Risk Assessment & Extension Education to Prevent Pneumonia in Dairy Calves
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Bovine respiratory disease (BRD)

Specific UC ANR Initiative: “Managing endemic and invasive Pests and Diseases”

Control of BRD in calves through:

• Eliminating causes and reducing risk factors
• Affordable, rapid, accurate, diagnostics
• Early detection
BRD Impact on US Cattle

- Leading endemic cause of mortality in US calves
  - > 1 million cattle deaths annually
- Primary cause of mortality post-weaned dairy calves
- Second cause of mortality in pre-weaned dairy calves
  - 22% of all preweaned heifer deaths
- Reduced production and growth rate
  - Reduced carcass yields in beef cattle
  - Delayed age at first calving in diary heifers
- Annually $1 billion (beef), $800 million (dairy heifers)
BRD Complex (BRDC)

Complex etiology (BRD Complex – BRDC)

- **Host**: neonatal calf management & nutrition
- **Environment**: Housing, ventilation, heat stress, dust, ammonia
- **Pathogens**
  - Viruses: IBR, BVDV, BRSV, PI3, BCV(?)
  - Bacterial: *Mannheimia haemolytica*, *Pasteurella multocida*, *Histophilus somni*, *Bibersteinia trehalosi* and *Trueperella pyogenes*
  - *Mycoplasma bovis*
BRD Diagnosis & Detection

• Currently, treatment crew on dairies and calf ranches
• No standardized tool for diagnosis or prevention
• Variable clinical presentation and severity
  • No specific pathognomonic signs
  • Wide variation in farm labor experience
**BRD Control Challenges**

- Multiple etiologies
- Complex web of risk factors
- Challenging to diagnose

→ False cases
→ Missed cases
→ Welfare problem

→ Unnecessary treatment ($, microbial resistance)
**Action Plan: BRD Risk Assessment Tool**

Comprehensive approach to reduce the risk of BRD in a cohort of calves on a dairy:

1. • Estimate burden of disease (e.g. Prevalence)
   • Identify management practices predisposing to BRD

2. • Determine management changes to control BRD
   • Identify staff responsible & assign duties

3. • Follow up & reassess BRD risk
   • Demonstrate success of control measures
• Calf-side diagnostic tool – assess clinical signs
• Statistical models to estimate scores (association)
• Six clinical signs (presence or absent)
• Cut-off determined statistically to classify dairy calves as BRD or non-BRD

• Estimate burden of disease (e.g. Prevalence)
• Identify management practices predisposing to BRD
# Bovine respiratory disease scoring system for pre-weaned dairy calves\textsuperscript{1,2}

<table>
<thead>
<tr>
<th>Clinical sign</th>
<th>Score if normal</th>
<th>Score if abnormal (any severity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye discharge</td>
<td>0</td>
<td>2 Or</td>
</tr>
<tr>
<td>Nasal discharge</td>
<td>0</td>
<td>4 Or</td>
</tr>
<tr>
<td>Ear droop or Head tilt</td>
<td>0</td>
<td>5 Or</td>
</tr>
<tr>
<td>Cough</td>
<td>0 No cough</td>
<td>2 Spontaneous cough</td>
</tr>
<tr>
<td>Breathing</td>
<td>0 Normal</td>
<td>2 Rapid or difficult breathing</td>
</tr>
<tr>
<td>Temperature</td>
<td>0 &lt; 102.5° F</td>
<td>2 ≥ 102.5° F</td>
</tr>
</tbody>
</table>

Add scores for all clinical signs, if total score is ≥ 5, calf may be positive for bovine respiratory disease.
• Estimate burden of disease (e.g. Prevalence)
• Identify management practices predisposing to BRD

• Score validated using a nested case-control study of 500 dairy calves (BRD 500 study) on 5 dairies and 2 calf ranches

*Extension & Outreach*

• Sensitivity 78% & Specificity 89%
1. **Estimate burden of disease (e.g. Prevalence)**
   - Identify management practices predisposing to BRD

2. **Prevalence estimation on dairy**
   - Random sample of calves identified & scored
   - Sample size

3. **Application development (Android/ iOS)**

**Extension & Outreach**
• Questionnaire investigate BRD risk on a dairy
• Questions grouped into sections
• Development:
  • What questions to include
  • Management practices across state
1. Estimate burden of disease (e.g. Prevalence)
2. Identify management practices predisposing to BRD

- **State-wide survey 1465 CA dairies**
  - Mail, internet & in-person survey
- **Questionnaire sections:**
  - Maternity pen management
  - Colostrum management
  - Calf management and nutrition
  - Vaccinations and veterinary care
  - Environment (housing, heat abatement, dust, ammonia concentrations, use of a flush system, and bedding type)
• Estimate burden of disease (e.g. Prevalence)
• Identify management practices predisposing to BRD

1

• Survey invited respondents to participate in our BRD research

*Extension & Outreach*

• Survey responses analyzed
  • Multivariate analysis
  • Important questions identified
  • Included in final risk assessment questionnaire
BRD Risk Assessment tool

Risk Assessment Tool Components

- BRD Risk Assessment Survey
- Standardized & Validated BRD scoring system
In-person Risk Assessment *Extension & Outreach*

- In-person 100 farm visits (55 completed)
  - BRD100 study
  - Data on BRD risk factors (questionnaire)
  - Estimate prevalence (scoring calves)
- **Factor analysis**: the association between risk factors and BRD prevalence
  - Estimate points assigned to each question

- **Determine management changes to control BRD**
- **Identify staff responsible & assign duties**
Cohort study of 10,000 calves followed up from birth to weaning

- BRD 10K study
- Implement and train producers on risk assessment tool

**Extension & Outreach**

- Epidemiology of BRD
  - Incidence, duration, treatment and therapy, morbidity and mortality
• Follow up & reassess BRD risk
• Demonstrate success of control measures

BRD 10K progress *Extension & Outreach*

• Target 7 dairies enrolled
• Risk assessment completed every 2m
• 5000 calves enrolled
• followed from birth to weaning
BRD Risk Assessment Extension

• **BRD500** Validation study
  • 5 dairies and 2 calf ranches
  • Approximately 600 calves followed from birth to weaning
  • Staff on dairies and calf ranches trained on scoring system & BRD control

• **BRD100**
  • In-person visit to 100 dairies (55 completed)
  • Staff training and BRD prevalence estimation

• **BRD10K**
  • Training of dairy staff from 7 dairies on risk assessment tool use
BRD Risk Assessment Extension

- **BRD scoring system**
  - Website (www.vmtrc.ucdavis.edu)
  - Printed material - water-proof field ready English & Spanish sheets
  - Distributed >2000 at national and local meetings
  - Free Mobile application (Android & iOS)
    - Score calves for BRD
    - Estimate prevalence of BRD in a herd of calves

- **Meetings:** National and local conferences
  - AABP, ADSA, Academy of Vet Dairy Consultants, USDA BR Symposium, Davis and Tulare Extension meetings

- **Grad. students** (2 PhD, 2 Masters), Post-Doc (1), Undergrads (5)

- **BRD Risk Assessment booklet (pending)**
  - Website
  - Printed material
Acknowledgements

- Producers and calf care-takers on study dairies and calf ranches
- Funding by UC ANR 2012 to 2016
- Collaborations with USDA BRD CAP Grant
- Leveraged grants
- BRD research and extension team
Questions? ... we are all ears!