameness prevention and control 'tool'.

Synergy Farm Health employs a team of 5 paraprofessional foot trimmers. Mobility scoring is an important part of their duties, initially as part of contract trimming arrangements or contracted for auditing purposes. We would like to describe how we are attempting to utilise mobility scoring as part of a lameness reduction and control plan on our clients' farms. We would emphasise, however, that this is still very much 'work in progress'.

The initial part of the talk will describe the practicalities and challenges of routine mobility scoring on farm as well as describing how software has been developed in the practice to aid reporting and monitoring; in the second part we will discuss the roles of the various 'players' in the approach to the individual lame cow and how the combined information can be used in prevention.

Figure 1. Flow of information in the ideal 'team approach'



RECORDING LAMENESS

Traditionally lameness has been recorded and monitored using an incidence rate (number of clinical cases diagnosed per 100 cows per year). This mirrors the method used for recording mastitis data on farms. However, whereas a case of mastitis is relatively easy to define, this is not the case with lameness. Problems occur due to subjective opinions on whether the cow is lame, the correct identification of the lesion and also recurrence rates. Table 1 demonstrates some of the commonly quoted incidence levels from the literature. However it can be seen that these are recorded by vets, foot trimmers and farmers or a combination of all these.

Table 1 Summary of lameness Incidence from recent research:

<i>Author</i>	<i>Year</i>	<i>Recorder</i>	<i>Analysis</i>	<i>Rate per 100 cows / year</i>	<i>Range</i>
Eddy and Scott (11)	1980	Vets	Incidence	7.30	
Russell <i>et al</i> (31)	1982	Vets	Incidence	5.50	
Prentice and Neal (27)	1972	Vets	Incidence	30	
Whitaker <i>et al</i> 1983 (40)	1983	Vets	Incidence	6.30	
	1983	Farmer	Incidence	18.70	
Clarkson <i>et al</i> (6)	1996	Farmer	Incidence	74	70 to 78
Collick <i>et al</i> (8)	1989	Stockmen / Trimmers	Incidence	17	
Esslemont <i>et al</i> (12)	1996	Stockmen / Trimmers	Incidence	17	
Clarkson <i>et al</i> (6)	1996	Stockmen / Trimmers	Incidence	55	
Hedges <i>et al</i> (17)	2001	Stockmen / Trimmers	Incidence	70	
Green <i>et al</i> (15)	2002	Stockmen / Trimmers	Incidence	70	
Harris <i>et al</i> (16)	1988	South Victoria	Incidence	7	
Gitau <i>et al</i> (14)	1996	Kenya	Incidence	18	

It is commonly accepted that a cow with a case of clinical mastitis is deemed to have a recurrence of that case if it is seen with mastitis greater than 7 days after clinical signs have resolved. There is no clear cut definition with lameness. A case of digital dermatitis will often resolve relatively quickly while a sole ulcer may take months to resolve. If a sole ulcer is treated monthly for six months, is this considered one case or six? Furthermore, it is generally accepted that the recording of digital dermatitis may be understated due to the use of blanket herd treatment (footbathing) as well as the

presence of dermatitis lesions with other lesions, such as sole ulcers, that may be deemed to be more significant by the operator.

More recently the industry has adopted the use of prevalence of lameness as a more meaningful tool to monitor the situation in a herd. This is simply the number of cows affected in a herd at a particular point of time as is monitored using mobility scoring (also previously known as locomotor scoring (4)). Table 2 demonstrates some of the commonly quoted levels in the literature. However, great care must be taken when looking at these levels.

Many different scoring criteria have been described which makes cross comparison difficult. Generally in the USA the Sprecher method (34) is well accepted while in the UK the DairyCo four level assessment has been used (See Appendix 1). It is important moving forward that if meaningful analysis and tracking of lameness prevalence is to be carried out that a consistent method is used and the authors would recommend that the industry in the UK continue to embrace the DairyCo method of scoring.

Table 2 Summary of lameness prevalence from recent research

<i>Author</i>	<i>Year</i>	<i>Description:</i>	<i>Analysis</i>	<i>%</i>	<i>Range</i>
Clarkson <i>et al</i> (6)	1996	37 farms	Prevalence	21%	
Rutherford <i>et al</i> (32)	2009	80 farms (40 organic)	Prevalence	19%	1.4% to 48.6%
Huxley <i>et al</i> (21)	2004	15 organic farms	Prevalence	24%	
Reader (unpub.) (29)	2009	28 organic farms	Prevalence	12%	1% to 40%
Manske <i>et al</i> (25)	2002a	Sweden	Prevalence	5%	
Dembele <i>et al</i> (10)	2006	Czech Republic	Prevalence	22%	
Wells <i>et al</i>	1993	USA	Prevalence	17%	
Cook (9)	2003	USA	Prevalence	24%	
Sprecher <i>et al</i> (34)	1997	USA	Prevalence	65%	

Even when consistency in scoring method is performed it is important that the same cows are being scored. Rarely are dry cows scored as this is not convenient and in many circumstances the nurse cow/straw yard/under treatment group are not scored. On many farms this group could contain the worst affected animals and an underestimated level of lameness could easily be recorded.

On a practical basis, studies within the practice have shown that a farm with an average lameness index of 32% across the year had 75% of the cows in the herd experiencing a score of 2 or 3 in a year when fortnightly mobility scoring was performed. Incidence of lameness as recorded by the farmer was 25 cases per 100 cows per year and 185 lesions were recorded by the foot trimmer per 100 cows in the herd. In this study 48% of the cows showed a change in mobility score between consecutive fortnightly mobility scores. This would certainly highlight that the use of a six monthly or annual mobility score is not appropriate.

In practice we would recommend regular mobility scoring of all milking cows in the herd followed by accurate diagnosis of lesions of all those cows scoring MS 2 or MS 3 to build up a picture of the lameness issues on the farm.

THE EFFECT OF LAMENESS AND MOBILITY SCORE ON MILK YIELD

An increasing body of work has looked at the effect of lameness on milk yield. Table 3 highlights some of the important pieces of work from the literature. However as discussed above all of these studies have looked at different parameters. Some have looked at clinical records from farmers while others have looked at mobility scoring on a one off basis or on a fortnightly basis across a year. When studying the milk yield the different authors have looked at different variables from monthly test day yield to twice

daily milk yields. This makes it difficult to compare and contrast the body of evidence currently available.

Green *et al* (15) reported that although lame cows actually produced more milk than non lame cows that over a lactation, cows which were lame could have produced an additional 360 kgs of milk if they had not been lame. Clinically lame cows had a reduced yield from up to 4 months before a case was diagnosed. This study looked at monthly test day yields and analysed clinical lameness (15). The most quoted work in relation to mobility scoring is unpublished work (30) by Robinson who showed milk loss of 17% for cows scoring 4 (on a Sprecher 5 point scale). Table 3 summarises the current literature relating to the effect of lameness on milk yield.

Table 3: Summary of the effect of lameness on milk yield

Author	Year	Parameter	Finding	Timing	Notes	Lameness measure
Lucey <i>et al</i> (24)	1986	Daily yield	1.1 kg/day	1 wk before and after	Friesian/Ayrsh/ Holst X	Clinical
Rajala-Schultz (28)	1999	Daily yield	1.5 - 2.8 kgs	2 - 3 wks after dx		Clinical
Warnick <i>et al</i> (36)	2001	Daily yield	2.6 kg/day	2-3 weeks after dx	Holsteins	Clinical
Green <i>et al</i> (15)	2002	305 d yield	360 kgs	4m pre to 5m post		Clinical
Hernandez (18)	2002	305 d yield	10% decrease		Interdigital Phlegmon	Clinical
Robinson (30)	2003		MS 3 - 5.1% MS 4 - 17% MS 5 - 26%			Mobility scoring
Juarez <i>et al</i> (22)	2003		2.8 kgs 4 kgs	Sub clinical Lame cows	1 score only	Mobility scoring
Hernandez (19)	2005	305 d yield	874 kgs	Based on 1st 100 day		Mobility scoring
Bicalho <i>et al</i> (5)	2008	305 d yield	314 - 424 kgs			Clinical
Amory <i>et al</i> (1)	2008	305 d yield	570 kgs 370 kgs 0	SU WLD DD	Incr. after tx	Clinical
Archer <i>et al</i> (2)	2009	305 d yield	351 kgs	Dependent on mth		Mobility scoring
Reader <i>et al</i> (29)	In press	Daily Yield	MS 2 - 4.5 kg MS 3 - 6kgs	44 d before to 54 d after return to MS 1		Mobility scoring

Research carried out by the authors has looked at the effect of mobility score on milk loss. Analysis of daily milk yields and fortnightly mobility scores was carried out. Mobility Score (MS) 1 cows produced more milk than MS 0, 2 and 3. The loss in milk for MS 2 and MS 3 cows began 44 days prior to a change in mobility score and went on for 54 days after the mobility score had returned to 1. The effect of mobility score on yield was related to the longevity of the lameness episode. However, in summary, when a cow became a chronic MS 2, she was losing 4.5kgs of milk per day. A cow that was a chronic MS 3 was losing 6.5 kgs of milk per day.

It is also important to note that it is not only yield losses that are the result of lame cows. The welfare of these animals are compromised (39) and they are in pain. If a farmer was to translate a lameness index score of 25% into the fact that 25% of the herd were in pain on that day then we think this would help to focus the mind.

PRACTICAL MOBILITY SCORING AT SYNERGY FARM HEALTH

Mobility scoring is carried out using the DairyCo four stage mobility scoring protocol. This is carried out by one of the team of paraprofessionals working for the practice. Ideally the same person will score each time. Group sessions are organised on a regular basis to try to standardise scoring to allow as accurate a comparison of data as possible. Scoring on the whole is performed as cows leave the milking parlour at afternoon milking. The techniques of scoring are well documented (38). However there are practical problems that are seen regularly on farm that need to be overcome.

Identification of cows is by far the biggest problem on many units. This is not an issue when the mobility score is being performed as a one off assurance exercise. However when close tracking of cows is to be performed then the correct identification is vital. On many farms this is overcome by writing down the cows in the parlour before they are released using the herdman's knowledge of the cows or by using the parlour software (e.g. Process control – Westfalia Dairy Plan 21).

Other major problems include the 'shadowing of cows' as they exit the parlour as well as cows that stop to investigate the scorer which subsequently hold up other cows, upset the order of cows as well as the flow of cows. It is important that the scorer is sited in such a place to minimise this as much as possible.

In most cases mobility scores are written on paper and then reported at a later date when they have been transferred to a suitable spreadsheet. Attempts have been made to electronically record data on a palm held computer but this has led to problems due to the size and durability of the device. Synergy Farm Health have developed a system using a ruggedised laptop on farm to enter data. There are two modes for data entry. Data may be entered as cows pass the scorer. On units where cows leave the parlour very quickly and the identification is poor a facility has been developed to enter the list of cows in the parlour onto the machine before they exit the parlour. This aids both identification accuracy as well as the speed of entry. Results and analysis are immediately available at the end of the scoring session with no need for further computer entry. An action list of cows requiring attention is printed off before the scorer leaves the farm for the urgent attention by the farmer.

Making the most of the mobility score on farm

It is well accepted that prompt treatment of lameness will lead to rapid recovery of cows. In our studies we have shown that if a cow is MS 2 then if that cow is prevented from becoming a MS 3 on just one occasion then the milk saving is in excess of 40 litres.

Having generated an action list for the farmer we would recommend that all cows that are a MS 2 or 3 for the first time are looked at in the next 48 to 72 hours. However we recognise that some cows may have been previously treated and are unlikely to have returned to MS 1 before the next recording session. The software has been developed in conjunction with foot trimming data entry on farm which allows mobility scoring and foot trimming records to 'talk' to each other. This allows a foot trimmer to ensure that a cow with a healing sole ulcer is not necessarily highlighted on the action list week in week out when it is satisfactorily improving. The same software allows the action list generated by the mobility scorer to appear in the foot trimming list for quick recording of those freshly lame cows. It will also quickly highlight those cows that have been scored as a MS 2 for the first time and have not been presented for trimming.

What about the score 1 cows?

These cows are often alluded to as the stepping stone for becoming lame. However is this strictly true? Firstly in our study score 1 cows were the largest population of cows

throughout the year. MS 1 cows produced more milk (and were more active) than MS 0 cows as well as the lame cows (MS 2 and 3 cows). As fortnightly scores were carried out we were able to track the mobility score 1 cows across time. A cow with mobility score for 3 successive recordings had a probability of 0.65 of being a MS 1 at the next scoring. The probability of the same cow becoming a MS 0 was 0.19 while the probability of this cows becoming lame (MS 2) was 0.16. On this farm, therefore, we can conclude that a MS 1 was not actually a stepping stone towards a lameness incident. However if a cow had been MS 2 before becoming a MS 1 for 2 consecutive scorings the probability of this cow becoming a MS 0 at the next scoring dropped to 0.09 and the probability of it becoming a MS 2 increased to 0.32. This would suggest that cows that have been previously MS 2 are twice as likely to become MS 2 again and this mirrors almost exactly the work carried out by Hirst *et al* on clinically lame cows (20). An example of this probability table can be seen in Appendix 1. This clearly shows that there are some cows with a MS 1 that are at higher risk than others of becoming lame.

THE FUTURE OF MOBILITY SCORING ON FARM

We believe that with the use of technology such as the system that Synergy Farm Health have devised that probability trees can be produced for individual farms. This will allow all cows with MS 2 and MS 3 to be trimmed immediately but also provide a tool specific to that farm for cows with MS 1 that are at the highest risk of becoming MS 2 or MS 3 in the future.

THE TEAM APPROACH TO LAMENESS ON FARM

In the second part of this paper the authors will explain how the use of mobility scores could be used successfully in a team approach to lameness control in the modern dairy set up.

In the 1980's herds were smaller, there were few foot trimmers and on many (but not all) farms a lower level of competence in foot trimming. Thirty years on we have larger farms, labour is often stretched and consequently contract trimmers are often used for routine care as well as attending to lame cows. A number of different parties can therefore become involved in dealing with lameness on the farm; for success it is important that the farmer, foot trimmer (if used) and the vet are in effective communication.

In spite of the fact that lameness is often the most expensive health issue on the farm, because of reduced performance and premature culling, the vet may have little involvement, lame cows too often being diagnosed as 'beyond hope' by the farmer and being dispatched by the knacker. On many farms it seems there is a need for the vet to be 'repositioned' in the 'team', but this requires appropriate skill, commitment and enthusiasm from all concerned for success. So what are the responsibilities of the various parties?

The farmer needs to be able to recognise **lame** cows EARLY; in problem herds this can be a major challenge as the farmer/herdsperson working with the cows on a daily basis can develop a degree of 'lameness tolerance' where only the severely (score 3) cows are classified as lame. In practice few farmers currently formally score their cows but doing this for him can be a good demonstration / education tool. Farmers need to be trained and encouraged to at least 'mentally' score their cows on a daily basis, where this may be less likely to happen frequent formal scoring is a good tool for early identification.

Facilities available on farm

Once identified, action is required **as soon as possible** (ideally the same day). This requires adequate facilities to shed off the cow and safely lift and inspect her foot. The crush should be under cover with good lighting and quality well maintained tools should be available. The farm should also have well designed foot bathing facilities that are easy to fill and empty and also to direct cows through - if everything is easy it will happen!

It is crucial that there is a sufficient level of competence on the farm to provide at least 'first aid' for the lame cow (at least being able to attach a block). Farmers may be more or less inclined to hone their foot trimming skills but they need to realise their limitations and be prepared to refer lameness cases sooner rather than later. It is important that provision is made for the periods when the regular 'foot care' member of staff is absent even if this has to be 'call the vet'!

The role of the foot trimmer

Many farms will now be using the services of a lay foot trimmer. Currently there is no requirement for trimmers to have reached a recognised standard but a good level of competence is obviously crucial and indeed more and more have now attained diploma standard. If farmers use trimmers they should ensure that the frequency of visits is sufficient enough to achieve what is required, for example maintaining correct foot shape and/or attending to mobility score (1), 2 and 3 cows. A danger of regular foot trimming visits is the tendency to wait for the trimmer to attend to the lame cow (i.e. a shifting in responsibility).

Even the most competent of trimmers will be presented with problematic cows and cows that are failing to resolve or getting worse. It is crucial that the trimmer has sufficient knowledge of 'foot pathology' to recognise when things are beyond the scope of normal trimming or progressing adversely and is prepared to refer cases promptly to the farm's vet.

Lesion recording will be invaluable in improving herd lameness, farmer-trimmer-vet communication is important to ensure definitions are correct and consistent and that data is collated in a form easy to analyse.

The foot trimmer, like any visitor to the farm, must be aware of the potential to import/export disease; to this end he/she will be helped by the provision of adequate wash-down facilities.

The role of the vet

Historically vets have been regarded by farmers, and certainly trimmers, as having poor competence in dealing with lame cows and relationships have often been strained. Thanks to a number of training initiatives this is changing but to gain the trust and respect of foot trimmers and farmers vets must show competence in both the practical and theoretical aspects of lameness treatment and control. The farm vet must be in a position to provide the quality control to both what the farmer and the foot trimmer are doing and be prepared (and able!) to intervene and redirect accordingly. The vet should be able to at least direct farmers to places for appropriate training in basic foot care when it is required.

The farm vet should have the skills to demonstrate the value of early referral of problematic cases. Whilst in terms of corrective trimming there is a lot a competent farmer/foot trimmer can achieve, in the authors' opinion there is no excuse for excision of live tissue without appropriate anaesthesia. In many cases the value may be in the advice regards case management and prognosis which will invariably be based on a cost benefit approach. Ultimately however the vet must be the guardian of the welfare of the cow.

The vet is also ideally placed to provide a holistic approach to the overall management of lameness on the farm when armed with the correct epidemiological data. This will lead to appropriate investigations into the environment, handling and cow time budgets on the farm. The vet may need to perform further investigations such as assessments including a cow comfort index. This is another area where a trained paraprofessional can be invaluable in the collection of this data on farm.

Ultimately the aim for all parties should be to prevent lameness; with effective communication, analysis of records and knowledge of the epidemiology and pathogenesis of lameness a targeted risk assessment should be the aim of all farms with ongoing attention to factors identified.

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Appendix 1: Dairy Co Mobility scoring system (Borsberry *et al*, 1999 / Whay *et al*, 2003)

<i>Score</i>	<i>Category of Score</i>	<i>Lame/Non lame</i>	<i>Description of Cow Behaviour</i>
0	Good Mobility	Non lame	Walks with even weight bearing and rhythm on all four feet with a flat back. Long fluid strides possible.
1	Imperfect Mobility	Non lame	Steps uneven or shortened strides. Affected limbs not immediately identifiable.
2	Impaired Mobility	Lame	Uneven weight bearing on limb immediately identifiable and/or obviously shortened stride. Usually arched back.
3	Severely Impaired Mobility	Lame	Unable to walk as fast as brisk human pace and signs of score 2.

Appendix 2: Probability of movement of scores from one mobility scoring session to the next on a farm in Somerset.

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Mob Score-3	Mob Score-2	Mob Score-1	0	1	2	3	Grand Total		Mob Score-3	Mob Score-2	Mob Score-1	0	1	2	3	Grand Total
			0	0.57	0.41	0.02	0.00	1.00				0	140	99	5	244
			1	0.49	0.44	0.06	0.01	1.00				1	95	86	12	194
			2	0.07	0.57	0.29	0.07	1.00				2	1	8	4	14
			3	0.00	1.00	0.00	0.00	1.00				3	1	1	1	1
		0	0	0.51	0.46	0.03	0.00	1.00				0	85	78	5	168
			1	0.35	0.54	0.09	0.02	1.00				1	78	121	21	224
			2	0.19	0.38	0.38	0.04	1.00				2	9	18	18	47
			3	0.00	0.00	1.00	0.00	1.00				3	1	2	2	2
		1	0	0.50	0.13	0.38	0.00	1.00				0	4	1	3	8
			1	0.31	0.47	0.19	0.03	1.00				1	11	17	7	36
			2	0.05	0.42	0.42	0.11	1.00				2	1	8	8	19
			3	0.00	0.00	0.67	0.33	1.00				3	1	4	2	6
		2	1	0.00	1.00	0.00	0.00	1.00				1	1	1	1	1
			2	0.00	0.50	0.50	0.00	1.00				2	1	1	2	2
			3	0.00	0.00	0.00	1.00	1.00				3	1	1	1	1
		3	0	0.44	0.51	0.05	0.01	1.00				0	80	92	9	182
			1	0.33	0.55	0.12	0.00	1.00				1	71	119	27	218
			2	0.08	0.54	0.32	0.05	1.00				2	3	20	12	37
			3	0.00	0.00	1.00	0.00	1.00				3	1	3	3	3
		0	0	0.33	0.57	0.10	0.00	1.00				0	75	132	22	230
			1	0.19	0.65	0.16	0.01	1.00				1	127	430	104	665
			2	0.08	0.45	0.45	0.02	1.00				2	14	83	83	184
			3	0.00	0.55	0.18	0.27	1.00				3	6	2	3	11
		1	0	0.10	0.66	0.00	0.24	1.00				0	3	19	7	29
			1	0.11	0.50	0.38	0.01	1.00				1	19	85	65	171
			2	0.05	0.28	0.64	0.04	1.00				2	9	54	122	192
			3	0.00	0.15	0.46	0.38	1.00				3	2	6	5	13
		2	1	0.17	0.58	0.25	0.00	1.00				1	2	7	3	12
			2	0.00	0.20	0.60	0.20	1.00				2	2	6	2	10
			3	0.00	0.00	0.00	1.00	1.00				3	3	5	5	5
		3	0	0.60	0.30	0.10	0.00	1.00				0	6	3	1	10
			1	0.13	0.50	0.33	0.04	1.00				1	3	12	8	24
			2	0.15	0.31	0.31	0.23	1.00				2	2	4	3	13
			3	0.00	0.00	0.00	1.00	1.00				3	3	1	1	1
		0	0	0.36	0.36	0.21	0.06	1.00				0	12	12	7	33
			1	0.09	0.57	0.32	0.02	1.00				1	15	97	55	171
			2	0.03	0.42	0.51	0.04	1.00				2	5	65	79	155
			3	0.00	0.50	0.33	0.17	1.00				3	6	4	2	12
		1	0	0.14	0.57	0.21	0.07	1.00				0	2	8	3	14
			1	0.06	0.40	0.49	0.05	1.00				1	9	64	79	160
			2	0.01	0.25	0.64	0.10	1.00				2	5	98	248	390
			3	0.00	0.05	0.61	0.33	1.00				3	3	35	19	57
		2	1	0.14	0.43	0.29	0.14	1.00				1	1	3	2	7
			2	0.02	0.09	0.50	0.39	1.00				2	1	5	27	54
			3	0.00	0.03	0.46	0.51	1.00				3	3	16	18	35
		3	0	0.67	0.33	0.00	0.00	1.00				0	2	1	1	3
			1	0.22	0.22	0.56	0.00	1.00				1	2	2	5	9
			2	0.00	0.33	0.50	0.17	1.00				2	2	3	1	6
			3	0.00	0.00	0.50	0.50	1.00				3	3	1	1	2
		1	0	0.00	0.00	1.00	0.00	1.00				0	1	2	2	2
			1	0.07	0.50	0.36	0.07	1.00				1	1	7	5	14
			2	0.00	0.11	0.66	0.23	1.00				2	5	29	10	44
			3	0.00	0.06	0.48	0.45	1.00				3	2	15	14	31
		2	1	0.00	0.00	0.50	0.50	1.00				1	1	1	1	2
			2	0.00	0.16	0.32	0.52	1.00				2	5	10	16	31
			3	0.00	0.02	0.31	0.67	1.00				3	3	17	36	54
		3	0	0.69	0.29	0.02	0.00	1.00				0	36	15	1	52
			1	0.36	0.47	0.17	0.00	1.00				1	17	22	8	47
			2	0.20	0.60	0.20	0.00	1.00				2	2	6	2	10
			3	0.00	0.00	1.00	0.00	1.00				3	3	1	1	1
		0	0	0.46	0.41	0.13	0.00	1.00				0	21	19	6	46
			1	0.23	0.60	0.15	0.02	1.00				1	27	69	17	115
			2	0.05	0.42	0.50	0.03	1.00				2	2	16	19	38
			3	0.00	0.50	0.50	0.00	1.00				3	3	1	1	2
		1	0	0.50	0.50	0.00	0.00	1.00				0	1	1	1	2
			1	0.00	0.46	0.50	0.04	1.00				1	11	12	1	24
			2	0.00	0.32	0.55	0.13	1.00				2	12	21	5	38
			3	0.00	0.00	0.20	0.80	1.00				3	3	1	4	5
		2	1	0.67	0.33	0.00	0.00	1.00				1	2	1	3	3
			2	0.00	0.50	0.50	0.00	1.00				2	2	2	4	4
			3	0.00	0.00	0.33	0.67	1.00				3	3	1	2	3
		3	0	0.46	0.45	0.09	0.01	1.00				0	52	51	10	114
			1	0.22	0.56	0.21	0.01	1.00				1	47	120	44	214
			2	0.03	0.34	0.57	0.07	1.00				2	2	25	42	74
			3	0.00	0.30	0.40	0.30	1.00				3	3	4	3	10
999	999	999	0	0.27	0.51	0.19	0.03	1.00				999	119	225	82	439
Grand Total				0.22	0.45	0.27	0.05	1.00	Grand Total			1221	2495	1491	297	5504

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POSTERS

MOBILITY, MILK YIELD AND MASTITIS

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INTRODUCTION

Farm assurance schemes and media interest are now increasing consumer awareness of dairy cow welfare [1]. Compared to consumer demands for welfare assurance being imposed on dairy farmers, the need for lameness monitoring and control may be more readily accepted as a priority if reliable data on the financial impact of mobility score on milk yield and somatic cell count were available.

Grading the locomotion of all cows in a herd using a standardised format has been recommended to improve the sensitivity of lameness diagnosis. Recently a four point mobility score scale has been proposed as the UK industry standard [2, 3].

Published literature on the effect of lameness assessed by mobility score on milk yield is limited. One farm out of two showed a significant decrease in milk yield of 1.89 kg/day for each unit increase in mobility score [4], but this was based on a single milk recording only. A decrease in milk yield associated with increasing mobility score in the first 100 day of lactation was demonstrated for a herd in Florida through comparison of 305 day milk yields; significant effects were demonstrated for cows from parity 2 and above with the most severe cases of lameness. These cows yielded 874 kg less milk than multiparous cows that were not lame [5].

To the authors' knowledge, no papers have considered the association between mobility score and somatic cell count.

MATERIALS & METHODS

Dairy herds were selected on the basis of location (Midlands, UK) and having a minimum of 100 cows in milk at any time. It was confirmed that herd managers were committed to monthly milk recording through National Milk Records (Chippenham, UK) and were willing to participate in the study; seven dairy herds comprised of predominantly Holstein-Friesian cows were included. Herd health history was not part of the selection criteria.

Assessment of mobility score for all milking cows on each farm was conducted at monthly intervals for 12 consecutive months between August 2008 and July 2009 by the first author. Afternoon visits were timed to coincide with the monthly milk recording date +/- 10 days. All cows were observed walking on flat, non-slip concrete in a well lit location that was consistent on each farm [6]. The proposed UK industry standard four point mobility score scale was used where zero coded "good mobility", one; "imperfect mobility", two; "impaired mobility", and three; "severely impaired mobility" [2]. Test day milk yield and somatic cell count for every cow was obtained electronically each month. Data were analysed to account for the correlation of repeated measures of milk yield and somatic cell count within cow [7].

RESULTS AND DISCUSSION

Provisional results indicate that severe lameness (mobility score 3) is associated with a significant decrease in milk yield that commences four months after the lameness is

observed [8]. The greatest reductions in milk yield are associated with the occurrence of severe lameness close to the time of calving, and its persistence. Until more is known about cost effective strategies to control lameness in different situation, these results emphasise the importance of prompt detection (through the use of mobility scores) and treatment of lameness particularly in freshly calved cows.

Cows that were ever lame during this study (mobility scores 2 and 3) tended to be higher yielding than those that were never lame. As a result any reduction in yield may not be tangible at the herd level; milk yield of lame cows is reduced towards that for "average" cows that are never lame. Lameness is unequivocally a "production disease" and its high prevalence in some herds is a welfare concern.

By the sixth month of lactation our provisional results also demonstrate that severely lame cows (mobility score 3) are approximately half as likely to have suffered an intramammary infection (somatic cell count over 200, 000/ml) in early lactation compared to non-lame cows (mobility scores 0 and 1). The pathogenesis of this relationship requires further research, however culling policies targeting low yielding cows with high somatic cell counts may currently contribute to the retention of lame cows in UK herds.

Financial incentives from milk buyers for lameness control and monitoring, similar to those currently available for somatic cell count would help in the development of knowledge on the cost effective control of this intractable disease.

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BARRIERS TO LAMENESS REDUCTION REPORTED BY DAIRY FARMERS: TIME PRESSURES LIMIT CATTLE LAMENESS CONTROL

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INTRODUCTION

Agricultural census figures show the labour force on dairy farms has been decreasing while herd size has been increasing steadily over the past ten years, resulting in farmers and their workers being responsible for more cows per person (1). As part of a survey of 222 UK dairy herds in winter 2006-7 (2), farmers were asked about the issues which restricted their efforts to reduce cattle lameness and data were collected to investigate if there was a relationship between limited farm labour and prevalence of lameness.

METHODS

The data were collected as part of the "Healthy Feet Project" on farms in Southern and central England and Wales. On a visit to each farm, one of four trained researchers interviewed the farmer about the farm and its management. The interview included questions on herd size, the number of people working with the dairy herd (expressed as full time labour equivalents), the prevalence of lameness which the farmer would consider a problem, the number of lame cows on the day of the visit, and the level of importance of a number of possible barriers to lameness control (Figure 1). The farmer was asked to score these barriers on a scale from 1 (not important) to 5 (extremely important) (2). The researcher also mobility scored all cows in milk, using a four point (0 to 3) scale (3), on which cows scoring 2 or 3 were defined as lame. The prevalence of lameness as assessed by the researcher on the day of the visit (RP) was calculated. Herd statistics and the farmers' responses on perception of lameness and the issues restricting efforts to reduce lameness were compared between the upper and lower twenty percent of the population of farms, ordered on RP (n = 45 farms for each group). These groups were compared using either Student's t-test for continuous variables or a Mann-Whitney test for categorical data. Cow:staff ratio (number of cows per full time equivalent labour unit) was plotted against RP for the full data set and a regression line fitted.

RESULTS

Time and labour issues were consistently given high importance as barriers to reducing lameness (Figure 1). Lack of time and skilled labour were significantly more important on farms with higher lameness. Conflicting advice was given slight importance on farms with more lameness, but was not important on low prevalence farms.

The relationship between RP and cow:staff ratio across all farms was: $RP = 0.104 \times (\text{cow:staff ratio}) + 29.4$, $R^2 = 0.035$, indicating that there was a tendency for lameness prevalence to increase with cow:staff ratio, but not a close relationship across all farms. Herd size and cow:staff ratio differed significantly between the herds with highest and lowest lameness prevalence (Table 1). Farmers' perception of the lameness prevalence also differed, with a significantly higher tolerance threshold on farms with higher prevalence (Table 1).

Figure 1 Importance of barriers to lameness control in herds with high and low lameness prevalence (Significant difference between groups: * $p < 0.05$; ** $p < 0.01$)

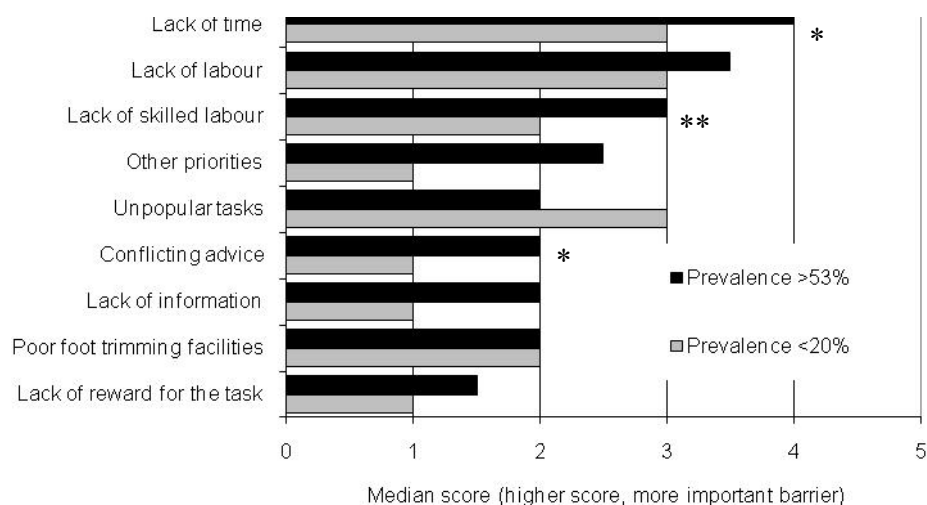


Table 1. Measures of lameness, herd size and labour statistics (mean and sd) for farms in the lower and upper twentieth percentiles for lameness prevalence (total n =222)

Group (n = 45 in each)	Lower 20%	Upper 20%	P value
Lameness prevalence as assessed by researcher (RP)	<20%	>53%	
Herd size	127 (69.7)	204 (117.0)	***
Cows per full time labour unit	61 (28.2)	79 (39.7)	*
Farmer estimate of prevalence	3.5% (4.11)	11.2% (8.91)	***
Lameness prevalence that farmer considers a problem	6% (0.7)	10% (1.0)	**

Significant difference between groups: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

CONCLUSIONS

Limited amounts of time, labour and skilled labour are seen by farmers as real barriers to controlling lameness in dairy herds. Herds with the highest levels of lameness are likely to have more cows per labour unit than those with the lowest. However, there is not a close linear relationship between lameness prevalence and cow:labour ratio, indicating that good lameness control can still be achieved with higher cow:staff ratios.

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"NO MORE LAME EXCUSES!" DEVELOPING A DAIRY COW LAMENESS REDUCTION PLAN CONSIDERING THE EXISTENTIAL CYCLE OF CHANGE

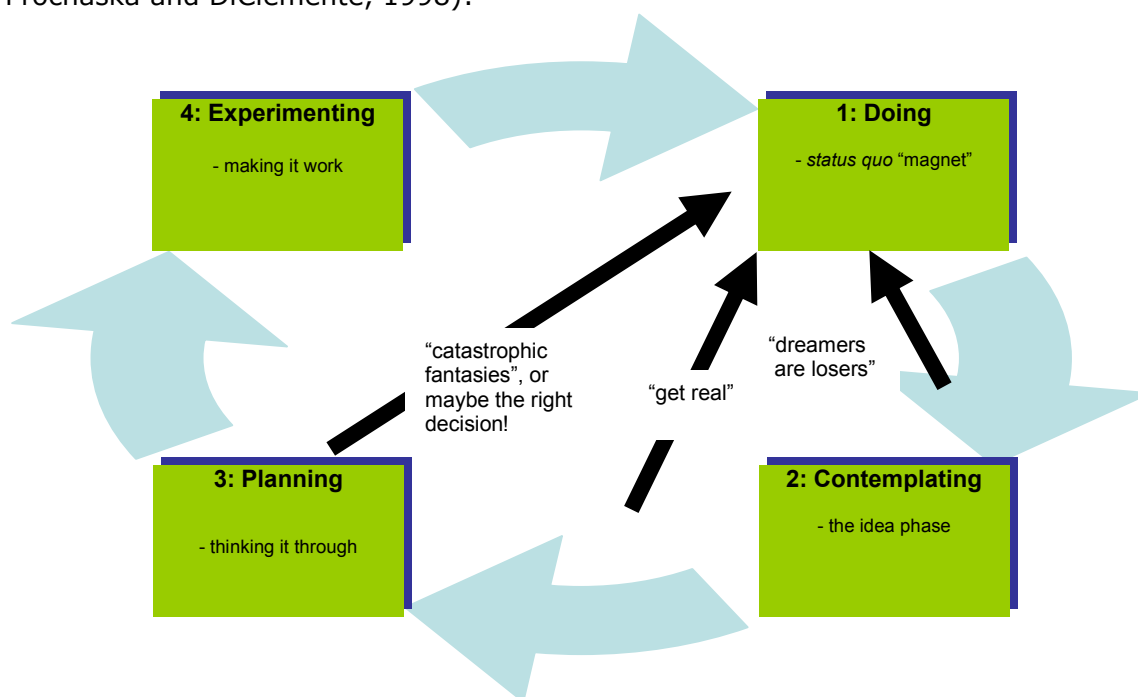
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Why is lameness such a difficult disease to influence through conventional health planning? How can intervention plans be used to reduce dairy cow lameness on farm? Perhaps there is a lack of evidence-based advice available, but this poster presentation deals with the more ethereal aspects of influencing change on farm.

A successful lameness reduction plan can involve changes in attitude, behaviour, management and farm infrastructure. It is important to appreciate the process of change (which we all undertake) so that the vet advisor can adapt his/her approach to best influence and motivate farmers, and achieve good compliance.

The Cycle of Change (adapted from the transtheoretical model of change proposed by Prochaska and DiClemente, 1998):



Before any change, there is a state of **"doing"**, or "status quo", and often there is considerable inertia to deviate from this state. The first phase of change is to have a notion or idea that there is a different way to do things. This is the **"contemplation phase"**. There can be a reluctance to progress even this far around the cycle. Such individuals may believe *"dreamers are losers"*, and can often be observed to farm in the same way as generations before them. Initiating farmers to change could be by showing that other ways can be successful, and that lameness reduction is under their control. Press articles, farm walks, discussion groups, social marketing and general conversation can all be valuable in this respect.

The next stage is the **"planning phase"** which should be the rational weighing up of pros and cons of any change. Farmers may not progress to this phase due to the instinctive reaction of *"get real - I can't possibly do that!"* Imagine a farmer thinking of every reason under the sun why regular footbathing is utterly impractical for him. In this respect, the "status quo" can be very appealing - safety in what you know. The "doing

phase" is described as a magnet because at every stage on the cycle, people are attracted back to this.

Veterinary advisors' traditional role is during the "planning phase", guiding a farmer through the decision and providing valuable information and analysis. Of course, a rational decision may be not to continue with the change: for example, after weighing up the practicalities of modifying cubicles, it may be felt that this measure would not have an appreciable impact on the lameness problem. Conversely, irrational *catastrophic fantasies* may lead back to the "status quo".

If a decision is taken to implement the change, the next stage of the cycle is the "**experimentation phase**". A farmer may decide on routine mobility scoring to reduce lameness, but taking this decision can be a long way from making it work. Often neglected is the support and reviewing which is necessary so that an adopted change is successful. In this example, the farmer must be trained in mobility scoring, he must find a suitable time and place to do it, he must have a robust system of identifying cows and recording results to pick out fresh lameness cases, and these must then be promptly treated. Training, encouragement, fine-tuning and coaching will be needed. The review process during the experimentation phase is critical to achieve good compliance.

The cycle is complete when the new "doing" fully incorporates the change.

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INTEGRATION AND ANALYSIS OF CLINICAL LAMENESS AND MOBILITY SCORE DATA USING NOVEL COMPUTER SOFTWARE

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INTRODUCTION

Mobility scoring allows for a reliable assessment of lameness prevalence in dairy herds, although the usefulness of the data is often dependent on many intrinsic factors including operator subjectivity, repeatability, frequency of scoring, place of assessment and accurate identification of individual cows. However, if performed reasonably frequently (for example every one to two months), mobility score data can be used alongside records of clinical lameness to assess individual cow foot health but also analyse disease trends within the herd. With the advent of sophisticated computer software, mobility score data captured on farm can now be used to generate individual cow-focussed 'action lists' and generate herd-level outcomes, such rates at which previously sound cows are identified as lame and rates at which lame cows persist as chronically lame.

DATA COLLATION AND CAPTURE

Using novel on-farm data capture software from the SUM-IT range (Quality Milk Manager, DairyMate and Total Dairy) or using other on-farm software such as Interherd and DairyPlan, mobility score data can be rapidly and simply collated and stored. Sheets can be printed from the SUM-IT ranges that are pre-populated with cow identification and the input process allows cross-validation of the data to avoid duplication. The data input process is speeded up by the ability to select groups of cows and enter data in blocks.

VIEWING COW AND HERD RESULTS

Having collected and collated mobility score data on-farm, several reports are immediately available for users of SUM-IT software, including:

- an assessment of the data integrity (i.e. the proportion of the herd scored at the latest mobility score date and the proportion of the herd that were missed)
- an assessment of the mobility score prevalence, based on the current DairyCo industry standard using the scale 0 (sound) to 3 (severe lameness)
- an individual cow graphical lameness history, incorporating mobility score data with dates of any clinical lameness and treatment events
- an overview of the herd, assessing the movement around the mobility score lameness threshold for those cows that were present at the 'last' score date and the current score date (for example cows that were mobility score 0 or 1 last score and are now mobility score 2 or 3 this score are presented and labelled 'Apparent New Lame').

ASSESSMENT OF HERD TRENDS IN MOBILITY DATA

Further analysis of the mobility score data is also available using the new analysis software program 'TotalVet'. This software is able to generate additional mobility score

reports for veterinary surgeons and consultants which are able to investigate and monitor:

- The RATE at which previously sound cows become lame (i.e. cross the threshold between imperfect locomotion and lame)
- The proportion of the herd lame between score dates
- The RATE at which previously lame cows become persistently lame (i.e. were observed to be score 2 or 3 at previous mobility score dates and remain chronically lame)
- The RATE at which previously sound cows remain sound (i.e. were observed to be score 0 or 1 at previous mobility score dates and remain sound or imperfect locomotion and are not lame)
- The CURE RATE for cows previously diagnosed as lame and are now observed to be score 0 or 1 at the current mobility score date

ASSESSMENT OF CLINICAL LAMENESS DATA

Records of lame cows that are treated allows the incidence rate of clinical lameness to be monitored as well as allowing a greater understanding of the disease on-farm via diagnosis of the prevalence of lesions causing lameness. On-farm data capture software from the SUM-IT range (Quality Milk Manager, DairyMate and Total Dairy) allows rapid and simple lameness data collection as well as 'forcing' good data capture via a structured format where users have to make a choice of lesion present and limb affected.

- Using the TotalVet analysis software, this clinical lameness data can be combined with mobility score data (if present) to produce a lameness 'action list', in a similar format to the udder health action list already available for mastitis and somatic cell count. This allows the advisor and herd owner to maintain an individual cow focus using lameness and mobility score records
- In addition, the incidence rate of clinical lameness (overall and by lesion type if recorded) can be analysed by month (allowing for seasonal patterns to be investigated), by stage of lactation and by time since birth (allowing the rate in heifers as they enter the adult herd to be investigated)
- TotalVet also allows for cohort analysis of the above data, enabling the advisor to track lameness in a cohort of animals over a period of time within the herd.

CONCLUSIONS

With the advent of powerful and novel computer software, the collection, collation and in particular, the ANALYSIS of mobility score data and clinical lameness data can be rapidly and simply performed. This allows for information to be used at the individual COW-LEVEL in the form of action lists for treatment but crucially also at the HERD-LEVEL in the form of rates and prevalence data to investigate and monitor disease trends and patterns as part of the veterinary surgeon and advisors role in optimising dairy herd health.

EVALUATION OF 14 US DAIRY HERDS USING FIRSTSTEP™: A NOVEL TOOL TO TROUBLESHOOT AND PREVENT LAMENESS

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INTRODUCTION

There is increasing need to address lameness in the dairy industry. Lameness is one of the most costly diseases in the dairy industry and continues to gain attention among consumers. Diagnosing the predominant causes of lameness requires a systematic approach to identify the important risk factors present within each dairy. FirstStep™ is a software program designed to assess key areas of a dairy known to impact lameness and provide reports that identify areas of weakness in the lameness management program. The objective of this study was to use FirstStep™ to evaluate 14 dairies in the Western US.

OBJECTIVE

The study was conducted from September 2007 through October 2008. The dairies were located in 7 western states and were comprised of freestall (5), dirt lot (5), freestall with dirt lot access (2), cross-ventilated (1), and pasture/freestall combination (1). Twelve dairies were Holstein herds and two were Jersey herds. Locomotion and hygiene scores were collected on the same two pens (avg. DIM 100-200) during each of five visits. On the initial visit, data was collected to assess freestalls, transition management, time budgets, footbaths, walking surfaces, dirt lots, heat abatement, holding areas, hoof-trimming and claw lesions (data from 8 dairies).

RESULTS

On average across all dairies and time periods, 18% (range of 11 to 26%) of cows scored were considered lame (>2 using the 1-5 locomotion scoring system). Average percent of leg hygiene score 3 and 4 (using 1-4 scoring system) were 38% with a range of 4 to 72%. Freestall platform length, neck rail positioning, and bedding use were identified as key areas for improving cow comfort. Nearly 80% of dairies were providing 76 centimeters of bunk space to transition cows and housing first lactation cows separately from mature cows; however, only 40% of freestall herds provided first lactation cows access to freestalls before calving. Nearly all footbaths were >10 centimeters deep however only 2 of 14 met the recommended length (245 centimeters) to achieve two immersions for each rear foot. Frequency of footbath change averaged 400 cow passes but ranged from 200 to 675 cows. Stall standing time was the most detrimental to lying time in freestall herds while milking time and time held away from pens (excluding milking) reduced lying times in dirt lot dairies. Concussion and slipping were the two most prevalent risk factors associated with walking surfaces on all dairies. All dirt lots assessed have adequate surface (m²) per cow, however 25% lacked proper orientation to aid in keeping the bedding beneath the shade structure dry. Nearly 70% of herds assessed could benefit from additional water availability to achieve 9 linear centimeters of trough perimeter per cow to aid in heat abatement. Parlor holding areas were inadequately sized at <1.6 m² per cow increasing the likelihood of cows slipping. The most common areas for improving hoof trimming technique were removal of axial and abaxial wall horn and trimming the claws flat (vs. concave). A need for standardizing claw lesion records was noted and presented to the participants of the study.

SIGNIFICANCE

FirstStep™ provides for a unique, methodical approach to investigating lameness on dairies. The program successfully identified lameness trigger factors within each participating dairy and provided recommendations for reducing lameness within the herds under study.

COMPARISON OF A NON-ANTIBIOTIC GEL WITH ANTIBIOTIC POWDER FOR THE TREATMENT OF DIGITAL DERMATITIS

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Since its first description in the UK (1) bovine digital dermatitis, a circumscribed ulcerative or papillomatous lesion typically on the skin above the heel bulbs, has become widespread and is now one of the major causes of lameness in dairy herds.

The main causative agents implicated are spirochetes of the genus *Treponema*. The existence of the specific treponemes in slurry has not yet been established but the odds of digital dermatitis were found to be lower when cows had full access to pasture, were housed on drier flooring or if correct manure scraping was employed (2) indicating that environment and hygiene play a key role in transmission.

The ease of isolation of pathological treponemes from digital lesions and not the environment may indicate that affected cows act as a main reservoir of infection; the introduction of new animals, particularly heifers, is associated with increased odds of digital dermatitis in the herd, indicating the contagious nature of the disease. Effective control of digital dermatitis in a herd would therefore seem to require aggressive treatment of obvious clinical cases, ideally involving bandaging to reduce spread as well as a program of foot bathing to reduce the prevalence of 'subclinical' disease.

Topical therapy, either antibiotic or non-antibiotic, is currently the most common form of treatment. Laven and Logue (3) reviewed the treatment strategies and noted the lack of peer-reviewed evidence for their efficacies; anecdotal evidence and personal experience plays a major role in choice of treatment amongst vets, foot trimmers and farmers.

The availability of non-antibiotic preparation for the treatment of digital dermatitis is welcome, contributing to reduced use of antibiotics, of value in organic farming situations and as a non-POM product that can be used by paraprofessionals. The aim of this study was to compare a single typical application of an organic copper/zinc gel product containing Aloe Vera (Intra Hoof Fit Get, Intracare BV, Veghel, The Netherlands) with the antibiotic tylosin tartrate (Tylan Soluble 100, Elanco Animal Health, Hampshire,UK).

29 cows (mean parity 3, range 1-7) from 3 herds were used in the study. Each affected animal had their feet lifted and trimmed according to the 'Dutch' method. Following confirmation of a digital dermatitis lesion the affected area was cleaned and an assessment made which included a digital photograph. The lesion was then allocated on an alternating basis to either treatment with the non antibiotic gel (A) or the antibiotic powder (B) both of which were applied under a gauze swab held in place with a bandage. After 7 days the dressing was removed and all measurements and photographs repeated. A total of 41 lesions in 29 cows were treated.

	A (Gel) n=20	B (Antibiotic) n=21
Apparent complete clinical resolution	10%	24% NS
Lesion surface area reduction	41%	63% NS
Horizontal lesion length	33%	48% NS
Vertical lesion length	28%	52% (p = 0.048)
Pain reduction	2 - 0	1 - 0 NS
	Primiparous	Multiparous
Lesion surface area reduction	74%	47.5%

No significant *between farm* differences were found.

CONCLUSIONS

- Varying appearance of the lesion on Day 0 and the low number of cases may have biased the results and made statistical significance difficult to demonstrate.
- There was a trend for an improved resolution of lesions with the antibiotic powder.
- Lesions in primiparous animals tended to show a better resolution than those in multiparous animals (contrary to previous findings).
- Alternatives to typical antibiotics are useful for the treatment of digital dermatitis but more evaluation with bigger samples size would be valuable.

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This study was completed as part of the final year research project at the Royal Veterinary College in May/June 2009.

FEEDING BEHAVIOUR OF LAME COWS IN A TOTAL CONFINEMENT SYSTEM

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INTRODUCTION

Previous UK studies have demonstrated that lameness is associated with reductions in milk yield. Incidence of clinical lameness have been associated with a mean reduction in 305 day yields of 357 kg (1). Recently, lameness measured by mobility score has also been demonstrated to lead to significant reductions in yield (2). It has been postulated that milk yield reduction are caused by a reduction in dry matter intake during the period that animals are lame. This study was designed to assess the differences in feeding behaviour of lame dairy cows housed in a total confinement system.

MATERIALS AND METHODS

The study was conducted in a total confinement, robotically milk (Lely A3 robots), high yielding (~9950L/cow/annum) 210 cow Holstein herd. Cows were housed in groups of approximately 50 animals on cubicles bedded with mattresses; all floor surfaces were covered with rubber matting. Animals had continuous access to a total mixed ration at a single 29 metre long feed face.

A case – control study design was employed. Case cows were mobility score 3 on a four point scale (DairyCo Mobility Score: 0 – Good mobility; 1 – Imperfect mobility; 2 – Impaired mobility; 3 – Severely impaired mobility); control cows were mobility score 0 or 1. Case / control pairs were matched by parity (same parity) and days in milk (+/- 70 days). Case and control animals were identified with unique luminous glue-on markers for easy of identification.

Video footage of the feed face was recorded over two 24 hour periods (04/11/09 and 13/11/09) using two high quality CCTV ceiling mounts cameras, with automatic infrared filming during period of low light intensity and darkness. Following filming, recordings were reviewed and the number and duration of each feeding bout was recorded for all study animals. Unpaired T tests were used to compare case and control cows. Significance was specified as $P \leq 0.05$ for a two tailed test.

RESULTS

Five independent case / control pairs were followed during the two 24 hour recording periods (three pairs during period 1 and two pairs during period 2).

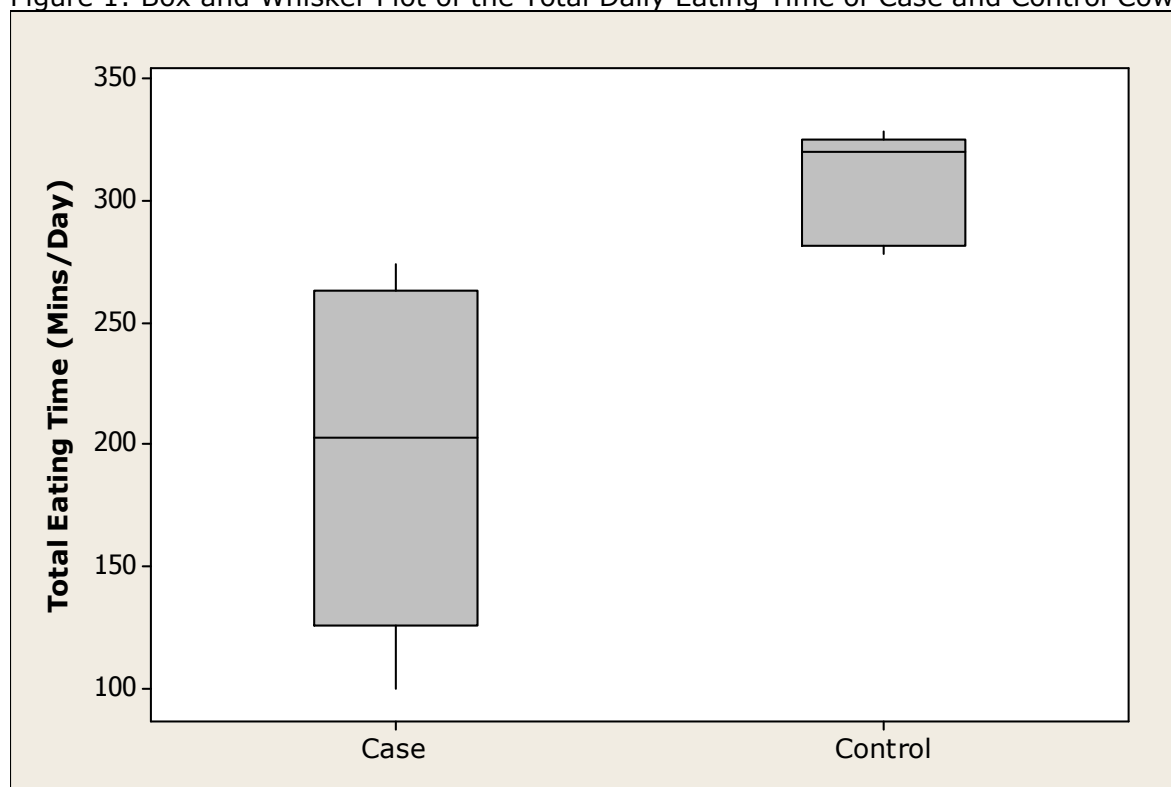
Provisional results suggest that lame cows spent significantly less time eating each day compared to the sound controls (196 mins/day vs 307 mins/day, $P=0.03$, Figure 1). The number of feeding bouts per day was similar between case and control pairs (12.6 vs 14.6). The difference in feeding bout length was lower in the lame cows compared to the controls (13.3 minutes/bout vs 19.7 minutes/bout), although the difference was not significant in this small data set.

DISCUSSION

In this pilot study lame cows spent significantly less time eating compared to their non-lame counterparts. The number of eating bouts was similar between animals. It would appear that the primary effect of lameness in this study was to reduce the average feeding bout length. This implies that the drive to visit the feed face remains similar between lame and non-lame animals, however the period of time they spend at the face is reduced. Further work is required to increase the size of this data set and confirm or refute the initial findings demonstrated here.

The reduction in eating time demonstrated in this study is likely to be associated with a reduction in dry matter intake, although it remains possible that lame cows in whole or in part, mitigate the effects of reduced eating time by increasing the rate of dry matter intake. Further studies, which include the measurement of dry matter intake are required to further clarify the affects of this painful condition on feeding behaviour and milk yield.

Figure 1: Box and Whisker Plot of the Total Daily Eating Time of Case and Control Cows



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**BACK OF PROCEEDINGS – PLAIN COLOURED CARD AND PLASTIC
BACK COVER**