Considerations in barn design to optimize cow behaviour and comfort

8th Annual Dairy Info Day
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What do cows do with their time?

Activity	Time (h/d)
Eating	4-5
Lying	10-12
Rumination	8-10
Drinking	0.5
Socializing	3-4
Outside pen (milking, holding pen, movement)	3-4

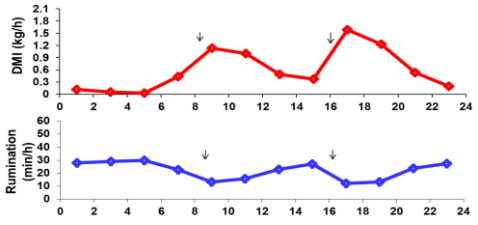
What happens if cows cannot devote the time they need to those behaviours?

- Less time lying down
  - More time standing inactive

What happens if cows cannot devote the time they need to those behaviours?

- Less time lying down
- Less time ruminating
  - Rumination keeps the rumen working and healthy!!!
    - Buffer the rumen
    - Reduce size of feed particles, increase surface area

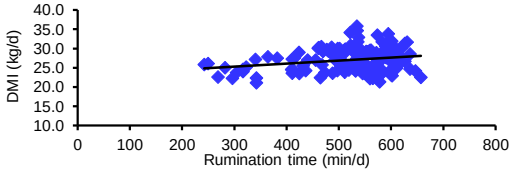
When do cows ruminate?



Schirmann et al. 2012. J. Dairy Sci. 95:3212-3217

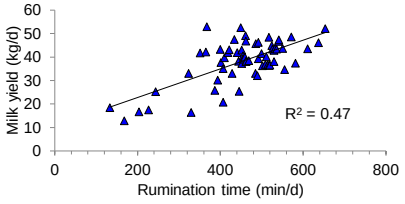
More rumination = greater intake!

- DMI was associated with:
  - rumination time (+0.2 kg/60min)



Data from Johnston and DeVries. 2018. J. Dairy Sci. 101:3367-3373

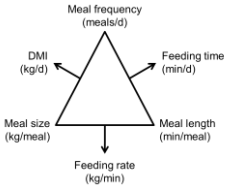
More rumination in early lactation = greater production!



Kaufman et al. 2018. J. Dairy Sci. 101:462-471

What happens if cows cannot devote the time they need to those behaviours?

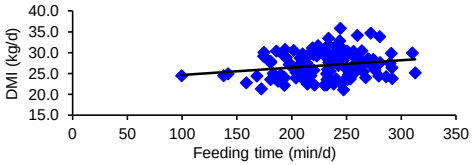
- Less time lying down
- Less time ruminating
- Less time eating
  - DMI is not maximized



Nielsen , B. L. 1999. Appl. Anim. Beh. Sci. 63:79-9

More time and meals at the bunk = greater intake!

- DMI was associated with:
  - feeding time (+0.02 kg/min) and meal frequency (+0.2 kg/meal)



Data from Johnston and DeVries. 2018. J. Dairy Sci. 101:3367-3373

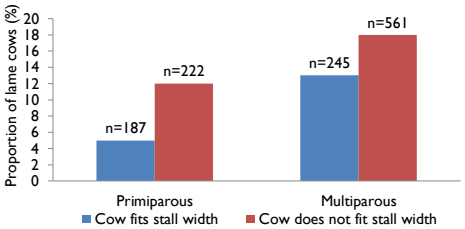
What influences the ability of cows to devote the time they need to these behaviours?

- Comfort of the environment of the cow!
  - Barn design!...and its management!

Lying area design and maintenance

- Cows should be able to lie down when they want to!

Lameness prevalence is greater when cows do not fit their stalls…



Westin et al. 2016. J. Dairy Sci. 99:3732-3743

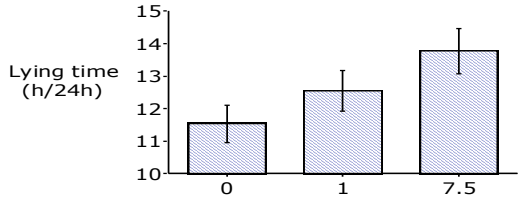
Higher risk (1.7x) of being lame when stalls have obstructed lunge space…i.e. >25% of stalls in pen have obstruction

Westin et al. 2016. J. Dairy Sci. 99:3732-3743

Higher risk (1.6x) of being lame when kept in a mattress vs sand bedded stall…

Westin et al. 2016. J. Dairy Sci. 99:3732-3743

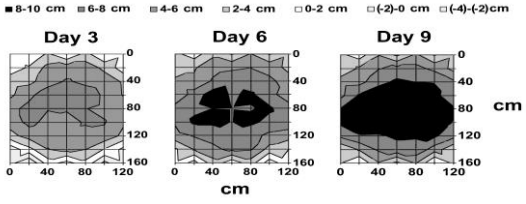
More bedding on mattresses = greater lying times



Tucker & Weary, 2004, J. Dairy Sci. 87: 2889-2895

More comfort = more maintenance is needed!

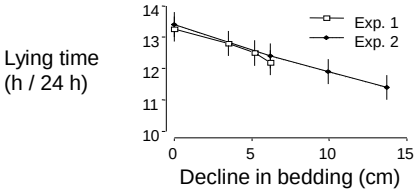
Maintenance of deep-bedded stalls affects cow comfort!



Days after sand bedding was added and leveled

Drissler et al., 2005, J. Dairy Sci. 88: 2381-2387

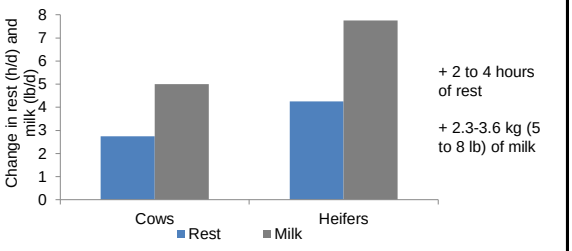
Cows spend less time lying down in stalls that have not been maintained



Drissler et al., 2005, J. Dairy Sci. 88: 2381-2387

Pens and milking holding areas need to be sized appropriately…

Time away from pen – 3 vs 6 h/d



Matzke, 2003

Too much time away from pen for milking is problematic…

- von Keyserlingk et al., 2012
  - British Columbia: 3.75 h/d
  - California: 3.75 h/d
  - North East US: 4.75 h/d
  - South West US: 4 h/d
- Endres et al., 2007
  - Minnesota: 4 h/d
    - **This time is associated with lameness prevalence!**

Too much time away from pen for milking is problematic…

- Goal would be to match parlour size with pen/holding pen size to limit time away to 45-60 min max per milking

What about feed area design and management?

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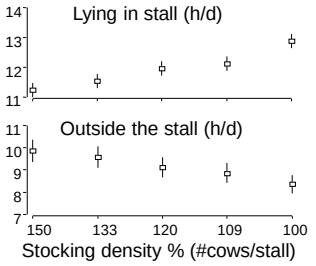
- Cows should be able to access feed when they want to…

How does feed barrier influence behaviour at the bunk?

No matter how comfortable is the feeding area…need to make sure feed is available!

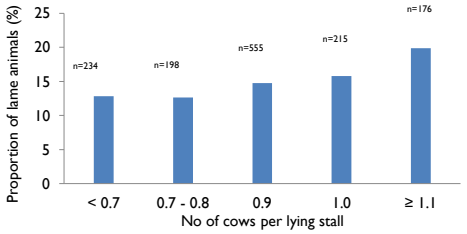
Cow density may have the biggest impact on cow behaviour and comfort!

Greater stocking density = shorter lying times



Fregenosi et al., 2007 J. Dairy Sci. 90:3349-3354

Greater stocking density = greater lameness prevalence



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Greater stocking density = altered eating patterns!

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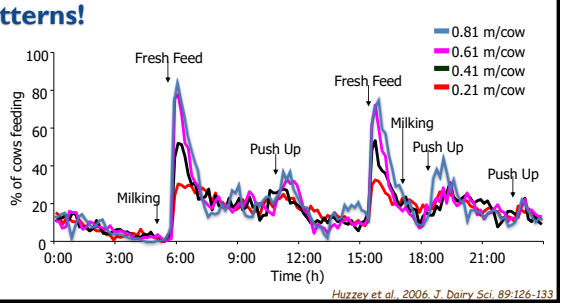


Huzzey et al., 2006. J. Dairy Sci. 89:126-133

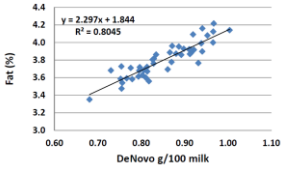
More bunk space = improved behavior = improved milk composition

- Field study of Canadian dairy herds
  - Mean = 0.56 m (22 inch)/cow (range 0.36 to 0.99 m/cow)
  - For every 10 cm (4 inch) increase in feed bunk space…
    - +0.06% milk fat
    - -13% SCC

Soya et al. 2013. J. Dairy Sci. 96:4759-4770

More bunk space = improved eating behavior = improved milk composition

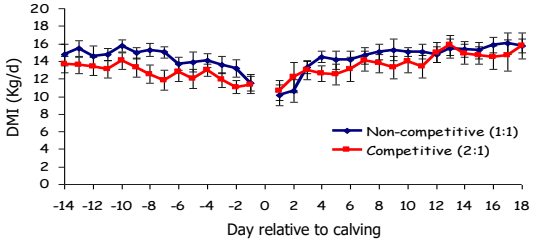
- High de-novo herds tended to be 10x more likely to have >18 inches (46 cm)/cow of bunk space



Woolpert et al. 2017. J. Dairy Sci. 100:5097-5106

When does this matter most?

Competition reduces DMI during transition, particularly before calving



Proudfoot et al. 2009. J. Dairy Sci. 92:3116-3123

Stocking density and early lactation health…

- Increasing stall stocking density by 5% during the week before calving was found to increase the risk of subclinical ketosis by 10%

Kaufman et al. 2016. J. Dairy Sci. 99:5604-5618

Stocking density at the water trough also matters!

- Field study of Canadian dairy herds
  - +0.77 kg/d milk yield for every 2 cm/cow increase in water trough space
    - Mean 7 cm/cow (range: 4 to 12 cm/cow)

Soya et al. 2013. J. Dairy Sci. 96:4759-4770

What should we be striving for transition cows?

- Stocking density – <100% at free stalls (ideally 80%); min 120 sq feet/cow for pack pens (min 100 sq feet/cow of usable pack)
- Bunk space – 30 inches (75 cm) per cow
- Water space – 4 inches (10 cm)/cow or more, in more than one location/pen

Take home messages:

- Cows need time and space to perform behaviours that are important to them
  - Lying, feeding, ruminating, drinking
- Barns need to be designed and managed to accommodate those behaviours!

Questions???

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