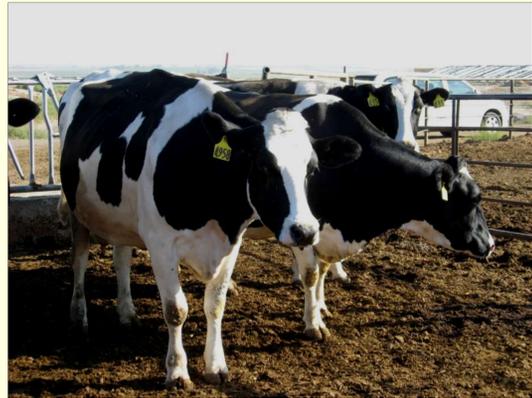


# Reducing the burden of lameness in dairy cows in the Pacific Northwest

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## Objective – Year one: 2011

- How can veterinarians and dairy producers quickly and accurately estimate the prevalence of lameness in a large dairy herd?



## Introduction

### Lameness:

- Reduces milk production (Juarez, 2003; Hernandez 2005)
- Reduces reproductive performance (Sprecher, 1997; Hernandez, 2001)
- Increases culling (Booth, 2004; Sprecher, 1997).
- Indicates limb pain and therefore has a negative impact on animal welfare (O'Callaghan 2003, Whay 1997).

### How much lameness is too much?

- The Dairy Farmers Assuring Responsible Management (F.A.R.M.) program includes an animal welfare assessment: requires that **<10% of cows have a locomotion score  $\geq 3$  on the 5 point scale** (National Milk Producers Federation 2010).
- Temple Grandin recently stated that **less than 5%** of dairy cows should be lame (Dairy Herd Network)
- Previous studies in the US estimate **lameness prevalence near 20%** (Cook 2003, Espejo 2006).

Monitoring prevalence and detecting lameness in individual cows is the first step to reducing lameness. If monitoring is to be more widely adopted, **an efficient, validated strategy for assessing lameness that is compatible with current dairy management is necessary.**

The goal of this project was test three methods of sampling cows to estimate herd prevalence and compare these methods to the true herd prevalence obtained by locomotion scoring all cows. Additionally, data was gathered to evaluate the detection of lameness in individual cows using observation of back and hind leg posture while cows stand in lock-ups.

Table 1. Locomotion Scoring System (Based on Sprecher 1997).

Score	Gait Description
1	Cow stands and walks with a level-back posture. Gait is normal.
2	Cow stands with level-back posture but develops an arched-back posture while walking. Her gait remains normal.
3	An arched-back posture is evident while standing and walking. Gait is affected and described as short-striding one + limbs.
4	An arched-back posture is always evident and gait is best described as one deliberate step at a time. The cow favors one or more limbs/feet.
5	The cow additionally demonstrates an inability or extreme reluctance to bear weight on one or more of her limbs/feet.

## Materials & Methods

Five dairies, 3 in Western Washington, 1 in Eastern Washington, and 1 in Western Oregon, were visited in the summer of 2011.

- All lactating cows were locomotion scored as they exited the parlor (n=4,431) or in their pen (n=160) using a 5 point scale (Table 1).
- Cows with a locomotion score  $\geq 3$  were considered lame.
- All cows caught in headlock at regularly scheduled times for management (breeding, pregnancy diagnosis, sorting) were observed as they stood in the lock-up.

True prevalence based on locomotion score of all cows was compared to prevalence estimated using three different strategies to select the sample of cows to score:

- Cows in the middle of the milking parlor exit order for each pen using a sample size calculation published by Main, et al. 2010.
- All cows in the High production pen, Low production pen, and Hospital/Lame pen, as designated by farm management.
- A calculated number of total cows with the number of cows per pen weighted by pen size, as utilized by the National F.A.R.M. program.

The following back and hind leg postures were recorded as cows stood in lock-up.

- Back arch
- Cow-hocked
- Wide stance
- Splayed claw
- Long claw
- Claw asymmetry
- Favoring a limb

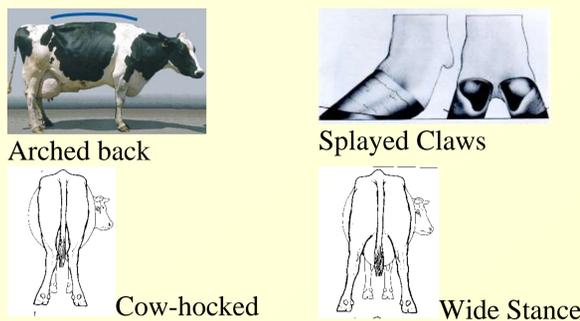


Figure 1. Examples of postural abnormalities in the back and hind limb of dairy cows

Figure 2. Are these cows lame?



While this cow is not visibly limping on a particular limb, she is walking with an arched back and is short striding. Locomotion score = 3



This cow is standing with an arched back, therefore her locomotion score is 3 or greater

## Results

- 3+ lactation cows were 6.2 times more likely to be lame than first lactation heifers ( $P < 0.001$ )
- Holsteins were 4.6 times more likely to be lame than Jerseys ( $P < 0.001$ ).
- Cows exiting the milking parlor in the last 40% of the pen were 1.5–1.7 times more likely to be lame than cows in the first 80% of the pen ( $P < 0.001$ )

### Sampling Strategies

- Locomotion scoring a calculated number of cows in the middle of the parlor exit order estimated prevalence within 2 percentage points of true prevalence on all farms. However, prevalence varied by pen (data not shown) so using this strategy still requires locomotion scoring a sample of cows from all pens.
- Locomotion scoring all cows in only the high, low, and hospital groups did not estimate lameness prevalence with 95% confidence on 4/5 farms.

a. High production, Low production, and Hospital Pens				b. Middle of parlor exit order		
Farm	True Herd Prevalence	Estimated Prevalence	95% Confidence Interval	Farm	True Prevalence**	Estimated Prevalence
2*	9.6%	12%	7.9%-17%	1	37%	36%
3*	21%	26%	22%-32%	2	10%	12%
4	35%	45%	39%-50%	3	15%	14%
5	10%	20%	17%-23%	4	34%	34%
				5	10%	9%

\*no designated hospital pens at time of data collection  
\*\*for all cows observed exiting milking parlor, cows locomotion scored in pen not included

Table 2. Comparison of true lameness prevalence to prevalence estimated from two different sampling methods: all cows in high production, low production, and hospital pens (a) and a sample of cows exiting the parlor in the middle of their pen (b).

- The sampling strategy used by the National F.A.R.M. program accurately (95% confidence) estimates lameness

FARM	Herd Size	Sample Size	True Prev	Sample Prev	95% CI
1	108	59	36.8%	37.3%	26.1, 50.1%
2	419	81	10.2%	8.6%	4.0, 17.0%
3	573	87	20.8%	26.4%	18.3, 36.6%
4	1085	92	33.3%	30.4%	21.9, 40.5%
5	2374	97	10.0%	13.4%	7.9, 21.7%

Table 3. Sampling strategy using calculated sample size and weighted samples by group (F.A.R.M. method). Farm number, herd size, sample size, true and sample prevalence, and 95% confidence interval.

### Can we use back and hind limb posture to predict lameness in individual cows?

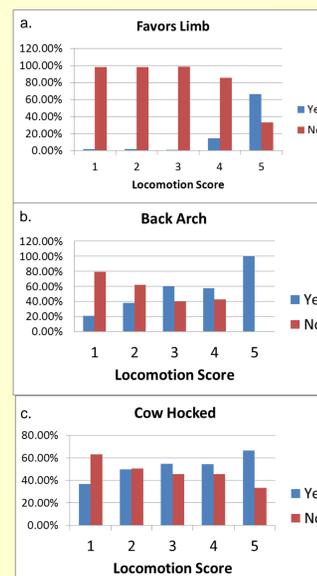


Figure 3. Proportion of cows observed with (Yes) and without (No) postural abnormalities by locomotion score

- Only 5% of all lame cows favored a hind limb.
- As a test for lameness, 'favored limb' sensitivity was 5% and specificity was 98%

- If a cow was observed with a back arch in the lockup, she was 3 times more likely to be lame. ( $P < 0.0001$ )
- As a test for lameness, arched back was only 63% sensitive and 64% specific.

- Of cows that stood with a cow-hocked posture, numerically more were lame.
- As a test for lameness, observing cow hocked posture was 54% sensitive and 57% specific.

## Future Work – Year 2 : 2012

- What is the prevalence of lameness on farms in Washington and Oregon?
- If a dairy herd chooses to remediate high lameness prevalence in their herd, what are the costs they might incur?
- Using the current body of scientific literature, develop an investigation tool for use on individual dairies to identify risk factors for lameness and develop a plan for mitigation on a herd level.
- Region-wide campaign for producers and veterinarians on the monitoring scheme and distribution of the tools, including lameness data management, monitoring, and lameness problem investigation tools as well as a regional workshop for dairy veterinarians in WA, OR, ID, and CA practitioners on use of the tools.



## Discussion

- The sampling strategy based on the National F.A.R.M. program was most effective at accurately estimating herd lameness prevalence. Therefore, this strategy could be used to determine herd level lameness prevalence for:
  - Evaluation of current lameness prevalence to compare with the dairy producer's current goals
  - Monitoring changes in herd level prevalence over time.
- The lock-up postural observations were not sensitive or specific enough to predict locomotion score  $\geq 3$  in individual cows.
  - However, a numerically greater proportion of cows with some of these postural abnormalities, especially arched back, were lame. Therefore, it may be useful as a screening method for managers and employees to use to identify cows in need of treatment.
  - Future research is needed to determine the influencing factors, significance, and relation to lameness of these postural changes.

## Acknowledgements

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