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

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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.......

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Background and Biases

Veterinary Epidemiologist
Department of Population Medicine
University of Guelph - Canada

Dairy Cattle Health & Welfare

Mastitis, Lameness, Infectious Disease

CanWest DHI – R & D

Evaluation of Milk-based Tests

Data Quantity AND Quality

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Validation of Disease/Health Data

- Milk → Lab
- Whiteboard
- Paper Record → DHI
- On-farm Computer
- Veterinarian / AI
- Technology
- Benchmarking
- Genetic Evaluation
- Surveillance
- Research

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Validation of Disease/Health Data

Milk → Lab

- Benchmarking
- Genetic Evaluation
- Surveillance
- Research

DHI

Technology

On-farm Computer

Definition

Retrospective evaluation of health event data recording on 50 dairies using Dairy Comp 305

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Data quality in the Norwegian dairy herd recording system: Agreement between the national database and disease recording on farm

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Q1: Why do “we” record disease data?

- Diagnosis and therapy of sick cows
- Health management - benchmarking
- Biosecurity - animal movement
- Health and welfare assurance
- Genetic selection - functional traits
- Surveillance for status & trade
- Research - prevention & control

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’

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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?

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Canadian National Health Project

“The Big 8”:

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

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Herds Recording Disease Events

Percent of Herds Recording ANY Disease Event

Varies by:
- Disease
- Herd
- Region / Province
- Year

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Disease Events Recorded on Farms

Ontario from 1999 to 2012

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<td>9</td>
<td>8</td>
<td>30</td>
<td>31</td>
<td>2.5</td>
</tr>
</tbody>
</table>

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

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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 report upon which the current discussion is based was prepared in response to the increasing interest of the dairy industry in the recording of clinical disease data. The major objective was to introduce guidelines and standards for the recording and presentation of the diseases of dairy cattle. Eight 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 disease definitions and reporting formats is a significant impediment with the recent interest in the impact of the use of

Prepared for: Cattle Breeding Research Council of Canada - 1997

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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

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Better Surveillance - Milk vs. Serum

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

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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%
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%
• Se of milk ELISA cut at 0.5 for MAP shedding = 83%

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Q6: How good are our incidence data?

\[ \text{Incidence} = \frac{\text{Numerator} \text{ (# Events)}}{\text{Denominator} \text{ (# At Risk) } \times \text{Time}} \]

**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...?

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Identifying Cows with Mastitis

Quarter

Cow

New Technologies

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New Technologies

Daily SCC Data - Cow # 81

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Q7: How good are our incidence data?

\[
\text{Incidence} = \frac{\text{Numerator (\# Events)}}{\text{Denominator (\# At Risk) \times Time}}
\]

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?

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Q8: How good are our incidence data?

Incidence = \frac{\text{Numerator (# Events)}}{\text{Denominator (# At Risk) \times 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?

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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
Clinical Mastitis Identified by Producers

Clinical Mastitis incidence on 91 Canadian Dairy Farms – CBMRN

- Severity Score:
  1. (abnormal milk) 50%
  2. (swollen quarter) 38%
  3. (systemic signs) 12%

Data from calendar year 2008

Q9: How good/bad are our national data?

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)

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

Injury above the claw

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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

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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.........

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