COW ACTIVITY MONITORS

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Types of monitors
Types of monitors
Leg Monitors

• Attach to lower leg
• Measure lying time and activity
  • Heat detection
  • Possible lameness or sick cow detection
• Possible to measure time at feedline
• Fitting to cow is difficult
  • Incorrect fit will give poor quality information and detection
• Can be somewhat dangerous to attach
  • Really should be put in squeeze chute
• Need to be cut off of cow to be removed
• Can cause comfort issues
Neck collars

• Hang around neck
• Multiple types of measurements
  • Activity
  • Rumination
    • using microphone on sensor
  • Respiration
    • Using microphone
  • Lying time
• Not all types of collars measure all these
• Easy to tell if a cow lost their monitor
• Easily reused
Fit is important with leg & neck monitors. They need to be able to accommodate for changes in body condition through lactation, but can’t be too loose. Too loose a fit will give variation in data as shown below.
Ear tags

- Easily applied
  - Put in like regular ear tag
- Position in ear is important, but once in place does not need to be adjusted
- Can be removed and reused
- Some issue with battery life currently, but can change battery
  - Increased labor and possible missed animals if battery dies
- Measurements
  - Activity
  - Lying time
  - Rumination
  - Ear temperature
Rumen boluses

- Put in cow with balling gun
- Once in cow, cannot really be retrieved or reused easily (some companies have advocated retrieving from packing plants)

- Measurements
  - Rumen Temperature
    - Only proven long term measurement, provided bolus stays in rumen
  - pH
    - Does degrade over a few months
    - Need to calibrate to be accurate, which requires retrieving bolus
  - Some do heat detection

- Working on activity function
- Possible future developments
  - Calving detection by temperature drop
Facial recognition

- New type of monitoring
- Closed circuit video with program learns animals based on facial recognition
- Measurements
  - Body condition score
  - Locomotion score
  - Activity
  - Feed sorting
  - Identification of dominant animals
- Possible to do all that other sensors can do and more
- Ability to work in grazing herds?
- Not currently commercially available
Monitor Development

- Animal welfare is #1 concern
  - Device must not harm animal
    - Eg, should break away if snagged
  - At same time, they must be tough enough to withstand a 1600 lb cow’s daily activities
- Originally, only neck and leg monitors used
  - Battery limitations and inefficient electronics necessitated a large battery
  - Only feasible on neck or leg
- As battery technology has advanced, so has electronic design with more efficient transmission protocols, enabling the development and deployment of a smaller device
- Most monitors store data for a given period of time, then transmit to receiver for download
What to know before using

• Cost
• Potential ROI
• Training for using system
  • Absolutely vital for success
• System support
• Compatible with current herd management software?

• How will this all be implemented and interface with computer?
• Will you use?
• How far can tags transmit?
  • Sources of potential interference on transmission?
  • Will multiple readers be needed?
  • Grazing herds?
Why use cow monitors?

PROS:

• You can’t be there all the time!
  • Can look at cow information remotely

• Monitoring data for the entire herd that would be difficult or labor intensive for humans
  • Rumination
  • Temperature
  • Respiratory rate

• Information is stored for retrospective analysis

• Different allocation of labor
  • Monitor alerts and cow information on computer, smartphone, tablet

• Removes some aspect of human error
  • Reading tail paint for heats
  • Picking out sick or lame cows
Why use activity monitors?

PROS:
- Early detection of transition diseases
  - 4x higher mortality during first 30 DIM compared to later lactation
  - Early research shows significant associations between rumination and/or activity during the transition period and transition cow disorders
  - Further research is still needed on how to use this information effectively on farm
  - Shows something not right with cow, still need to diagnose correctly
- Heat Detection and timing of AI
  - Can reduce amount of synch hormones used
  - Can reduce labor needed for heat detection (tail paint)
  - Ideal insemination time for conventional semen from first mount is 4-12 hours for mature cows and 4-16 hours for heifers
    - Knowing time when increased activity started can help ensure insemination within these windows
  - Ideal insemination time for sexed semen is 20-28 hours from first mount
Why use activity monitors?

**PROS:**

- Rumination
  - Can look at herd level rumination data
    - Analyze mix consistency
    - Look for changes in rumination after a feed change
  - As stated previously, can help with detection of individual sick cows
    - When used properly, can see how efficacious treatment has been (how quickly rumination recovers)

- Respiration
  - Respiration rate is highly correlated with heat stress, and may be a better indication than rumen temperature
  - Monitoring whole herd respiration can indicate how well heat abatement strategies are working
  - May be able to point to locations that need improvement in heat abatement
  - Future interface with cooling systems?
Are there negatives to activity monitors?

**CONS:**
- Computers are not foolproof
  - Still need monitoring of system to ensure working correctly
  - Alerts for sick or lame cows still need to verified by human
  - Most alerts are based on a cows baseline behavior, tailored to that individual
  - Different skillset needed than traditionally
    - Need to be able to diagnose system and hardware issues (failing sensors, lost sensors)
- Monitors need to applied correctly or the data may not be correct
- Monitors can be lost
- Upfront expense
  - A dairy that has great heat detection and reproduction, great sick cow monitoring, and an attentive staff may not see a return from activity monitors
Just lactating animals?

- Recommend that all adult animals and breeding age heifers have activity monitors
- Monitoring in transition period can help with disease detection post calving
- Prediction of calving
  - Reliable drops in rumination 6 hrs prior to calving
- Monitoring heat stress in dry animals is just as important as in lactating animals
- Dry animals can sometimes be “forgotten”
  - Easy to check up on animals that may be on another site
Possible future developments

• Machine Learning
  • Evaluation of quality of life
    • Comfort and stress correlation with monitored parameters
    • Would need human intervention to aid in learned and confirm machine’s evaluation of animals
  • Earlier and accurate detection of disease
    • Identify before intense interventions (antibiotics) are needed

• Identification of genomic traits in animals with genomic testing done that correlate to positive performance on farm
• Allow to tailor herd to market
Possible future developments

• Interface with other on-farm systems
  • Possible ability to use cow data to drive ventilation system
    • If cows are not in heat stress, can back off on aggressiveness, saving $
    • If cows are in heat stress even if environmental temperature says they shouldn’t be, can increase ventilation rate
  • Using ventilation controls throughout barn as access points for activity monitor data uploads
  • New wireless VFD’s can be used as transmitters and receivers for wireless monitors to increase accuracy with those companies willing to share technology.
  • Not just animal monitoring but animal environment monitoring and having the environment respond and change depending on the animal requirements.
VES ENVIRONMENTAL SYSTEMS MONITOR AND CONTROL INTERNAL AIR QUALITY FOR OPTIMAL ENVIRONMENTS.
References