Real Herds...Real Heifers
Ways to Optimizing Calf Health

Tina Kohlman, Dairy & Livestock Agent
UW-Extension Sheboygan County
World Dairy Expo and The Babcock Institute's
International Dairy Short Course
Monday, September 29, 2008
Concourse Hotel, Madison, Wisconsin
Heifers...An Investment in the Future Dairy Herd

- Provides high quality replacements for improving genetic progress.
- Heifer raising is the *second* largest expenditure on the dairy farm.
What defines a successful calf raising program?

Calves are alive
Calves are healthy
Calves are growing well
Calf Mortality

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Other Unknown</th>
<th>Weaned</th>
<th>Preweaned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving problems</td>
<td>9.9</td>
<td>12.8</td>
<td>5.9</td>
</tr>
<tr>
<td>Lameness or injury</td>
<td>4.3</td>
<td>12.6</td>
<td>16.5</td>
</tr>
<tr>
<td>Joint or navel problems</td>
<td>7.8</td>
<td>46.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Respiratory problems</td>
<td>14.6</td>
<td>12.6</td>
<td>12.6</td>
</tr>
<tr>
<td>Scours, diarrhea</td>
<td>14.6</td>
<td>14.6</td>
<td>14.6</td>
</tr>
</tbody>
</table>

Goal for death loss should be less than 5%

Building Better Heifers

Failures
- Pneumonia
- Scours
- Days on milk
- Death

Successes
- Live Calf
- Healthy Growing
- Colostrum
- Sanitation
- Isolation
- Environment
- Nutrition
- Immunization
- Medication

Failures

Successes
Focus on Calf Health
It starts on Day 1

- Colostrum
- Pathogen Control
- Nutrition
- Housing
Calves are born without an immune system.

Immune function is passed from the cow to the calf via proteins (immunoglobulins) in the colostrum. Immunoglobulins are disease-specific and therefore must be robust.

Close in 24 h

Source: Pat Hoffman, UW-Extension Dairy Replacement Specialist, 2005
Colostrum Absorption
(within 2 hours of birth)

Blood vessel

Intestinal tract

Source: Steve Hayes, Technical Veterinary Services, APC
Colostrum Absorption
(~4 hours of age)

Blood vessel

Intestinal tract

Source: Steve Hayes, Technical Veterinary Services, APC
Colostrum Absorption
(10 hours of age)

Source: Steve Hayes, Technical Veterinary Services, APC
Colostrum Absorption
(~16 hours of age)

Blood vessel

Intestinal tract

Source: Steve Hayes, Technical Veterinary Services, APC
Colostrum Absorption
(after 24 hours of age)

Source: Steve Hayes, Technical Veterinary Services, APC
Protecting Your Calf

Blood antibodies

Total Antibody

Source = Colostrum

Source = Calf

Age in Weeks

Source: Steve Hayes, Technical Veterinary Services, APC
Achieving Passive Immunity: The 3 Q’s of Colostrum Management

- Quantity
- Quality
- Quickly
## Quantity

### How much colostrum is fed?

<table>
<thead>
<tr>
<th>Amount</th>
<th>% Operations</th>
<th>% Heifer Calves*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 quarts or less</td>
<td>23.3</td>
<td>16.8</td>
</tr>
<tr>
<td>More than 2 quarts but less than 4 quarts</td>
<td>45.8</td>
<td>43.1</td>
</tr>
<tr>
<td>4 quarts or more</td>
<td>30.9</td>
<td>40.1</td>
</tr>
</tbody>
</table>

*Born during 2006 and alive at 48 hours
Source: USDA APHIS 2007 NAHMS
## Quantity

**More is Better!**

<table>
<thead>
<tr>
<th>Amount of Colostrum Fed</th>
<th># herds</th>
<th>% Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 2 qts</td>
<td>18</td>
<td>15.3</td>
</tr>
<tr>
<td>3 to 4 qts</td>
<td>16</td>
<td>9.9</td>
</tr>
<tr>
<td>4 to 5 qts</td>
<td>26</td>
<td>6.5</td>
</tr>
</tbody>
</table>

*Source: Hugh Chester-Jones, University of MN, 2003*
How is colostrum fed?

<table>
<thead>
<tr>
<th>Delivery Method</th>
<th>% Operations</th>
<th>% Heifer Calves*</th>
</tr>
</thead>
<tbody>
<tr>
<td>During first nursing of dam</td>
<td>36.3</td>
<td>26.5</td>
</tr>
<tr>
<td>Hand-fed with bucket or bottle</td>
<td>59.2</td>
<td>59.6</td>
</tr>
<tr>
<td>Hand-fed using esophageal feeder</td>
<td>4.3</td>
<td>13.7</td>
</tr>
<tr>
<td>Did not receive colostrum</td>
<td>0.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

*Born during 2006 and alive at 48 hours
Source: USDA APHIS 2007 NAHMS
### Percent of Operations that Evaluated Colostrum Quality

<table>
<thead>
<tr>
<th>Herd Size (Number of Cows)</th>
<th>All Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small (Fewer than 100 cows)</td>
<td>7.6</td>
</tr>
<tr>
<td>Medium (100-499 cows)</td>
<td>19.8</td>
</tr>
<tr>
<td>Large (500 or more cows)</td>
<td>45.2</td>
</tr>
<tr>
<td></td>
<td>13.0</td>
</tr>
</tbody>
</table>

USDA APHIS 2007 NAHMS
# Testing Colostrum Quality

<table>
<thead>
<tr>
<th>Primary Method</th>
<th>Percent Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colostrometer</td>
<td>43.7</td>
</tr>
<tr>
<td>Visual Appearance</td>
<td>41.6</td>
</tr>
<tr>
<td>Volume of first milking (pounds)</td>
<td>9.7</td>
</tr>
<tr>
<td>Other</td>
<td>5.0</td>
</tr>
</tbody>
</table>

USDA APHIS 2007 NAHMS
Colostrum quality

- Good: > 50 g/L
- Moderate: 20-50 g/L
- Poor: < 20 g/L
## IgG Levels and Calf Performance

<table>
<thead>
<tr>
<th>Item</th>
<th>Poor</th>
<th>Fair</th>
<th>Average</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Calves</td>
<td>51</td>
<td>85</td>
<td>126</td>
<td>195</td>
<td>176</td>
</tr>
<tr>
<td>Serum Ig, mg/mL</td>
<td>0-5</td>
<td>5-10</td>
<td>11-15</td>
<td>16-25</td>
<td>&gt;25</td>
</tr>
<tr>
<td>4-Week Gain, pounds per day</td>
<td>0.73</td>
<td>0.81</td>
<td>0.85</td>
<td>0.90</td>
<td>0.92</td>
</tr>
<tr>
<td>Feed conversion, pounds feed per pound gain</td>
<td>2.9</td>
<td>2.6</td>
<td>2.5</td>
<td>2.0</td>
<td>1.9</td>
</tr>
<tr>
<td>Scour, days</td>
<td>8.7</td>
<td>6.1</td>
<td>4.7</td>
<td>5.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Mortality, percent</td>
<td>33</td>
<td>11</td>
<td>7</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Veterinary Costs, dollars</td>
<td>$12.50</td>
<td>$9.85</td>
<td>$7.40</td>
<td>$7.70</td>
<td>$6.20</td>
</tr>
</tbody>
</table>

Source: Data adapted from M.A. Fowler, 19999 PDHGA Proceedings, by P.C. Hoffman, University of Wisconsin
## Operations that Monitor for Passive Transfer

<table>
<thead>
<tr>
<th>Herd Size (Number of Cows)</th>
<th>% of Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small (Fewer than 100 cows)</td>
<td>1.1</td>
</tr>
<tr>
<td>Medium (100 to 499 cows)</td>
<td>2.4</td>
</tr>
<tr>
<td>Large (500 or more cows)</td>
<td>14.5</td>
</tr>
<tr>
<td>All Operations</td>
<td>2.1</td>
</tr>
</tbody>
</table>
Factors affecting colostrum quality

- Dam’s age
- Disease history
- Pathogen exposure
- Prepartum milking
- Leaking of milk from udder prior to calving
- Pooling of colostrum
When do calves receive their first colostrum feeding?

<table>
<thead>
<tr>
<th>Herd Size (Number of Cows)</th>
<th>3.4 hours</th>
<th>3.3 hours</th>
<th>2.8 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>Less than 100 cows</td>
<td>Medium (100-499 cows)</td>
<td>Large (500 or more cows)</td>
</tr>
<tr>
<td></td>
<td>3.4 hours</td>
<td>3.3 hours</td>
<td>2.8 hours</td>
</tr>
</tbody>
</table>

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Timing is Everything!

- Lose 5% of immunoglobulin absorption every hour
- 0% absorption by 24 hours

Source: Raising Dairy Replacements (1991)
Importance of Colostrum

- Studies have shown failure of passive transfer
  - Increased calf morbidity and mortality
  - Reduced calf growth rate and efficiency
  - Decreased first and second location milk production in heifers

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Colostrum...the key to calf health

- Be prepared to feed colostrum 24 hours per day, 365 days per year
  - Use Fresh Colostrum
  - Have Colostrum Replacer Available
  - Have Frozen Colostrum Available
  - Have Refrigerated Colostrum Available
- Treat colostrum like gold!
# Storing Method of Colostrum

<table>
<thead>
<tr>
<th>Primary Method</th>
<th>Small (Fewer than 100 cows)</th>
<th>Medium (100-499 cows)</th>
<th>Large (500 or more cows)</th>
<th>All Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stored without refrigeration</td>
<td>4.4</td>
<td>2.8</td>
<td>3.0</td>
<td>3.9</td>
</tr>
<tr>
<td>Stored in refrigerator</td>
<td>6.0</td>
<td>15.2</td>
<td>50.5</td>
<td>11.1</td>
</tr>
<tr>
<td>Stored in Freezer</td>
<td>24.8</td>
<td>36.2</td>
<td>34.7</td>
<td>28.2</td>
</tr>
<tr>
<td>Not Stored</td>
<td>64.8</td>
<td>45.8</td>
<td>11.8</td>
<td>56.8</td>
</tr>
</tbody>
</table>
Manage Colostrum...Intensively

Before feeding.............

- Harvest clean colostrum immediately
- Avoid using colostrum from cows that are milked prefresh/leaked
- Discard colostrum contaminated with mastitis and blood
- Avoid pooling colostrum
- Do not store colostrum at room temperature
- Use a Colostrometer® to exclude poor colostrum
Manage Colostrum...Intensively

At Feeding.............

- Use sanitary equipment (gloves)
- Feed 3-4 quarts within 1-3 hours of birth
- Feed 2 quarts of colostrum 10 to 12 hours after birth
- Use a tube feeder if necessary
- Use a colostrum replacer when necessary
- Excess colostrum:
  - Immediately divide into small portions to enhance cooling
  - Refrigerate if to be used within 5 days
  - Freeze excess high quality colostrum for future needs
...If colostrum is limited

- Never mix colostrum supplement or replacement products with colostrum
- If using colostrum supplement/replacement, feed colostrum first, then feed replacement 2 hours later
Focus on Calf Health
It Starts on Day 1

- Colostrum
- Pathogen Control
- Nutrition
- Housing
Disease on the Calf Operation

**IMMUNITY**
(Calf’s ability to fight off disease)

**PATHOGEN LOAD**
(Number of disease-causing bacteria and viruses presented to the calf)

**VS.**
How Diseases Spread to Your Herd

Contact with Affected Animals

On-Farm Sources

Susceptible Animals

Contact with Manure, Milk, Blood or Tissue from Affected Animals

Off-Farm Sources

Contact with Infected humans
Minimizing Transmission of Infectious Disease

- **On Farm Sources**
  - Feeding waste milk
  - Contaminated calving pens
  - Contact between healthy and sick cows
  - Farm personnel work practices
  - Feed contaminated with manure
Isolation of sick calves

- Isolate calves:
  - Air
  - Water
  - Feed
Isolate calf from cow
(To avoid dam to calf disease transfer...)

- Nose dive into bedded pack (*E. coli*)
- Sucking on cow’s (manure-laden) brisket, belly, legs or teats (*E. coli*)
- Ingestion of contaminated colostrum (Multiple diseases)
- Remove calf before it can stand up
Time Operations Removed Calf From Dam

- Immediately: 7.3%
- After nursing but less than 12 hours: 15%
- 12 to 24 hours after birth: 22%
- More than 24 hours after birth: 56%

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# Time with Cow Increases Mortality

<table>
<thead>
<tr>
<th>Time with dam after birth</th>
<th># herds</th>
<th>% Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-6 hrs</td>
<td>13</td>
<td>5.2</td>
</tr>
<tr>
<td>7-12 hrs</td>
<td>35</td>
<td>9.3</td>
</tr>
<tr>
<td>13-24 hrs</td>
<td>32</td>
<td>10.7</td>
</tr>
<tr>
<td>25-48 hrs</td>
<td>24</td>
<td>20.5</td>
</tr>
<tr>
<td>48+ hrs</td>
<td>35</td>
<td>14.4</td>
</tr>
</tbody>
</table>

Source: Hugh Chester-Jones, University of MN, 2003
Immediately Separate Calves from Dam

- Allowing calf to acquire colostrum directly from the dam at first nursing presents problems:
  - Increase risk calf does not receive adequate amount of colostrum
  - Impossible to estimate quantity of antibodies and quality of colostrum ingested
  - Increase risk of disease transmission via “manure meals”
Restriction of Movement

- Do visitors wear disposable plastic boots?
- Do visitors wash boots prior to going into barn or before leaving the farm?
- Visitors may be bringing in new diseases onto your farm from places they have been previously.
Sanitation is critical to breaking the disease cycle!

Sanitation breaks

Disinfect

- Choose the right disinfectant for the job
- Thoroughly clean boots before applying disinfectant
- Read and follow the label
Milk House - Cleaning
### Frequency of Cleaning and Disinfection of Bottle, Buckets & Nipples

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Small (Fewer than 100 cows)</th>
<th>Medium (100-499 cows)</th>
<th>Large (500 or more cows)</th>
<th>All Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Calves</td>
<td>21.4</td>
<td>30.9</td>
<td>39.1</td>
<td>24.4</td>
</tr>
<tr>
<td>Daily</td>
<td><strong>59.8</strong></td>
<td><strong>55.9</strong></td>
<td><strong>51.8</strong></td>
<td><strong>58.5</strong></td>
</tr>
<tr>
<td>Weekly</td>
<td>7.0</td>
<td>5.2</td>
<td>1.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Monthly</td>
<td>3.8</td>
<td>1.4</td>
<td>2.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Other</td>
<td>8.0</td>
<td>6.6</td>
<td>5.6</td>
<td>7.5</td>
</tr>
</tbody>
</table>

USDA APHIS 2007 NAHMS
Keep Everything Clean and Dry
Feeding Equipment Storage
Sanitation and Calf Housing
All in – all out vs. continuous flow?
Focus on Calf Health
It Starts on Day 1

- Colostrum
- Pathogen Control
- Nutrition
- Housing
Goals in Calf Nutrition

- Health
- Growing
- Rumen Development
Question...

- Is a new born calf a ruminant or a monogastric animal?

She is a *monogastric* animal.
Calf versus Adult Rumen

Calf
0.5 : 1 Volume Ratio
Rumen : Abomasum

Adult
10:1 Volume Ratio
Rumen : Abomasum
Inside the Rumen

Provide Water

Provide Grain

Starch

Fermentation

VFA

Propionate  Butyrate

Acetate

Absorption of VFA through epithelium stimulates rumen development
Why chemical and not physical?

- Research results show rumen development stimulated by VFA’s—*not “scratch factor”*. 
- Milk, hay and grain fermented to produce VFA.
- Sponges did not contribute VFA for rumen development—added “scratch”.

<table>
<thead>
<tr>
<th>Material</th>
<th>Effect on Rumen Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>++</td>
</tr>
<tr>
<td>VFA Salts</td>
<td></td>
</tr>
<tr>
<td>Acetate</td>
<td>++</td>
</tr>
<tr>
<td>Propionate</td>
<td>+++</td>
</tr>
<tr>
<td>Butyrate</td>
<td>++++</td>
</tr>
<tr>
<td>Grain</td>
<td>+++</td>
</tr>
<tr>
<td>Hay</td>
<td>++</td>
</tr>
<tr>
<td>Plastic Sponges</td>
<td>-</td>
</tr>
<tr>
<td>Inert Particles</td>
<td>-</td>
</tr>
</tbody>
</table>

Ingredients to Initiate Rumen Development

- Bacteria
- Liquid in the rumen
- Muscular movement
- Absorptive ability of the tissue
- Availability of feed stuff in the rumen
Veal Calf’s Stomach

18 pounds
Rumen 18 x 11”
Abomasum 12 x 5”
Dairy Calf's Stomach

70 pounds
Rumen 24 x 22”
Abomasum 16 x 4”
A Look at the Papillae

Heads or Tails?
What about hay?

- Digestion of hay provides acetic acid.
- Acetic acid is less crucial for rumen development.
- Hay provides a “scratch factor” to promote healthy growth of papillae.
- Hay should be offered 0-4 weeks after weaning.
Focus on Calf Health
It Starts on Day 1

- Colostrum
- Pathogen Control
- Nutrition
- Housing
Preventing Pneumonia

- Provide well ventilated facilities
- Keep calves dry and well-bedded
- Feed enough milk
- Avoid nose-nose contact
- Keep age groups separate
- Avoid buying calves
- Prevent aspiration pneumonia
- Minimize weaning stress
- Vaccinate dams
- Give an immunity boost
Industry’s Preferred Housing
...Calf Hutches
But who wants to feed in outside during the winter?
These appear to be well ventilated barns!

Why do we have endemic calf pneumonia?

Maybe the barns are ventilated and the pens are not?

Differences in gases? NH₃? CO₂? Bacteria?
These appear to be well ventilated barns!

- Median barn ventilation rate was 5.5 changes per hour (range 0-93) *
  * assistance of Brian Holmes and David Kammel

- Pen air NH$_3$ average 2 ppm (0-4)

- Alley cfu/m$^3$ associated with barn ventilation rate $P<.0001$

- Pen cfu/m$^3$ were NOT associated with barn ventilation rate

- Pens are microenvironments within the barn

Lago et.al., J Dairy Sci 89:4014, 2006
Key Factors in Respiratory Health

Solid Wall Between Calves

Deep Bedding for Nesting

Slide Courtesy of Ken Nordlund, DVM, UW-School of Veterinary Medicine
Airborne bacteria cfu/m$^3 \times 1000$

Prevalence of respiratory disease

- **Mesh sides**
- **Solid sides**

Lago et al., J Dairy Sci 89:4014, 2006

Slide Courtesy of Ken Nordlund, DVM, UW-School of Veterinary Medicine
Environmental Influence on Growth

Increased Energy Needs

Cold

Thermal Neutral Zone

Hot

Increased Energy Needs

50°-78°F Newborn Calf

32°-738°F One-month old Calf
Airborne bacteria cfu/m³ x 1000

Prevalence of respiratory disease

<table>
<thead>
<tr>
<th>Airborne bacteria cfu/m³ x 1000</th>
<th>Prevalence of respiratory disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>0%</td>
</tr>
<tr>
<td>52</td>
<td>10%</td>
</tr>
<tr>
<td>77</td>
<td>20%</td>
</tr>
<tr>
<td>102</td>
<td>30%</td>
</tr>
<tr>
<td>127</td>
<td>40%</td>
</tr>
<tr>
<td>152</td>
<td>50%</td>
</tr>
<tr>
<td>177</td>
<td>60%</td>
</tr>
<tr>
<td>202</td>
<td>70%</td>
</tr>
<tr>
<td>227</td>
<td></td>
</tr>
<tr>
<td>252</td>
<td></td>
</tr>
<tr>
<td>277</td>
<td></td>
</tr>
<tr>
<td>302</td>
<td></td>
</tr>
<tr>
<td>327</td>
<td></td>
</tr>
</tbody>
</table>

Nesting Score 1 - Legs **visible** when laying down

Nesting Score 2 - Legs partially **visible** when laying down

Nesting Score 3 - Legs **not visible** when laying down

**Lago et al., J Dairy Sci 89:4014, 2006**

Slide Courtesy of Ken Nordlund, DVM, UW-School of Veterinary Medicine
Calf Pens can be Microenvironments

Slide Courtesy of Ken Nordlund, DVM, UW-School of Veterinary Medicine
Factors to decrease pathogens in pens

- Lower temperature
- Larger pens
- Fewer solid walls
The Ideal Calf Pen Concept

- Solid partitions between calves
- Open front and back
- Sides extend out 12 inches from front
- 12 to 18 inches solid back wall
- Deep bedding
<table>
<thead>
<tr>
<th>Location</th>
<th>August 2004 investigation</th>
<th>Feb. 2005 after tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pens, cfu/m3</td>
<td>177,453</td>
<td>42,807</td>
</tr>
<tr>
<td>Alleys, cfu/m3</td>
<td>26,459</td>
<td>16,716</td>
</tr>
</tbody>
</table>

After supplementation, respiratory disease treatments estimated to be 25% of previous years.

Slide Courtesy of Ken Nordlund, DVM, UW-School of Veterinary Medicine
What defines a successful calf raising program?

Calves are alive
Calves are healthy
Calves are growing well
Building Better Heifers

Pneumonia  Colostrum  Live Calf
Scours     Sanitation  Healthy
Days on    Isolation   Growing
milk       Environment
Death      Nutrition
           Immunization
           Medication

Failures  Successes
Focus on Calf Health
It Start’s on Day 1

- Colostrum
- Pathogen Control
- Nutrition
- Housing
Thank You!

Tina Kohlman
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UW-Extension Sheboygan County

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http://sheboygan.uwex.edu/ag/dairy/heifermanagement