

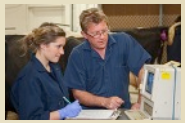

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Associations between bovine respiratory disease complex and the probability and latency of group- reared neonatal dairy calves to approach a novel object or stationary person

Catie Cramer* and Amy Stanton

University of Wisconsin- Madison
Department of Dairy Science



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Macrophages → Inflammatory Cytokines →

(+)

Anorexia, lethargy, decreased social and exploratory behavior

(-)

Infectious Pathogens

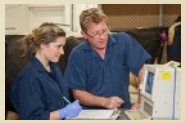
Figure adapted from Johnson, 2002



Sickness Behavior

- Highly coordinated and evolved response
- Increase probability of survival
- Conserve energy for febrile response
- Nonspecific for illness
- Common across different species
- Interest in using this to detect disease





Bovine Respiratory Disease (BRD)

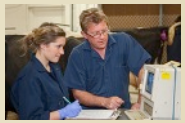
- 12% calves affected on US dairies, 22.5% of deaths (NAHMS, USDA, 2010)
- Reduced growth (Virtala et al., 1996; Stanton et al., 2012)
- Increased likelihood of morbidity and age at first calving (Waltner- Toews, 1989; Stanton et al, 2012)
- Increased risk of not completing the first lactation (Bach, 2011)



BRD Impacts Animal Welfare

- Evidence of pain and labored breathing (Theurer et al., 2013, White et al. 2013)
- Decrease welfare (Mellor and Stafford, 2004)

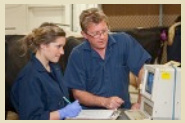




Disease Detection in Group Housing

- Group housing increasing in popularity
  - Challenge for illness detection
  - Socially competitive environment
- Calf Health Scoring Chart (McGuirk, 2008)
  - Individual animal evaluation time consuming
- Automated feeder data (e.g. Borderas et al., 2009)
  - Expensive
- Screening tools needed
  - Low cost, valid, quick





Approach Tests

- Test fearfulness and exploratory behavior in cattle (Arave et al., 1997; Lauber et al., 2005)
- Illness in mice decreased exploration of novel object (Haba et al., 2012)
- New opportunity for disease detection in calves?




Objectives

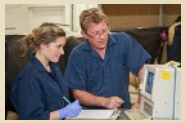
- To determine associations between BRD status of group-housed calves and the probability of approaching a novel object (OBJ) and stationary person (SP)
- To determine associations between BRD status of group-housed calves and the latency of approaching a novel object (OBJ) and stationary person (SP)



Hypotheses

- Calves with BRD will be less likely to approach compared to healthy calves
- Calves with BRD will have a longer latency to approach compared to healthy calves

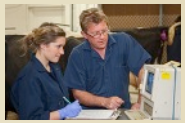




Materials and Methods

- Commercial dairy in Wisconsin, USA
- 79 calves in group housing
  - 8-10 calves per pen, 8 pens
- Research staff visited once per week
- Enrolled over 2 weeks
- Birth to 6 weeks of age
- *Ad lib* acidified milk
- Weaning began at 6 weeks





Approach Tests

- Calves tested at beginning of farm visit
- 60 seconds to approach OBJ **AND** SP
  - All calves tested with both every week
- Tests recorded on video
  - Time of approach for each calf for 6 weeks

Health Scores

- Performed after approach tests
- Umbilical palpation
- Diarrhea
- Respiratory disease (McGuirk, 2008)

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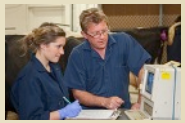

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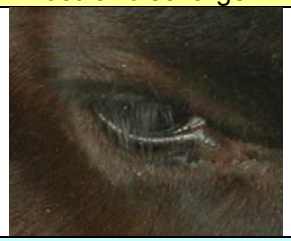
Calf Health Scoring Criteria			
0	**1**	**2**	**3**
Rectal temperature			
100-100.9	101-101.9	102-102.9	≥103
Cough			
None	Induce single cough	Induced repeated coughs or occasional spontaneous cough	Repeated spontaneous coughs
Nasal discharge			
Normal serous discharge	Small amount of unilateral cloudy discharge	Bilateral, cloudy or excessive mucus discharge	Copious bilateral mucopurulent discharge




Eye scores			
Normal	Small amount of ocular discharge	Moderate amount of bilateral discharge	Heavy ocular discharge

Ear scores			
Normal	Ear flick or head shake	Slight unilateral droop	Head tilt or bilateral droop





BRD Scoring Chart

0= Normal

3= Severely Abnormal

Temp + Cough + Nasal + Eye or Ear = **BRD Score**

*2 scores of 2+ = **BRD**

McGuirk, 2008



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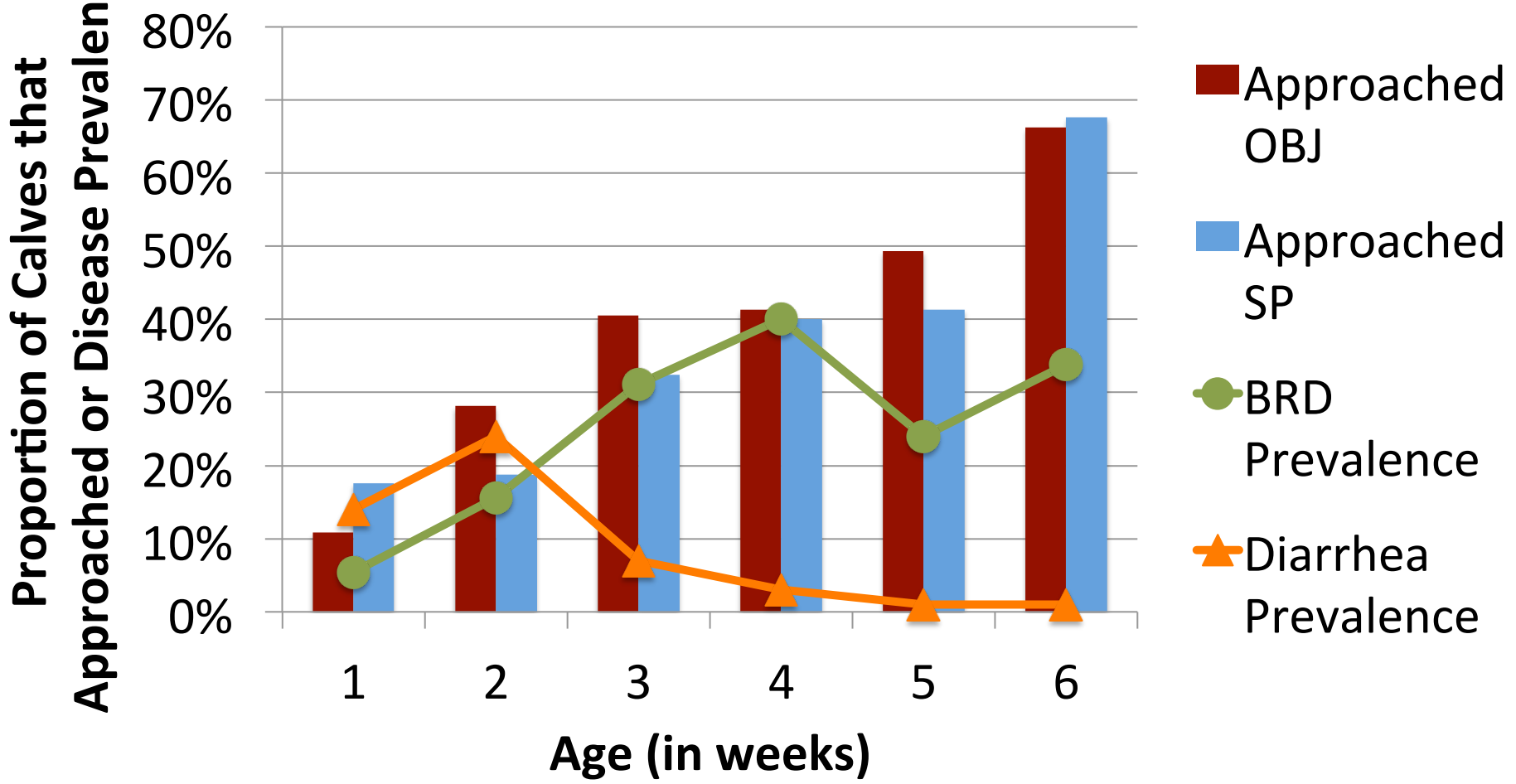
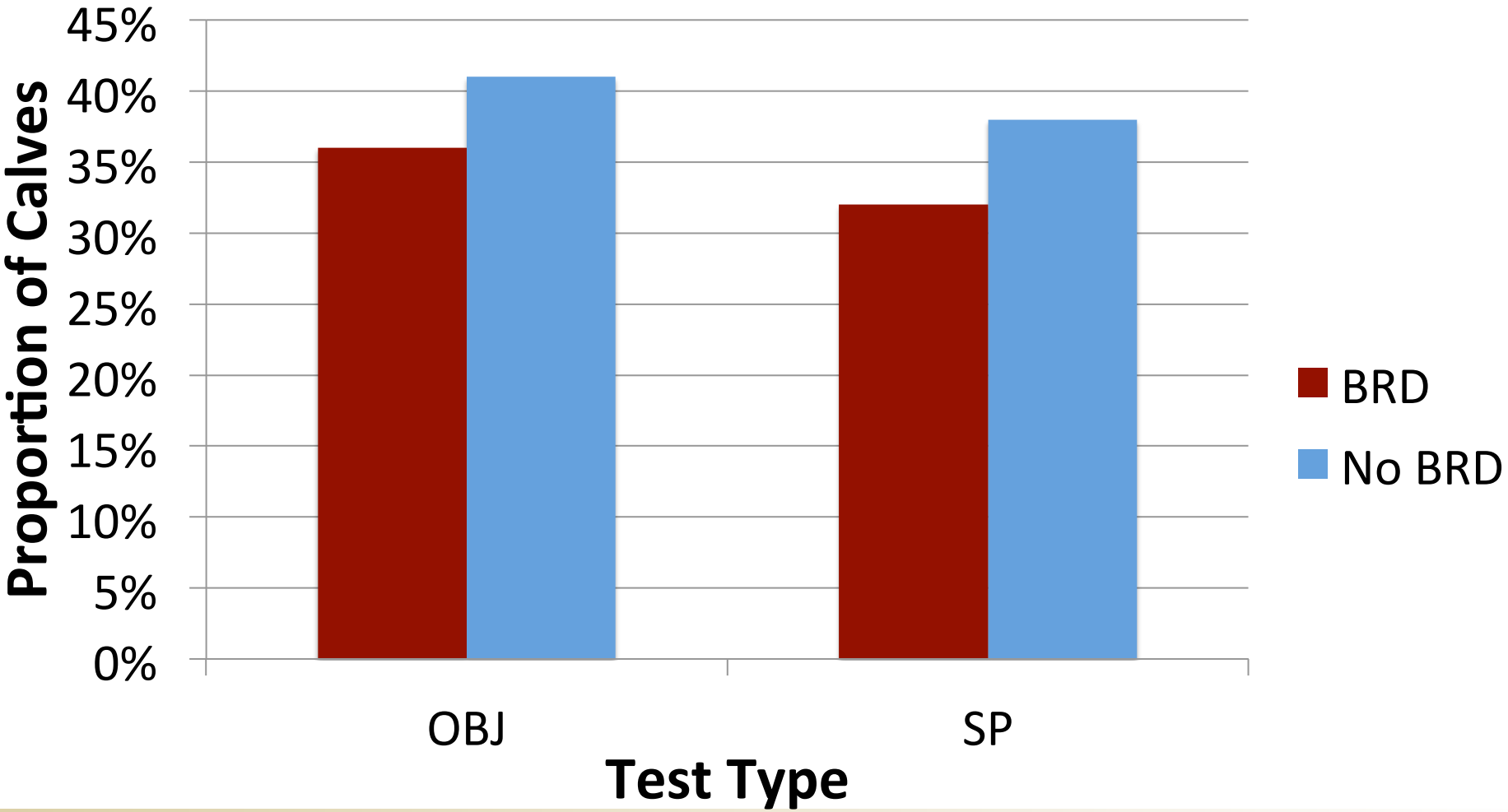
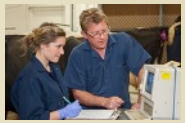
Proportion of All Calves that Approached OBJ and SP and Prevalence of Diarrhea and BRD



Proportion of Calves With and Without BRD that Approached







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BRD Status and Probability of Approach

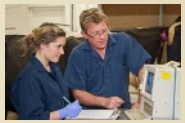
- OBJ

  - Calves with BRD were 0.5 (95% CL: 0.3 to 0.9) times as likely to approach OBJ compared to calves without BRD (P <0.05)

- SP

  - Calves with BRD were 0.5 (95% CL: 0.3 to 0.9) times as likely to approach SP compared to calves without BRD (P <0.05)





BRD Status and Latency to Approach

- OBJ

- Calves without BRD were 0.6 (95% CL: 0.4 to 0.8) times as likely to approach OBJ at any given time point during the test, compared to calves with BRD (P <0.01)

- SP

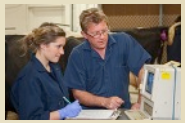
- Calves without BRD were 0.6 (95% CL: 0.4 to 0.9) times as likely to approach SP at any given time point during the test compared to calves with BRD (P <0.05)



Summary

- Calves with BRD exhibit decreased exploratory behavior
- When calves with BRD approached, they did so more slowly compared to calves without BRD

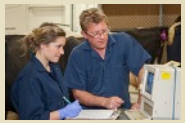




Screening Tool

- Sensitivity: 64% (OBJ) and 68% (SP)
  - Correctly identify 64 or 68% of calves with BRD
  - Miss about 30% of calves
- Specificity: 43% (OBJ) and 42% (SP)
  - Identify 42 or 43% of healthy calves
  - Rule out animals that are not sick





Conclusion

- Approach tests may be useful in identifying calves with BRD in group housing
  - Low cost and quick
  - Should not be sole method
  - Require observation of calves
- Combine with other behavioral measures
- Screening tools are needed to detect disease early in group- housed calves to improve welfare



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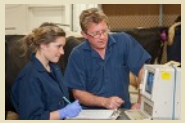

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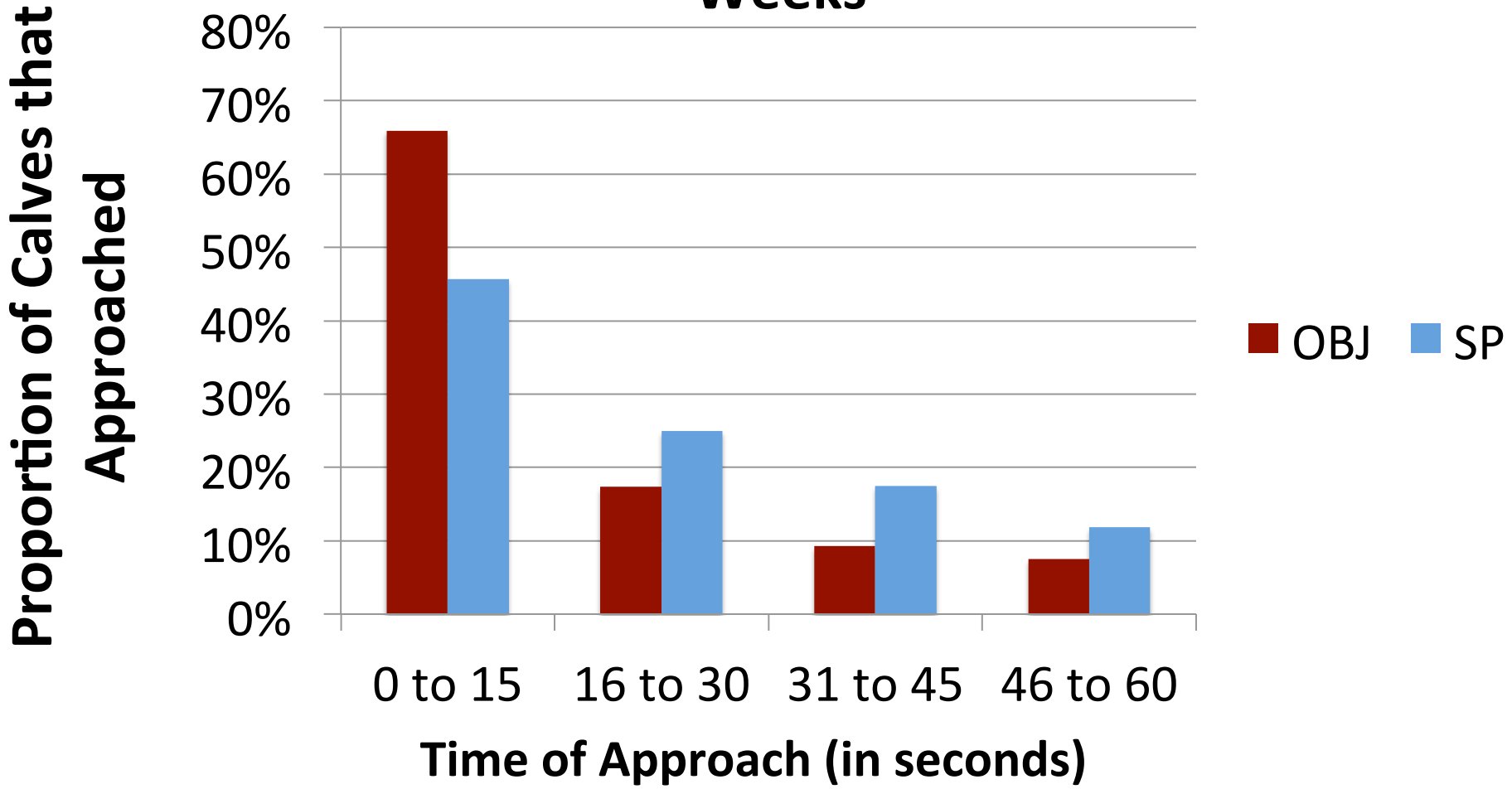
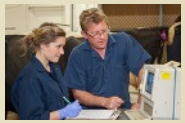
Proportion of All Calves that Approached OBJ and SP During Four Different Time Points for All Weeks







Statistical Analysis

- Separate models for OBJ and SP
- Probability of Approach
  - Linear mixed model (PROC GLIMMIX in SAS)
- Latency of Approach
  - Cox proportional hazards regression (PROC PHREG in SAS)
- Models controlled for
  - Week (age of calf in weeks), pen, pen order, enrollment group, test order, and diarrhea status