Validation, use and interpretation of health data: *an epidemiologist's perspective*!

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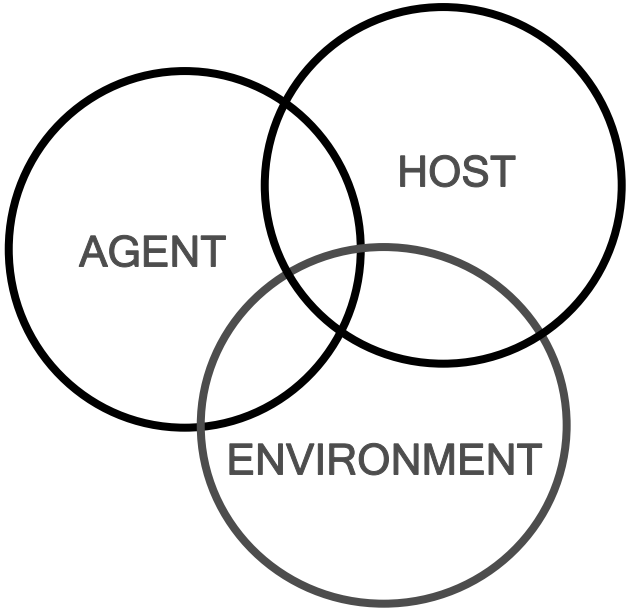
An epidemiologist's perspective:

Issues to be addressed…..

- My background and my biases
- The 10 questions about dairy cattle health data that keep me awake at night!
- Challenges and opportunities…….

Background and Biases



Veterinary Epidemiologist
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Dairy Cattle Health & Welfare

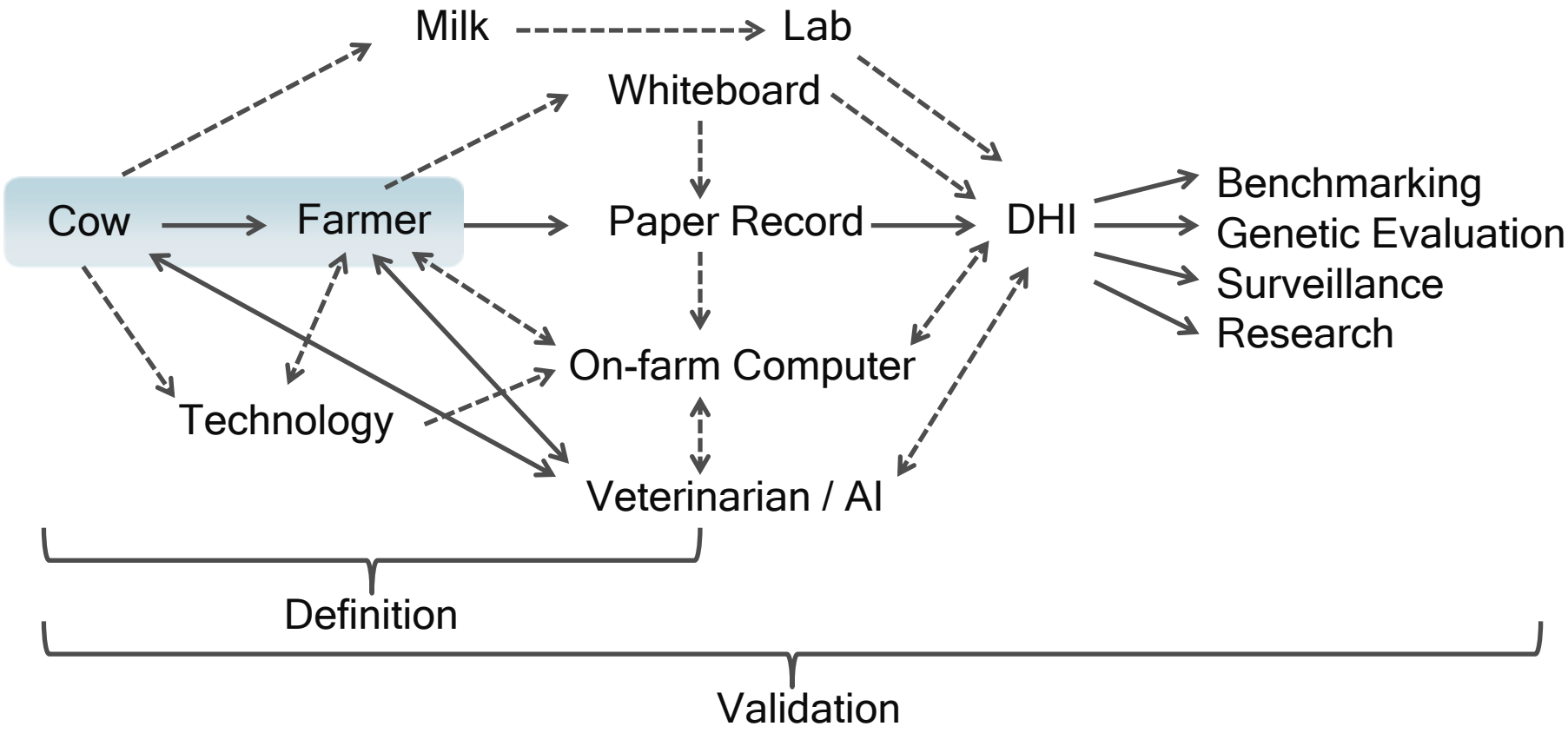
Mastitis, Lameness, Infectious Disease

CanWest DHI – R & D

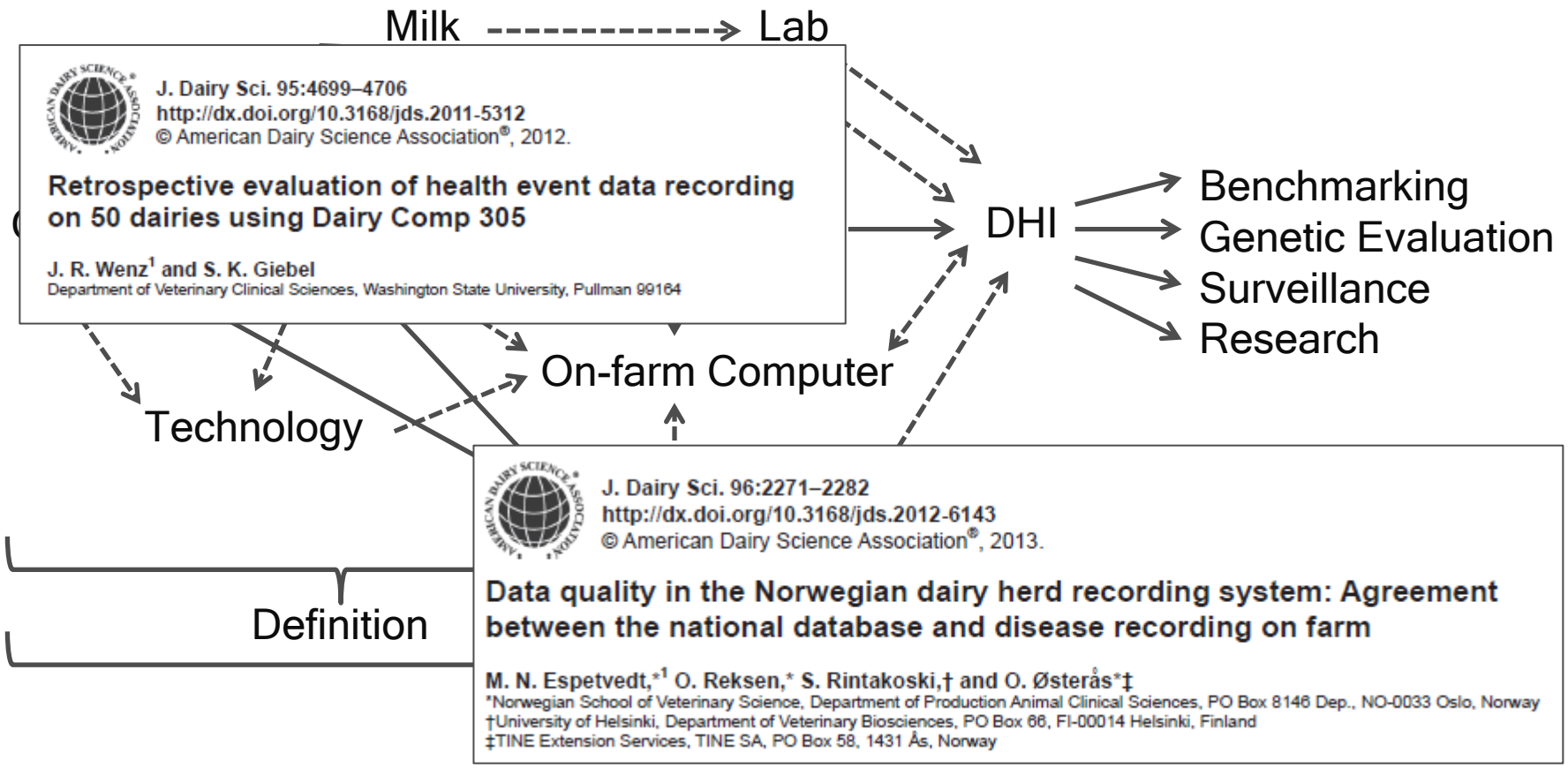
Evaluation of Milk-based Tests

Data Quantity AND Quality

Validation of Disease/Health Data



Validation of Disease/Health Data



Q1: Why do “we” record disease data?

- Diagnosis and therapy of sick cows
- Health management – benchmarking
- Biosecurity - animal movement

1^0

- Health and welfare assurance
- Genetic selection – functional traits
- Surveillance for status & trade
- Research – prevention & control

2^0

Implications / Importance of Accuracy and Completeness vary with purpose.

Q2: What do we mean by “disease data”?

- Testing for **Disease Status**…point in time
  - Infectious disease (ParaTB, BLV,….)
  - Screen a specific number of animals at a specific point in time with a test of known performance
  - Validation is ‘relatively easy’
- **Disease Events**…sporadic
  - The ‘Big 8’ or more with highly variable definitions
  - Waiting for something to happen and we hope that we’ll recognize it AND record it when it does
  - Validation is ‘NOT so easy’

Challenges of Event Recording

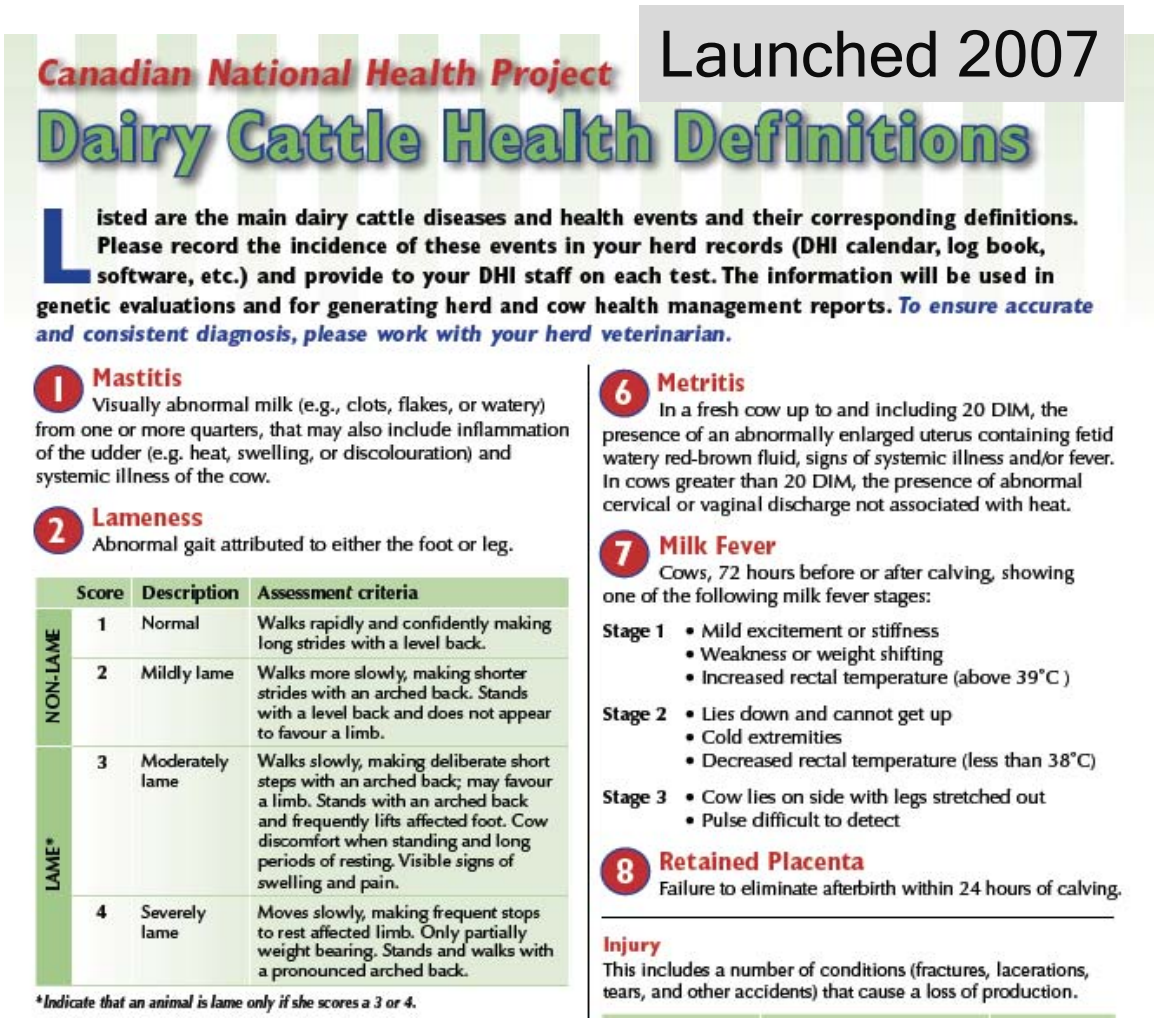
- Does anyone see and recognize the ***disease event*** ?
- Do ***disease events*** get recorded at all….anywhere?
- Do ***disease events*** get into an electronic form….anywhere?
- Do ***disease events*** get uploaded to a central location…where?
- Can ***disease events*** come from non-farm sources?
- Is there any ***disease*** data validation….anywhere?

Canadian National Health Project

"The Big 8":

- Mastitis
- Lameness
- Cystic Ovaries
- Ketosis
- Displaced Abomasum
- Metritis
- Milk Fever
- Retained Placenta

Launched 2007



Canadian National Health Project

Dairy Cattle Health Definitions

Listed are the main dairy cattle diseases and health events and their corresponding definitions. Please record the incidence of these events in your herd records (DHI calendar, log book, software, etc.) and provide to your DHI staff on each test. The information will be used in genetic evaluations and for generating herd and cow health management reports. ***To ensure accurate and consistent diagnosis, please work with your herd veterinarian.***

1 Mastitis
Visually abnormal milk (e.g., clots, flakes, or watery) from one or more quarters, that may also include inflammation of the udder (e.g. heat, swelling, or discolouration) and systemic illness of the cow.

2 Lameness
Abnormal gait attributed to either the foot or leg.

	Score	Description	Assessment criteria
NON-LAME	1	Normal	Walks rapidly and confidently making long strides with a level back.
	2	Mildly lame	Walks more slowly, making shorter strides with an arched back. Stands with a level back and does not appear to favour a limb.
LAME*	3	Moderately lame	Walks slowly, making deliberate short steps with an arched back; may favour a limb. Stands with an arched back and frequently lifts affected foot. Cow discomfort when standing and long periods of resting. Visible signs of swelling and pain.
	4	Severely lame	Moves slowly, making frequent stops to rest affected limb. Only partially weight bearing. Stands and walks with a pronounced arched back.

*Indicate that an animal is lame only if she scores a 3 or 4.

6 Metritis
In a fresh cow up to and including 20 DIM, the presence of an abnormally enlarged uterus containing fetid watery red-brown fluid, signs of systemic illness and/or fever. In cows greater than 20 DIM, the presence of abnormal cervical or vaginal discharge not associated with heat.

7 Milk Fever
Cows, 72 hours before or after calving, showing one of the following milk fever stages:

Stage 1
- Mild excitement or stiffness
- Weakness or weight shifting
- Increased rectal temperature (above 39°C)

Stage 2
- Lies down and cannot get up
- Cold extremities
- Decreased rectal temperature (less than 38°C)

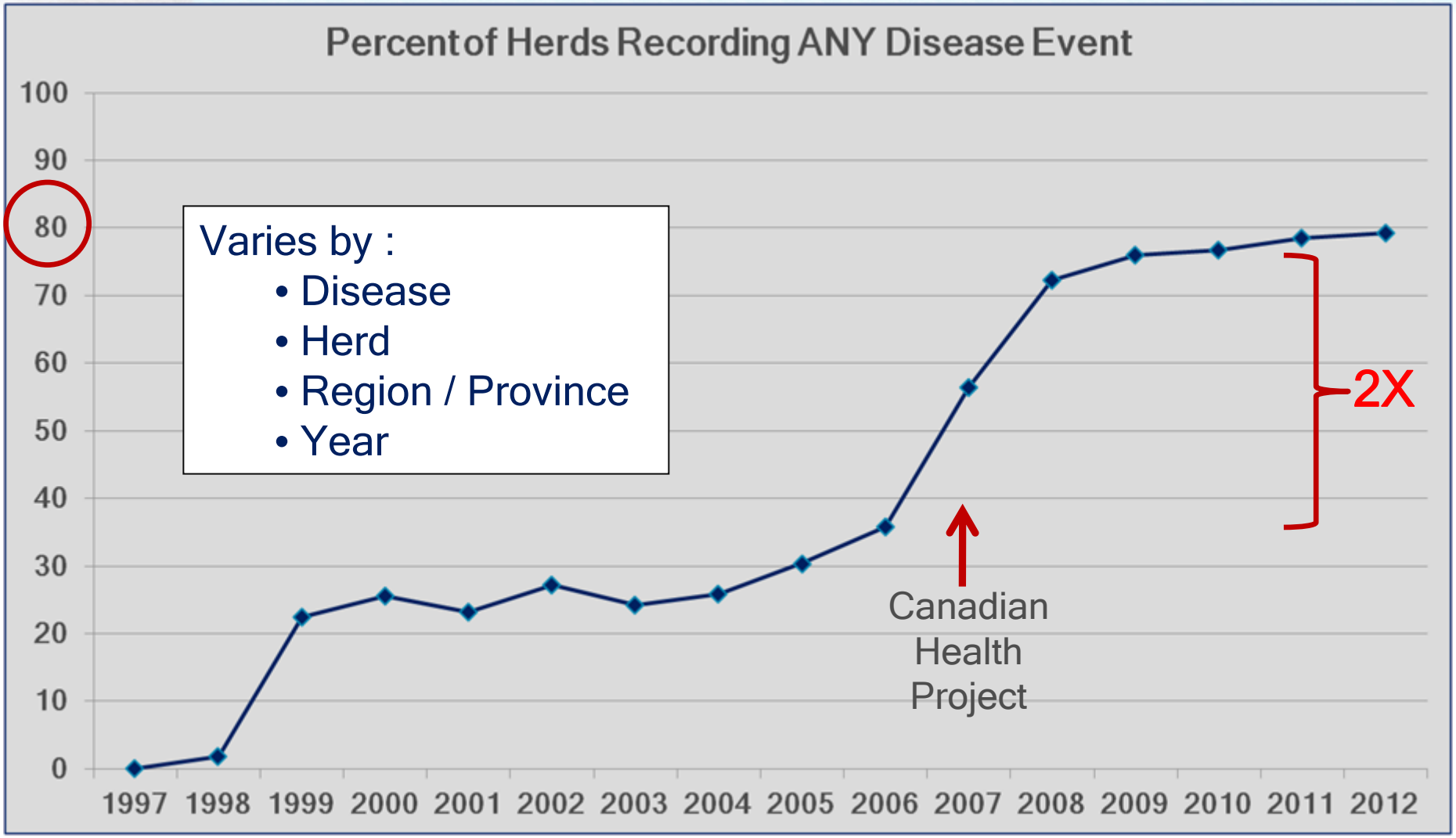
Stage 3
- Cow lies on side with legs stretched out
- Pulse difficult to detect

8 Retained Placenta
Failure to eliminate afterbirth within 24 hours of calving.

Injury
This includes a number of conditions (fractures, lacerations, tears, and other accidents) that cause a loss of production.

Holstein Canada

Herds Recording Disease Events



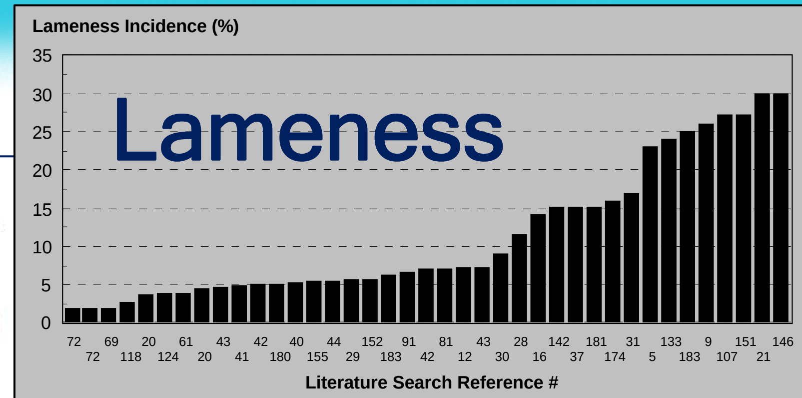
Disease Events Recorded on Farms

Ontario from 1999 to 2012

Percent of Herds Recording Specific Disease Event					Events/Herd
Disease	**1999**	**2004**	**2009**	**2012**	**2012**
Retained Placenta	10	8	29	30	4.4
Metritis (Acute)	2	4	16	23	6.0
Mastitis	10	17	61	68	12.5
LamenessProblem	5	7	25	27	6.8
Ketosis	4	3	11	11	5.0
Milk Fever	6	4	17	16	2.7
Displaced Abomasum	9	8	30	31	2.5

Dairy producers record what is of use to them!
Encouraging /forcing them to do more…is that a good thing?

Q3: Why these 8 diseases?



OUR INDUSTRY TODAY

Recommendations for Recording and Calculating the Incidence of Selected Clinical Diseases of Dairy Cattle

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ABSTRACT

The r ort upon which the current discussion is based as prepared in response to the increasing interes of he dairy industry in the recording of clinica disea e data. The major objective was to introduce ui elines and standards for the recording and presentation of the diseases of dairy cattle. Eight cli
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ical mastitis. Standardized definitions for these dis-

and regional basis; 2) to modify efficiently the management practices that promote the health of cattle; 3) to investigate further the genetic component of disease occurrence and resistance; and 4) to monitor the health status of the national dairy herd. A major impediment to this initiative is the lack of consistent standards for the definition of diseases and the presentation of these data. Use of disparate dis-
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with the recent interest in the impact of the use of

Prepared for: Cattle Breeding Research Council of Canada - 1997

ICAR Health Data Conference, Aarhus, 2013

Q4: How good are our prevalence data?

Where do we get a more representative sample?....better geographical coverage for surveillance purposes?

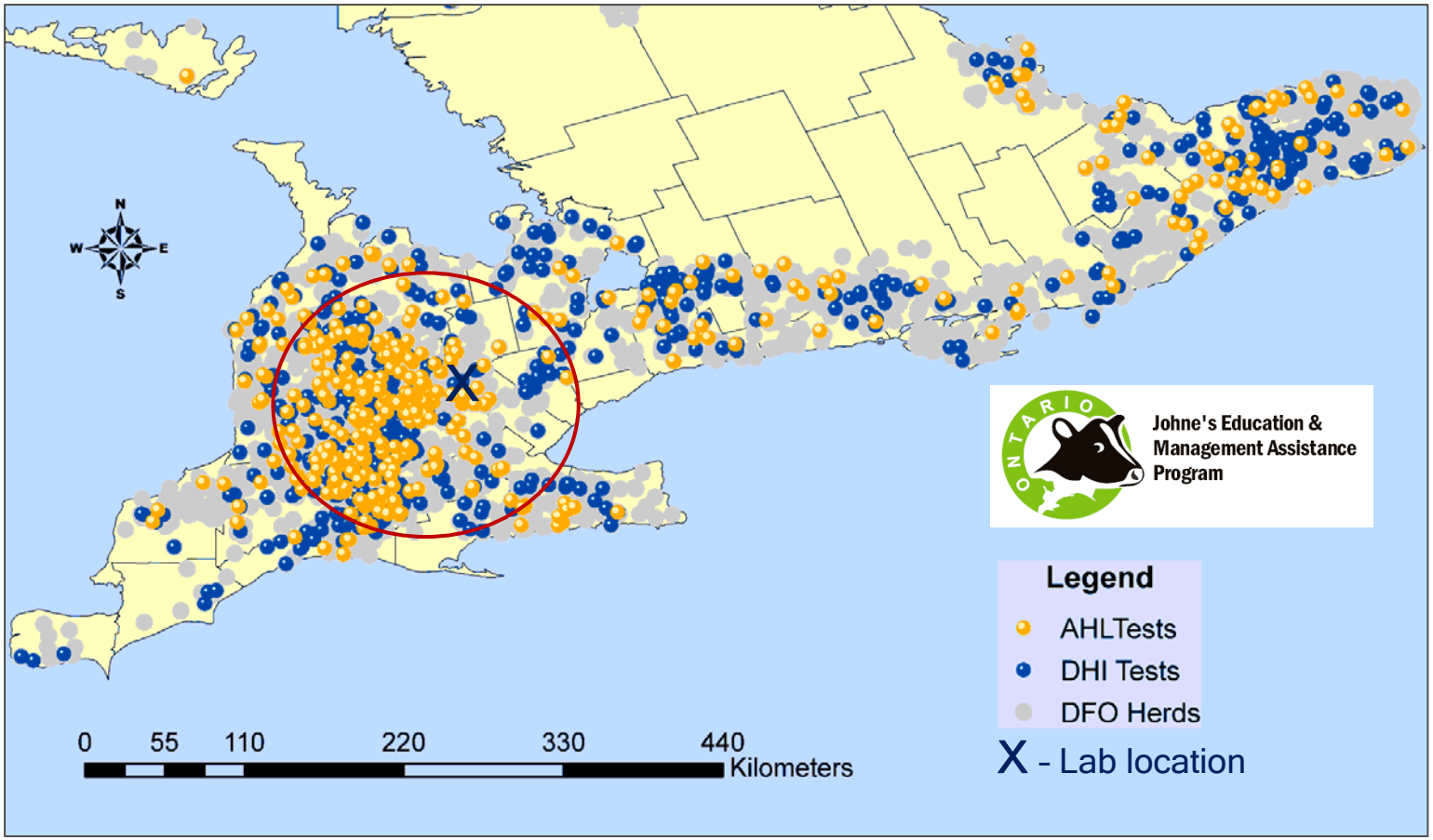
- Serological test samples submitted to our Animal Health Laboratory by veterinarians

OR

- DHI herds testing with milk-based tests

Better Surveillance - Milk vs. Serum

Distribution of AHL and DHI JD Herd Tests from 2007 to 2009



Q5: How good are our disease tests?

What do we know about test performance?

Sensitivity and Specificity of milk-based tests

the right TEST for the QUESTION being asked

Leukosis:

- Se of milk ELISA for BLV infection = 98%

Paratuberculosis (Johne's Disease):

- Se of milk ELISA cut at 0.1 for MAP infection = 30%

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- Se of milk ELISA for BLV infection = 98%

Paratuberculosis (Johne's Disease):

- Se of milk ELISA cut at 0.1 for MAP infection = 30%
- Se of milk ELISA cut at 0.5 for MAP shedding = 83%

Q6: How good are our incidence data?

$$\text{Incidence} = \frac{\text{Numerator (\# Events)}}{\text{Denominator (\# At Risk) X Time}}$$

Disease Definition!

Mastitis:

- Do we want clinical or subclinical or both?
- What is the detection threshold of the veterinarian/farmer/farm worker?
- What triggers recording….treatment….SCC….clots…..EC…..LDH?
- Which cases get treated….mild….moderate….severe?
- Do we record by quarter… by pathogen… ?

Identifying Cows with Mastitis

Quarter

Cow

SCC REPORT — *Management List*

Ontario DHI 1-800-549-4373

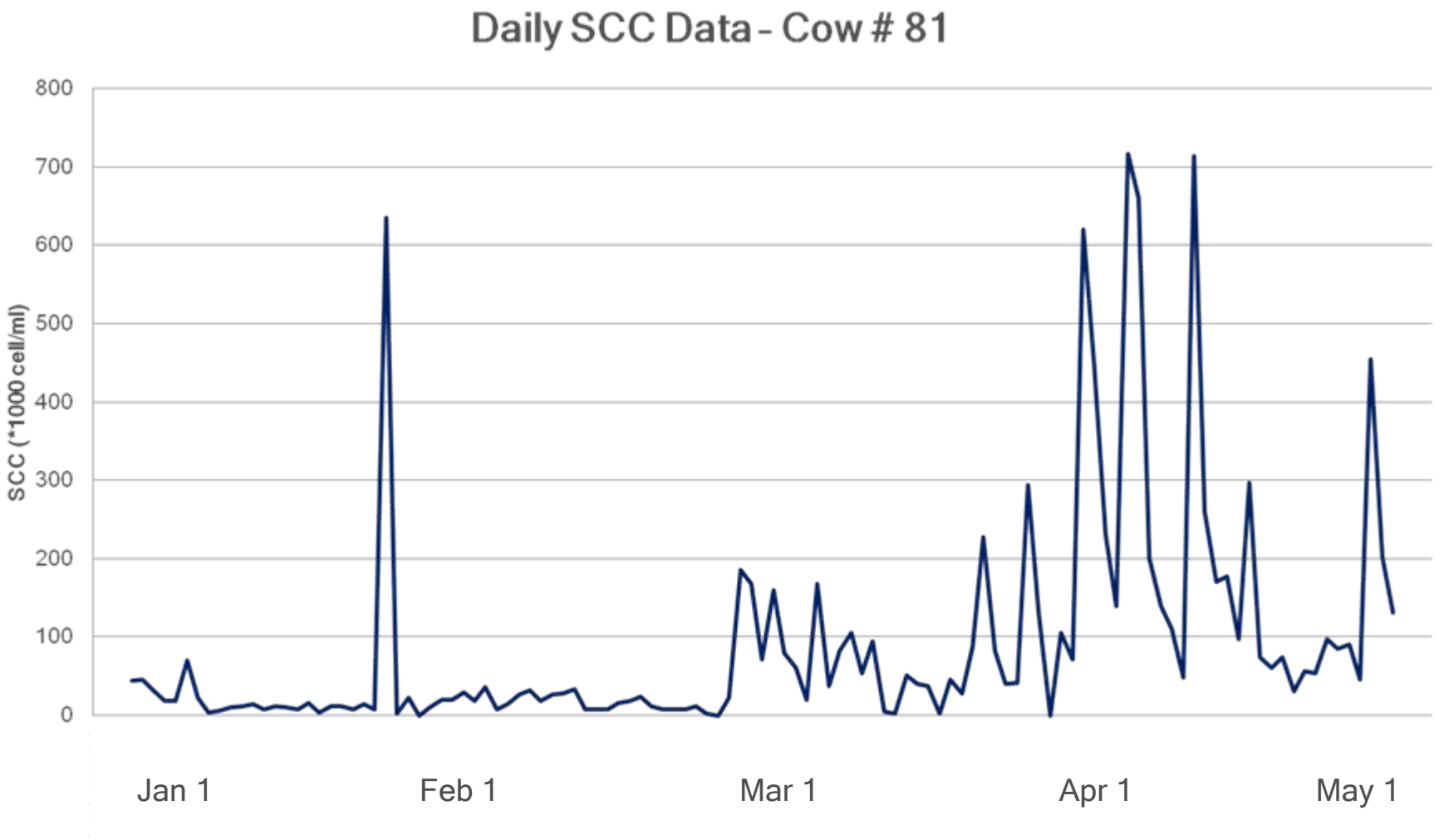
NAME | HERD NUMBER | PAGE 1 of 1 | TEST DATE 27 Dec 1999 | SERVICE P12AP

Cow Name / Chain #	Test Day Data: Lact #	Days in Milk	Milk kg	LS	SCC 000's/ml	% Of Herd SCC	LS: # Tests > 4	LS: Lact Avg	Estimated Lactation Milk Loss $	Notes
Kate 0000	2	182	28.4	7	2118	13	4	6	356	
Wyoming 0000	4	421	25.2	8	2198	12	12	6	356	
Wades 0028	1	214	27.3	7	1417	8	6	5	158	
Maggie 0000	1	170	23.1	7	1373	7	6	7	243	
Honey 0000	2	230	22.1	7	1295	6	6	5	267	
Nicole 0000	2	296	25.2	6	1004	5	2	3	99	
Miranda 0000	1	10	25.2	6	668	4	1	6	183	

New Technologies

ICAR Health Data Conference, Aarhus, 2013

New Technologies



Q7: How good are our incidence data?

$$\text{Incidence} = \frac{\text{Numerator (\# Events)}}{\text{Denominator (\# At Risk) X Time}}$$

Who is at Risk?

MUCH EASIER…..thanks to DHI herd inventories!

BUT…….Milk Fever:

- Are all parity groups at risk….equally?
- Are all breeds equally at risk….Holsteins…Jerseys….cross-breds?
- Are cows in pasture-based systems at risk?
- Do we only count the first case in a lactation….or all cases?

Q8: How good are our incidence data?

$$\text{Incidence} = \frac{\text{Numerator (\# Events)}}{\text{Denominator (\# At Risk) X Time}}$$

How long at Risk?

Ketosis:

- How long after calving are cows at risk…. 2 weeks or 2 months?

Displaced Abomasum:

- If a cow had a DA last lactation and was treated….is she at risk in the current lactation……if she had surgery…..what form of surgery?

Q9: How good/bad are our national data?

Clinical Mastitis Identified by Producers

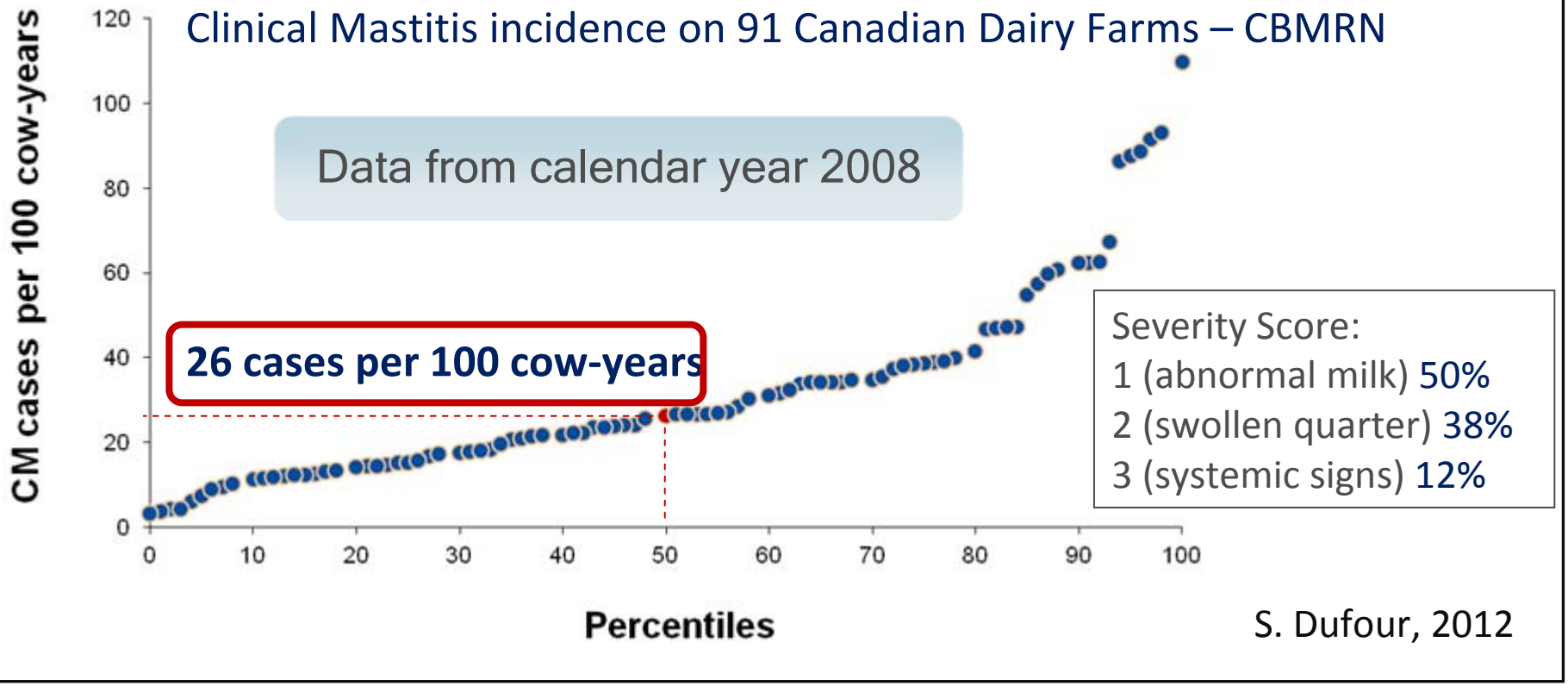
Clinical Mastitis incidence on Canadian Dairy Farms Recording Mastitis Events in National Dairy Health Database: 19 cases per 100 cow-years.

Data from calendar year 2008

Q9: How good/bad are our national data?

Clinical Mastitis Identified by Producers

Clinical Mastitis incidence on Canadian Dairy Farms Recording Mastitis Events in National Dairy Health Database: 19 cases per 100 cow-years.



Q10: When is one disease two diseases?

Lameness:

Infectious

- Foot Rot (pasture foot rot)
- Digital Dermatitis (strawberry)
- Heel Horn Erosion (stable foot rot)

An example of a footwart (Papillomatous Digital Dermatitis).

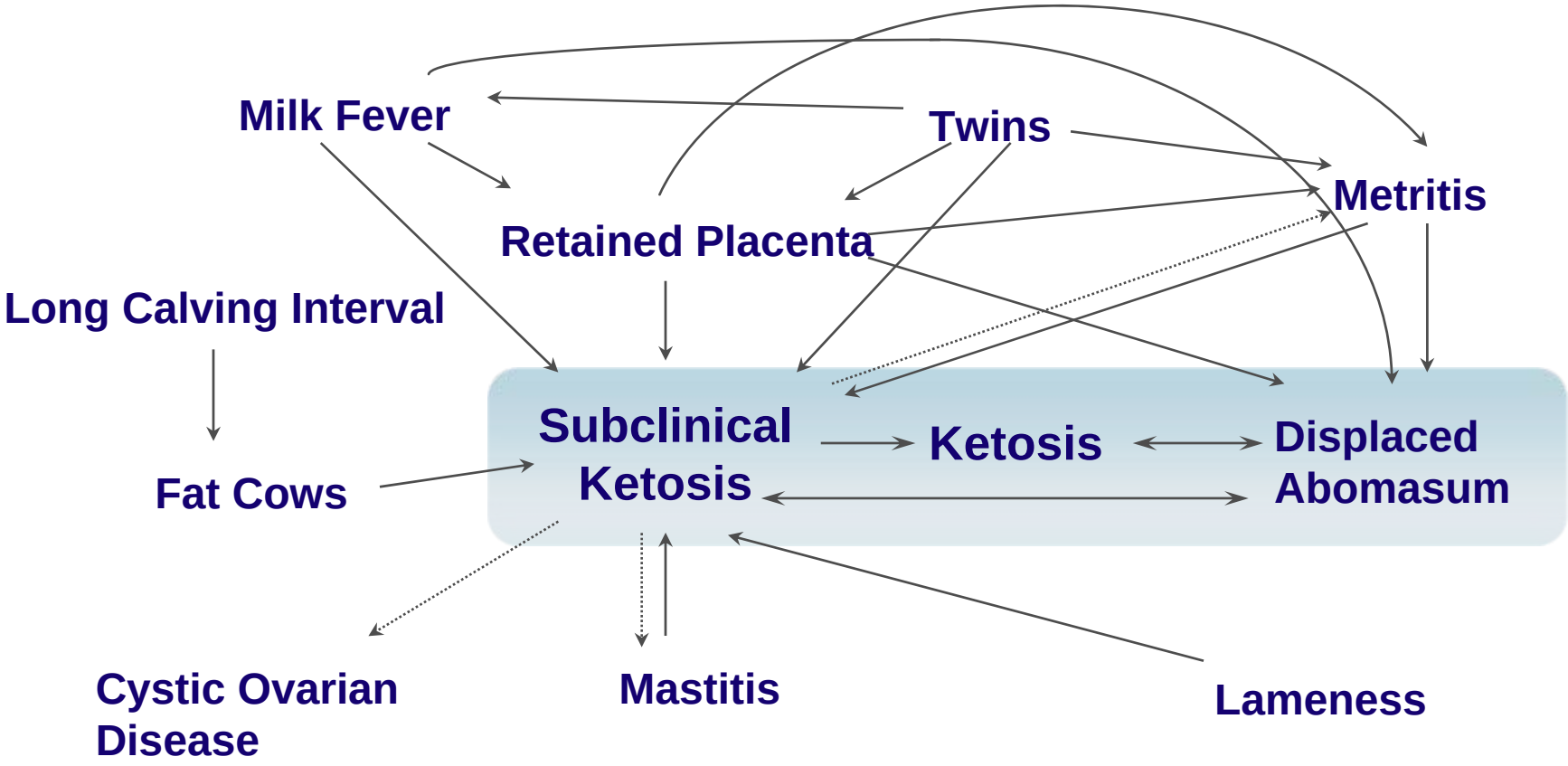
Non-infectious

- Hemorrhage
- Ulcer at the toe, heel or sole
- White Line Disease

Injury above the claw

Q10: When are two diseases really one?

Ketosis and Displaced Abomasum:



Adapted from: Dohoo & Martin, 1984; Grohn et al, 1989; Correa et al, 1993; Duffield, 1997

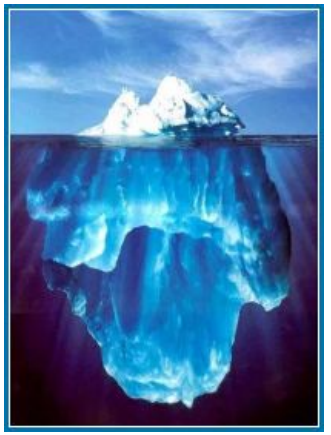
Summary Comments:

- We are using event data collected primarily for farm use….be cautious!
- Quality is just as important as quantity!
- Health data utility will vary with end use!
- Think about standardization of:
  - Disease Definition….many options!
  - Case Definition….when is it a ‘new’ case?
  - Time at Risk….will vary with disease condition!
- We’ve come a long way…….

Final Question to Ponder:

Can we eliminate the 'human element' in Event Recording?

- Mastitis – in-line SCC, LDH, EC… by quarter……
- Ketosis/LDA – in-line BHB, acetone…..
- Lameness – activity monitors……..
- Cystic Ovaries – in-line progesterone……
- Milk Fever – ???? – NIR…MIR……
- Retained Placenta / Metritis - ????



Recognizing that there are many challenges……

FOSS AfiLab™ Real-Time Milk Analyzer LELY lattec DeLaval

Thank You! Questions???

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