What We Have Learned with Activity and Rumination Monitors

Dr. Gláucio Lopes, DVM, MS.
Large Herd Manager and Reproduction Specialist
Established in 1976
Over 300 employees
Over 800K tags shipped every year
20% of the companies’ employees are R&D engineers
More than 70 partners around the world
Part of the Global Allflex Group
Progression of SCR technology

Millions of cows served by SCR technologies on a daily basis

Cows served by SCR technologies


0.13M  1.3M  1.5M  2.0M  3.9M  7.9M  12M  13.0M  14.0M

Products
Outline:

• Cows challenges – health and reproduction
• Technological transformation
• What have we learned?
  – Health
  – Reproduction
• What’s new and what’s improved
Cows challenges – Dr. Jeff Bewley (KY)

• Catching sick cows in early lactation
• Finding and treating cows with mastitis
• Finding and treating lame cows
• Finding cows in heat
• Understanding nutritional status of cows
  – Feed intake
  – Body condition (fat or thin)
  – Rumen health (pH/rumination time)
Incidence of Health Disorders in the First 60 d in Milk in High-Producing Holstein Herds

5,719 postpartum dairy cows evaluated daily for health disorders from eight experiments in seven dairy farms in the US.

### Health Problems in the First 60 DIM in Lactating Dairy Cows

#### Resumption of Estrous Cyclicity

<table>
<thead>
<tr>
<th>Category</th>
<th>Cyclic, %</th>
<th>Adjusted OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>84.1</td>
<td>1.00</td>
<td>---</td>
</tr>
<tr>
<td>1 case of disease</td>
<td>80.0</td>
<td>0.97 (0.72 – 1.30)</td>
<td>0.83</td>
</tr>
<tr>
<td>&gt; 1 case of disease</td>
<td>70.7</td>
<td>0.60 (0.44 – 0.82)</td>
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</tr>
</tbody>
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#### Type of health problem

<table>
<thead>
<tr>
<th>Health Problem</th>
<th>Cyclic, %</th>
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</thead>
<tbody>
<tr>
<td>Calving problem</td>
<td>70.5</td>
<td>0.52 (0.40 – 0.68)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Metritis</td>
<td>63.8</td>
<td>0.37 (0.28 – 0.50)</td>
<td>&lt; 0.001</td>
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<tr>
<td>Clinical endometritis</td>
<td>68.9</td>
<td>0.51 (0.37 – 0.71)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Fever postpartum</td>
<td>80.0</td>
<td>0.55 (0.40 – 0.74)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Mastitis</td>
<td>81.5</td>
<td>0.87 (0.55 – 1.36)</td>
<td>0.53</td>
</tr>
<tr>
<td>Clinical ketosis</td>
<td>77.7</td>
<td>0.71 (0.47 – 1.07)</td>
<td>0.10</td>
</tr>
<tr>
<td>Lameness</td>
<td>85.0</td>
<td>0.82 (0.52 – 1.30)</td>
<td>0.40</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>88.9</td>
<td>1.78 (0.22 – 14.34)</td>
<td>0.59</td>
</tr>
<tr>
<td>Digestive problem</td>
<td>60.7</td>
<td>0.54 (0.25 – 1.17)</td>
<td>0.12</td>
</tr>
</tbody>
</table>
## Health Problems in the First 60 DIM in Lactating Dairy Cows

### Resumption of Estrous Cyclicity

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<td>0.83</td>
</tr>
<tr>
<td>&gt; 1 case of disease</td>
<td>70.7</td>
<td>0.60 (0.44 – 0.82)</td>
<td>0.001</td>
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</tbody>
</table>

### Pregnancy/AI

<table>
<thead>
<tr>
<th>Category</th>
<th>Pregnant, %</th>
<th>Adjusted OR (95% CI)</th>
<th>P</th>
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<tbody>
<tr>
<td>Healthy</td>
<td>51.4</td>
<td>1.00</td>
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</tr>
<tr>
<td>1 case of disease</td>
<td>43.3</td>
<td>0.79 (0.69 – 0.91)</td>
<td>0.001</td>
</tr>
<tr>
<td>&gt; 1 case of disease</td>
<td>34.7</td>
<td>0.57 (0.48 – 0.69)</td>
<td>&lt; 0.001</td>
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</tbody>
</table>

### Pregnancy Loss

<table>
<thead>
<tr>
<th>Category</th>
<th>Loss, %</th>
<th>Adjusted OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
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<td>8.9</td>
<td>1.00</td>
<td>---</td>
</tr>
<tr>
<td>1 case of disease</td>
<td>13.9</td>
<td>1.73 (1.25 – 2.39)</td>
<td>&lt; 0.001</td>
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<tr>
<td>&gt; 1 case of disease</td>
<td>15.8</td>
<td>2.08 (1.36 – 3.17)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

5,719 postpartum dairy cows evaluated daily for health disorders in seven dairy farms in the US.  

Santos et al. (2010)
Technological transformation - Dr. Jeff Bewley (KY)

- Extension of other industries
- New dairy industry demands
  - Animal well-being
  - Consumer demands
  - Environmental pressure
  - Labor challenges
  - Economic competition
Rumination Graph

Baseline (Average)

Raw Rumination

Calving

Group Change
Estrus Detection – Activity and Rumination Graph

High Activity

21 days

42 DIM

63 DIM
What have we learned?
What have we learned? - Step by step

Dry period
Pre-partum

Calving

Fresh period and beginning of lactation

Reproductive Management

Health

Repro
Dry period and pre-partum
Association between Prepartum and Postpartum Rumination

Correlation: $r = 0.63$ (95% CI = 0.53, 0.67); $P < 0.01$
Partial correlation: $r = 0.65$; $P < 0.01$

Liboreiro et al. (2014)
Association Among Pattern of Rumination and Prevalence of Sub-clinical Hypocalcemia and Ketosis

\[ y = 1.4044x - 16.778 \]
\[ R^2 = 0.8754 \]

\[ y = 3.4233x - 44.188 \]
\[ R^2 = 0.9817 \]
Association Among Pattern of Ruminati

\[ y = 0.8143x - 10.872 \]
\[ R^2 = 0.5777 \]

\[ y = -0.417x + 110.17 \]
\[ R^2 = 0.9441 \]
Calving
CHANGES IN RUMINATION RELATIVE TO CALVING

Days relative to calving

-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7

Daily Rum
Rum last 24h
ProCalve™ Application

General health related

6 DIM - 260 Days pregnant

- Distress

Events not alerts

Calving related

260 Days Preg' - calving

- Pre calving - Moderate Dis'

Distress! - Pre Calving

Calving - 5DIM

- Distress! - Post Calving

Real time push notifications
The pre-calving distress alert is triggered if rumination remains low for a long period of time before reported calving.

Cows appearing in this report are at greater risk of developing post-calving diseases.

Each cow’s rumination is monitored after reported calving and a post-calving distress alert is triggered if a cow is in distress.

*This report may also include cows that are recorded with distress unrelated to calving (“distress”) – not included in the alert.*
Fresh Period and Beginning of Lactation
Daily rumination time of healthy and (later diagnosed) diseased cows in the first week after calving

![Graph showing rumination time over days after calving for healthy and diseased cows.]

Fonte: SCR research
Transition Cow Monitoring: Fresh Cow Recovery

Fresh cow rumination time recovery is automatically monitored. System looks for about an hour rumination time added each day in first week of lactation.
How accurate is the system to detect rumination?


[R^2 = 0.87, n = 51, P<0.001]
Use of Ruminations and Activity Monitoring for the Identification of Dairy Cows with Health Disorders

M.L. Stangaferro, R. Wijma, C.E. Quinteros, M.B. Medrano, M. Masello, and J.O. Giordano

Dairy Cattle Biology and Management Laboratory
Objectives

(1) **Ability** of the HR system to identify cows with health disorders (HD).

(2) **When** does HR system identify cows with HD compared to farm personnel?

(3) **Describe** activity, rumination and HI score patterns of cows suffering or not suffering HD.

**Observational Prospective Cohort Study**

- Baseline data Collection
- Health monitoring = RP, MF, MET, MAST, KET, DA and IND
- Rumination, Activity and Health index Score raw data (every 2 h)

Collars on (HR-Tags)

Calving

Collars off (HR-Tags)

N=1,121 cows

Study period: November 2013 to October 2014
Health Monitoring SOP

• Daily examination all cows from 1 to 10 DIM
  – *Direct observation* (general appearance and attitude, presence of the placenta, vaginal discharge, foot health, udder health, and manure consistency)
  – *Rectal temperature* ($C^\circ$)
  – *Urine ketone bodies* (*Ketostix*, *Bayer Animal Health*)
  – *Daily milk weights*

• Rumen auscultation

• Vaginal discharge - all cows at 8 DIM if no prior MET Dx

• Milk culture - all cows at the beginning of lactation and mastitis cases

• Monitoring after 10 DIM: thrice daily milk weights and milk conductivity
Health Index Report

<table>
<thead>
<tr>
<th>Cow Number</th>
<th>Group</th>
<th>Lactation Status</th>
<th>Days in Lactation</th>
<th>Days from Last Breeding</th>
<th>Activity Peak</th>
<th>Ruminations Peak</th>
<th>Daily Ruminations</th>
<th>Amount Of Evaluation</th>
<th>Health Index for Non</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20600</td>
<td>7 Before</td>
<td>6</td>
<td>-15</td>
<td>-40</td>
<td>0</td>
<td>-132</td>
<td>20.00</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10856</td>
<td>7 Before</td>
<td>5</td>
<td>-40</td>
<td>-44</td>
<td>13</td>
<td>-464</td>
<td>32.60</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9473</td>
<td>7 Before</td>
<td>8</td>
<td>-75</td>
<td>-100</td>
<td>38</td>
<td>-561</td>
<td>55.00</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>11558</td>
<td>11 No Heat</td>
<td>5</td>
<td>-39</td>
<td>-40</td>
<td>0</td>
<td>-462</td>
<td>66.30</td>
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<tr>
<td>5</td>
<td>9362</td>
<td>7 Colostrum</td>
<td>3</td>
<td>-37</td>
<td>-98</td>
<td>86</td>
<td>-136</td>
<td>67.20</td>
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<tr>
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<tr>
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<td>-290</td>
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<tr>
<td>9</td>
<td>2152200</td>
<td>No Heat</td>
<td>9</td>
<td>-13</td>
<td>-23</td>
<td>133</td>
<td>-23</td>
<td>81.50</td>
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<tr>
<td>10</td>
<td>950600</td>
<td>7 Ready</td>
<td>8</td>
<td>-40</td>
<td>2</td>
<td>2</td>
<td>-35</td>
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<tr>
<td>11</td>
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<tr>
<td>15</td>
<td>12561</td>
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<td>46</td>
<td>-5</td>
<td>-15</td>
<td>186</td>
<td>5</td>
<td>85.50</td>
<td></td>
</tr>
</tbody>
</table>

Evaluate the ability of Health Index (HI) score to identify cows with health disorders.
HR-Tag SCR Dairy - DA Cow example
**Health Index Pattern**

**DISPLACED ABOMASUM**

**HEALTH INDEX**

- Healthy (n = 451)
- HI (-) (n = 1)
- HI (+) (n = 40)

Group: P<0.001
Day: P=0.59
Group * Day: P<0.001

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Health Index Score

Days relative to clinical diagnosis
Reproductive Management
Why is reproduction so important?

LACTATION CURVE
CONTROL COST OR INCREASE MILK LEVEL

Reproduction Regulates % of lifetime spent in each phase

Source: Dr. Dave Galligan, UPenn
Courtesy: Dr. Ricardo Chebel

3rd Lactation: 9.000 Kg
Reducing Calving Interval increases milk production

- Additional 3.33 lbs milk/day
- Additional ~1,096 lbs milk/year
- Reduction of 63 days of CI

Ribeiro et al. (2012)
## Expected Monetary Value difference between current and expected 21d PR

<table>
<thead>
<tr>
<th>CURRENT 21D PREGNANCY RATE</th>
<th>GOAL 21D PREGNANCY RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>11</td>
<td>32</td>
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<tr>
<td>12</td>
<td>62</td>
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<td>13</td>
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<td>14</td>
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<td>29</td>
<td>367</td>
</tr>
<tr>
<td>30</td>
<td>377</td>
</tr>
</tbody>
</table>

Annual Value of improving 21d PR ($/cow/year)

Metrics to Assess Reproductive Efficiency in Dairy Herds

Using Pregnancy Risk as a Key Performance Indicator

Luís G. D. Mendonça, DVM, MS
Assistant Professor and Dairy Extension Specialist
Department of Animal Sciences and Industry
Kansas State University
Estrus detection – Activity and Rumination Graph
Ideal window opportunity for AI

Hours to Breeding

Activity Peak

Optimum time to breed

Acceptable AI Range

Ovulation

- 26
- 24
- 10
- 4
- 0
Ideal window opportunity for AI
Anestrus cows and cows with irregular heat
Cows with irregular heat
Interval from Onset of Estrus to Ovulation and Probability of Pregnancy according to Interval from Onset of Estrus

Avg. interval = 25.7 h

Transition Period Management and Use of Automated Rumination/Activity/Lying Behavior Monitors, Western Dairy Herd Conference 2015, Chebel et al., U of Minnesota, U of Florida
What’s new and what’s improved

• Evaluation of feeding consistency / additives
• Real-time group routine
  – Activity
  – Rumination
• Group consistency
• Overcrowding evaluation
• Managing from the distance – mobile app
Relationships among Rumination, Resting, and Feeding (Schirmann et al., 2012)

- Rumination and feeding time/DMI were correlated positively after a 4-h lag (r=0.23)
  - Following periods of high feed intake, cows spend more time ruminating
  - Restricted DMI reduces rumination (each 1 kg/d decrease in DMI, 44 min/d decrease in rumination Metz, 1975)
- Rumination is correlated positively with lying time (r=0.60)
  - Periods of rumination are more frequent when lying down

Courtesy of Dr. Heather Dann, Miner Institute, 2014
Heatime®Pro – Real-Time Group Routine – Activity

The green line is the current real-time data. The gray line is the group's two-week activity average. Any difference between the lines indicates an abnormality.
Heatime® Pro – Real-Time Group Routine – Rumination

The purple line is the current real-time data. The gray line is the group’s two-week rumination average. Any difference between the lines indicates an abnormality.
The top line on the graph shows the group Avg. daily rumination.

The bottom line shows the variation in rumination levels across the group. When this line goes down, it is a good indication that the group is more homogenous.
Evaluation of Feedstuffs
Overcrowding and Rumination  (Batchelder, 2000)

• 100 versus 130% stocking rate
  – Stalls and headlocks, 4-row barn
  – Cows fed same TMR

• Average % cows ruminating:
  – 28% of cows ruminating at 130% SR
  – 38% of cows ruminating at 100% SR

• ~2 h/d difference in rumination
  – 9.4 gal/d more saliva production
  – 209 g/d more bicarbonate
  – Recommended level of bicarbonate is ~170-200 g/d

Courtesy of Dr. Heather Dann, Miner Institute, 2014
Data dashboard for quick reference of herd stats

Monitoring from another device:

- Health Report
- Cows in Heat
- Daily Ruminanion
- Heat Report

Cow Card

Activity & Rumin. Change

DAILY RUMINATION

Total 23: 3653
- Group: 3
- DIM: 97
- Hours to AI: 13
- Max activity chg: 100

Total 31: 2842
- Group: 6
- DIM: 215
- Health Index: 23
- Daily Ruminanion: 483

Total 31: 3252
- Group: 6
- DIM: 9
- Health Index: 65
- Daily Ruminanion: 275

Total 31: 2012
- Group: 7
- DIM: 291
- Health Index: 56
- Daily Ruminanion: 319

Welcome
HealthyCow 24
Typical Results—Individual Cow

• Ability to reduce lock up time
• Reduced death loss
• Reduced number of DA’s
• More choices on synch & drug expenses
• Reduced days open
• Increased employee accountability
• Track sick cows when away from the dairy
• Less blame games between AI and Nutritionists
• More confidence to use sexed semen/better bulls
• Greater peace of mind
THANK YOU!