Transition cow management to minimize peripartum disorders

José Eduardo P. Santos
Universidade da Florida
Discuss the multifactorial aspects that impact health performance of dairy cows

Impact of diseases on cow performance

Comment on how producers have approached this period

By the end of the presentation, I hope you can put in perspective how the information applies to your farm or production system
The Evolution of the Dairy Cow in the US Industry

Graphs showing the changes in milk and dry matter production over weeks.
Current World Record (2017)

- **Ever-Green-View My Gold-ET** has set a new single-lactation world record for milk production
  - 365-day record of 35,144 kg in 365-d at 5-years of age (77,480 lbs)
  - 906 kg of fat
  - 934 kg of true protein
  - Her milk contained 2.57% fat and 2.65% true protein
    - She averaged 96.3 kg/d of milk, 2.50 kg/d of fat and 2.56 kg/d of protein
Altered and Adapted Nutrient Metabolism

Negative Nutrient Balance

Energy
(Mcal NE/day)

Calories Required

Calories Ingested

Days from Calving

Babcock Institute
Diet → Oxidizable metabolic fuels → Fatty acids

Glycogen

Essential processes: cell maintenance, circulation, neural activity

Reducible processes: Thermoregulation, locomotion, growth, and LACTATION

Expendable processes: REPRODUCTION, fat storage

Partitioning of metabolic substrates according to priority

Summary of Metabolic Changes with Onset of Lactation

Vázquez-Añón et al., 1994; JDS
Risk factors for resumption of estrous cycles by 65 days postpartum and pregnancy at 1st AI in lactating dairy cows

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cyclic, % (n/n)</th>
<th>Adjusted OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BCS change from calving to 65 DIM</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost 1 unit or more</td>
<td>58.7 (279/475)</td>
<td>Referent</td>
<td>-------</td>
</tr>
<tr>
<td>Lost &lt; 1 unit</td>
<td>74.6 (2,507/3,361)</td>
<td>1.96 (1.52, 2.52)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>No change</td>
<td>80.9 (2,071/2,560)</td>
<td>2.39 (1.74, 3.28)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Milk yield in the first 90 DIM</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1, 32.1 kg/d</td>
<td>72.7 (1,011/1,390)</td>
<td>Referent</td>
<td>-------</td>
</tr>
<tr>
<td>Q2, 39.1 kg/d</td>
<td>77.6 (1,204/1,552)</td>
<td>1.34 (1.13, 1.60)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Q3, 43.6 kg/d</td>
<td>77.6 (1,350/1,739)</td>
<td>1.36 (1.15, 1.62)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Q4, 50.0 kg/d</td>
<td>75.3 (1,292/1,715)</td>
<td>1.21 (1.02, 1.43)</td>
<td>0.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pregnant, % (n/n)</th>
<th>Adjusted OR (95% CI)</th>
<th>P value</th>
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<tr>
<td><strong>BCS change from calving to 65 DIM</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost 1 unit or more</td>
<td>28.9 (132/472)</td>
<td>Referent</td>
<td>-------</td>
</tr>
<tr>
<td>Lost &lt; 1 unit</td>
<td>37.3 (1204/3230)</td>
<td>1.42 (1.13, 1.79)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>No change</td>
<td>41.6 (1008/2422)</td>
<td>1.69 (1.32, 2.17)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Milk yield in the first 90 DIM</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1, 32.1 kg/d</td>
<td>37.2 (496/1,334)</td>
<td>Referent</td>
<td>-------</td>
</tr>
<tr>
<td>Q2, 39.1 kg/d</td>
<td>38.9 (576/1,481)</td>
<td>1.06 (0.91, 1.24)</td>
<td>0.42</td>
</tr>
<tr>
<td>Q3, 43.6 kg/d</td>
<td>39.3 (652/1,661)</td>
<td>1.09 (0.93, 1.26)</td>
<td>0.26</td>
</tr>
<tr>
<td>Q4, 50.0 kg/d</td>
<td>37.6 (620/1,648)</td>
<td>1.03 (0.88, 1.21)</td>
<td>0.65</td>
</tr>
</tbody>
</table>

OR = odds ratio
CI = confidence interval

If Energy Balance is a Major Drive of Reproductive Success in the Dairy Cow, then the Focus Should be on Intake and not Milk Yield
Timeline Management of Dairy Cows For Successful Transition

Provide Proper Comfort and Heat Abatement

1. **Dry off**
   - 230 days of gestation
   - Proper body condition
   - Control of mastitis
   - Routine hoof trimming
   - Vaccination program
   - Proper diet to avoid over and under consumption of nutrients

2. **Close up**
   - Move based on days pregnant
     - 255 days of gestation
   - Proper grouping
   - Vaccination program
   - Feed diets to minimize metabolic disorders in early lactation

3. **Parturition**
   - Training of personnel
   - Minimize intervention
   - Reduce calving related disorders

4. **Early Postpartum**
   - Monitor health for early diagnosis of diseases and treatment
   - Feed diets that do not limit intake
   - Control ketosis

5. **High group**
   - Feed diets that maximize milk production and recovery of body condition

**Day Relative to Calving**

- 45 d
- 21 d
- 21 to 28 d
- > 28 DIM
Manage BCS in Late Lactation for Successful Transition

Who is more likely to have peripartum problems?
Distribution of Gestation Length in Holstein Cows

Mean ± SD = 276 ± 6 d

Dry Off Cows

✓ Dry off cows at 230 ± 3 d of gestation
  – 1st lactation cows need 45 d of dry period
  – Older cows need a minimum of 28 d of dry period

✓ Short dry periods for 1st lactation compromise subsequent lactation

✓ No cow needs more than 45 to 50 days dry

✓ Assure 45 days dry for all cows
Move Cows to Prepartum Transition Group

- Manage dry cows in two groups
- Dry, far off group
- Prepartum transition group

- Weekly moves to transition pen
- $255 \pm 3$ d of gestation

- Target 3 weeks in the prepartum pen and assure that all cows spend a minimum of 14 d
Mortality Based on Weeks in Prepartum Pen

<table>
<thead>
<tr>
<th>Stage postpartum</th>
<th>&gt; 2 wk</th>
<th>&lt; 2 wk</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death 30 d</td>
<td>2,0</td>
<td>3,0</td>
<td>7,1</td>
</tr>
<tr>
<td>Death 60 d</td>
<td>2,4</td>
<td>3,3</td>
<td>7,8</td>
</tr>
<tr>
<td>Death 120 d</td>
<td>3,1</td>
<td>3,9</td>
<td>9,0</td>
</tr>
<tr>
<td>Overall</td>
<td>3,6</td>
<td>4,7</td>
<td>10,1</td>
</tr>
</tbody>
</table>

Santos et al. unpublished results
Survival Analyses of Time to Pregnancy Based on Exposure to Transition Diets

Controlling for farm, age, calving order (mating start date)

Adequate Calving Assistance

Patience, hygiene and lots of lubrication
<table>
<thead>
<tr>
<th>Country</th>
<th>Breed of dam</th>
<th>Nulliparous, %</th>
<th>All cows, %</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>H</td>
<td>NR</td>
<td>6.9 (1.7 M)</td>
<td>Sewalen et al. (2008)</td>
</tr>
<tr>
<td>Denmark</td>
<td>H-F</td>
<td>8.7 (1.8 M)</td>
<td>NR</td>
<td>Hansen et al. (2004)</td>
</tr>
<tr>
<td>Egypt</td>
<td>F</td>
<td>7.7</td>
<td>6.9 (1,342)</td>
<td>Gaafar et al. (2011)</td>
</tr>
<tr>
<td>New Zealand</td>
<td>H-F</td>
<td>8.1</td>
<td>6.1</td>
<td>Mee et al. (2011)</td>
</tr>
<tr>
<td>Norway</td>
<td>NR</td>
<td>2.7</td>
<td>1.1 (3.2 M)</td>
<td>Heringstad et al. (2007)</td>
</tr>
<tr>
<td>Spain</td>
<td>H</td>
<td>3.1</td>
<td>2.5 (33,532)</td>
<td>Lopez de Maturana et al. (2007)</td>
</tr>
<tr>
<td>Sweden</td>
<td>SH</td>
<td>8.3</td>
<td>6.8 (692,602)</td>
<td>Steinbock (2006)</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>H-F</td>
<td>NR</td>
<td>7.8 (677,975)</td>
<td>Eaglen and Bijma (2009)</td>
</tr>
<tr>
<td>USA</td>
<td>H</td>
<td>22.6</td>
<td>13.7</td>
<td>Gevrekci et al. (2006)</td>
</tr>
<tr>
<td>USA</td>
<td>H</td>
<td>6.0</td>
<td>3.1 (3.9 M)</td>
<td>Norman et al. (2010)</td>
</tr>
</tbody>
</table>

H= Holstein; H-F = Holstein-Friesian; N = Normand; NR = Norwegian Red; SH = Swedish Holstein

8.1% of primiparous and 6.1% of all cows have dystocia

Adapted from Mee (2012)
Dairy Dreams

In 2016:

- 3,100 milking cows
- 41 kg/d of energy-corrected milk
- 40 kg of milk/day
- 3.80% fat
- 3.30% true protein (~3.45% milk CP)
- Yearly average of 2.85 kg/cow/d of milk solids
- Yearly average stillbirths < 2%
- Herd averaged 21-d cycle PR of 30%
- 21-d cycle insemination rate of 65%
- Pregnancy per AI of 46%
Industry Standards for Space and Comfort Oftentimes Are Inadequate for Transition Cows
Incidence (%) of diseases in the first 60 days postpartum in 11,400 dairy cows from 16 herds according to region of the country and season of calving

<table>
<thead>
<tr>
<th>Disease</th>
<th>NE Warm</th>
<th>NE Cool</th>
<th>MW Warm</th>
<th>MW Cool</th>
<th>SE Warm</th>
<th>SE Cool</th>
<th>SW Warm</th>
<th>SW Cool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained placenta</td>
<td>8.0</td>
<td>5.9</td>
<td>7.4</td>
<td>5.4</td>
<td>15.0</td>
<td>7.6</td>
<td>4.3</td>
<td>2.9</td>
</tr>
<tr>
<td>Metritis</td>
<td>24.7</td>
<td>22.9</td>
<td>12.5</td>
<td>20.2</td>
<td>19.7</td>
<td>18.5</td>
<td>27.6</td>
<td>24.8</td>
</tr>
<tr>
<td>Subclinical ketosis</td>
<td>41.8</td>
<td>18.7</td>
<td>25.9</td>
<td>15.5</td>
<td>24.9</td>
<td>20.1</td>
<td>31.3</td>
<td>14.6</td>
</tr>
<tr>
<td>Mastitis</td>
<td>26.1</td>
<td>16.0</td>
<td>6.1</td>
<td>5.5</td>
<td>18.0</td>
<td>21.3</td>
<td>12.0</td>
<td>8.1</td>
</tr>
<tr>
<td>Displaced abomasum</td>
<td>3.0</td>
<td>3.0</td>
<td>2.8</td>
<td>4.4</td>
<td>3.6</td>
<td>4.6</td>
<td>4.9</td>
<td>4.9</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1.1</td>
<td>1.5</td>
<td>1.7</td>
<td>1.8</td>
<td>3.8</td>
<td>13.4</td>
<td>7.1</td>
<td>3.5</td>
</tr>
<tr>
<td>Clinical endometritis</td>
<td>15.4</td>
<td>32.5</td>
<td>25.9</td>
<td>20.4</td>
<td>23.4</td>
<td>42.9</td>
<td>24.3</td>
<td>26.1</td>
</tr>
<tr>
<td>Lameness</td>
<td>11.3</td>
<td>2.6</td>
<td>2.1</td>
<td>8.1</td>
<td>1.7</td>
<td>12.1</td>
<td>5.4</td>
<td>2.0</td>
</tr>
</tbody>
</table>

~ 50% of the dairy cows are diagnosed with a problem in the first 60 DIM
Morbidity is a Problem of Early Lactation Cows

30 to 35% of cows are affected by disease in the first 3 weeks of lactation

78% the first disease diagnosis occur within 3 weeks postpartum

N = 753 cows with metritis in dairy farms in NY, OH, and CA

What is the Best Way to Reduce Disease Incidence?

No detection

What is the 2nd Best Way to Reduce Disease Incidence?

No record
Controlling Peripartum Diseases Starts at Dry-off

Diseases in the first 30 DIM can be a result of cow management starting 45 days before calving.

A need for effective monitoring systems and biomarkers.
Improve Cow Comfort and Implement Programs that Result in Improved Animal Health and Fertility
Milk Fever and Subclinical Hypocalcemia

- Milk fever affects ~5 to 7% of the multiparous dairy cows
- Subclinical hypocalcemia affects 25% of primiparous and 45 to 60% of multiparous cows

Subclinical Hypocalcemia and Lipid Metabolism

Martinez et al. (2012) J. Dairy Sci. 95:7158-7172
Subclinical Hypocalcemia and Risk of Metritis

<table>
<thead>
<tr>
<th></th>
<th>Subclinical hypocalcemia&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Normocalcemia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Risk</td>
<td>High Risk</td>
</tr>
<tr>
<td>Metritis, %&lt;sup&gt;*&lt;/sup&gt;,¶</td>
<td>40.7 (11/27)</td>
<td>77.8 (35/45)</td>
</tr>
<tr>
<td>Puerperal metritis, %&lt;sup&gt;*&lt;/sup&gt;,¶</td>
<td>29.6 (8/27)</td>
<td>53.5 (24/45)</td>
</tr>
</tbody>
</table>

*Effect of hypocalcemia (P < 0.05),
¶ Effect of metritis risk (P < 0.05).
<sup>1</sup> Serum Ca ≤ 8.59 mg/dL in the first 3 d postpartum.
<sup>2</sup> Puerperal metritis was defined as metritis with presence of fever (≥ 39.5°C).

Martinez et al. (2012) J. Dairy Sci. 95:7158-7172
Induced Subclinical Hypocalcemia in Dairy Cows

Induced Subclinical Hypocalcemia in Dairy Cows

Several risk factors: NEB, DMI, DOA, parity, RP, Ease, twins, ...

Metritis is diagnosed. Sick cows will have heavy anaerobic contamination

Subclinical endometritis; A. pyogenes?, inflammation and no bacteria?

Sequence of Events Based on Literature

- **0-3 DIM**: Fimbriated E. coli contamination is the #1 cause uterine diseases
- **7-14 DIM**: T. Pyogenes and F. necrophorum cause clin. endometritis
- **20-35 DIM**: Metritis, CE, and CytE will impact repro performance
- **35-45 DIM**
- **> VWP**

Courtesy of R.C. Bicalho, Cornell University
Inflammatory Disease and Nutrient Flux

✓ Fed/Control
  • Fed *ad libitum* and not challenged

✓ Fed/Challenge
  • Fed *ad libitum* and challenged with 10 mL of 1x10^9 mL CFU of *M. haemolytica* via a tracheal tube on h 0

✓ Fasted/Control
  • Feed was removed 14 h before the challenged steers received *M. haemolytica* and steers Control steers remained without feed during the sampling period (total of 72 h)

✓ Fasted/Challenge
  • Feed was removed 14 h before the *M. haemolytica* challenge and steers remained without feed during the sampling period (total of 72 h)

Burciaga-Robles et al. (2009)
Arterial haptoglobin concentration in steers fed or fasted with or without a *M. haemolytica* intratracheal challenge

Diet effect, $P = 0.009$
Disease effect, $P < 0.0001$
Diet×Disease effect, $P < 0.0001$

Burciaga-Robles et al. (2009)
Amino Acid Hepatic Flux in Steers Fed or Fasted with or without an Intratracheal Challenge with *M. haemolytica*

Differential of 2.6 moles/day → 380 g of AA for a 400 kg steer

**Essential amino acids**
- Disease effect, \( P = 0.11 \)
- SEM = 19.6

**Non essential amino acids**
- Disease effect, \( P = 0.03 \)
- SEM = 28.5

**Total amino acids**
- Disease effect, \( P = 0.02 \)
- SEM = 45.4

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Burciaga-Robles et al. (2009)
Prevalence of Fatty Liver in Dairy Cows Reported in the Literature

<table>
<thead>
<tr>
<th>Study</th>
<th>Prevalence of fatty liver, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderate (5 to 10% TAG)</td>
</tr>
<tr>
<td>Reid (1980)</td>
<td>48</td>
</tr>
<tr>
<td>Reid (1980)</td>
<td>33</td>
</tr>
<tr>
<td>Grohn et al. (1987)</td>
<td>&gt;15</td>
</tr>
<tr>
<td>Mazur et al. (1988)</td>
<td>65</td>
</tr>
<tr>
<td>Schafer et al. (1991)</td>
<td>53</td>
</tr>
<tr>
<td>Acorda et al. (1995)</td>
<td>33</td>
</tr>
<tr>
<td>Jorritsma et al. (2000)</td>
<td>45</td>
</tr>
<tr>
<td>Jorritsma et al. (2000)</td>
<td>40</td>
</tr>
<tr>
<td>Gerloff et al (1986)</td>
<td>20</td>
</tr>
<tr>
<td>Herd (1991)</td>
<td>&gt;24</td>
</tr>
<tr>
<td>Lima et al. (2013)</td>
<td>28</td>
</tr>
</tbody>
</table>

40.6% of the early lactation cows develop moderate fatty liver

Adapted from Bobe et al. (2004) J. Dairy Sci. 87:3105–3124
TNF increases liver TAG content

Association between fatty liver and other disorders/diseases
Prevalence of Subclinical Ketosis

McArt et al. (2012) J. Dairy Sci. 95:5056-5066
Direct & Indirect effects of Heat Stress during the dry period (late-lactation)

Heat stress during the DRY PERIOD (ITH>68, late gestation 6-8 weeks prepartum)

- Lower birth BW (-4.5 kg)
- Decreased IgG absorption
- Compromised immunity
- Reduced grain intake
- Reduced growth rate (ADG)
- Increased culling rate

Produce 4-5 kg/d less milk throughout lactation than cows cooled with soakers and fans when dry (even when all of the cows are cooled during lactation)

Produce 4 kg/d less milk throughout lactation than in-utero cooled heifers (even when there are cooled during their first lactation)

Tao et al., 2011; Tao and Dahl, 2013; Monteiro et al., 2016; Laporta et al., 2017
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1. Dry off
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jepsantos@ufl.edu