

Respiratory Disease and Pen Microenvironments in Calf Barns

Rebecca Brotzman, DVM Ken Nordlund, DVM





Naturally ventilated calf barns









- Individual pens
- Solid or mesh sides
- +/- Pen covers
- Variable bedding







"We don't have much respiratory disease"

- Frequently overlooked because "appetite" is used as indicator of health
- Use of clinical calf scoring system increases diagnosis prevalence Scoring system developed by Dr. Sheila McGuirk: http://www.vetmed.wisc.edu/dms/fapm/fapmtools/calves.htm
- Use of ultrasound to identify lung lesions shows an even greater prevalence
 T. Ollivett, PhD studies at University of Guelph





Importance of growth rate pre-weaning

- Weight gain during first 50 days of life has huge effect on adult milk yield
- Difference of 1 kg (2.2 lb) Average Daily Gain during days 1-50 yields an additional 850 kg (1,800 lb) of milk in first lactation
 - Soberon et al, J. Dairy Sci., 2012
- Calves "treated" for respiratory disease showed major reduction in adult milk yield



- J. Dairy Sci. 89:4014-4025
- © American Dairy Science Association, 2006.

Calf Respiratory Disease and Pen Microenvironments in Naturally Ventilated Calf Barns in Winter

A. Lago, S. M. McGuirk, T. B. Bennett, N. B. Cook, and K. V. Nordlund¹
Department of Medical Science, School of Veterinary Medicine, University of Wisconsin, 2015 Linden Drive, Madison 53706

Field trial to examine risk factors

Selection criteria for barns:

- Natural ventilation
- Single calf pens
- Minimum of 15 calves on milk
- Current health status "typical" for barn
- Trial conducted Jan-Mar 2004



Data collected

- Respiratory scores -15 or more nursing calves
- Airborne bacterial counts (Total cfu & coliform) in pens and alleys
- Ammonia in pens
- Temperature & humidity inside and outside
- Bedding depth and dry matter
- Building and inlet dimensions
- Animal counts
- Outdoor wind speed & direction, etc.....



Calf Respiratory 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	Repeated				
		coughs or occasional	spontaneous coughs				
		spontaneous cough					
Nasal discharge							
Normal serous	Small amount of	Bilateral, cloudy or	Copious bilateral				
discharge	unilateral cloudy	excessive mucus	mucopurulent				
	discharge	discharge	discharge				

Scoring system developed by Dr. Sheila McGuirk - http://www.vetmed.wisc.edu/dms/fapm/fapmtools/calves.htm



Calf Respiratory Scoring Criteria						
0 1		2	3			
Eye scores						
Normal	Small amount of ocular discharge	Moderate amount of bilateral discharge	Heavy ocular discharge			
Ear droop score						
		Slight unilateral droop	Head tilt or bilateral droop			
A cumulative score of						

A cumulative score of
5 or more points is
considered to be a case of
respiratory disease

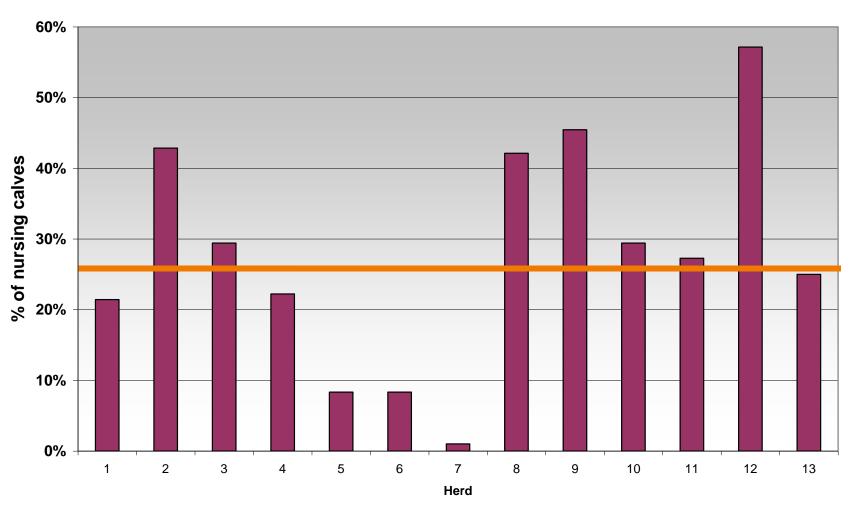




Scoring system developed by Dr. Sheila McGuirk - http://www.vetmed.wisc.edu/dms/fapm/fapmtools/calves.htm



Percentage of calves scored 5+





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Typical values

- Outdoor air: 100 1,000 cfu/m³
- Clean office air: 1,000 2,000 cfu/m³
- Well-ventilated barn: 10-15,000 cfu/m³



Ventilation Findings

- Median barn ventilation rate was 5.5 changes per hour
 (range 0-93 ach) * assistance of Brian Holmes & David Kammel
- Pen air NH3 avg 2 ppm (range 0-4 ppm)
- Alley cfu/m3 associated with barn ventilation rate P<.0001
- Pen cfu/m3 were NOT associated with barn ventilation rate
- Pens are microenvironments within the barn



Service alley cfu/m³ associated with barn ventilation rate *P<.0001*

Pen cfu/m³ NOT associated with barn ventilation rate





Total airborne bacterial cfu/m³ in PEN associated with prevalence of respiratory disease P≤0.003

Association is not causation...

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



Airborne bacterial counts

- Potential marker for microbial cell wall agents
- Cause inflammation, suppress immunological defenses
- Bacterial source agents
 - Endotoxin in Gm-, peptidoglycan in Gm+, and enzymes
- Fungi & mold source agents
 - β-glucan, chitin, and enzymes

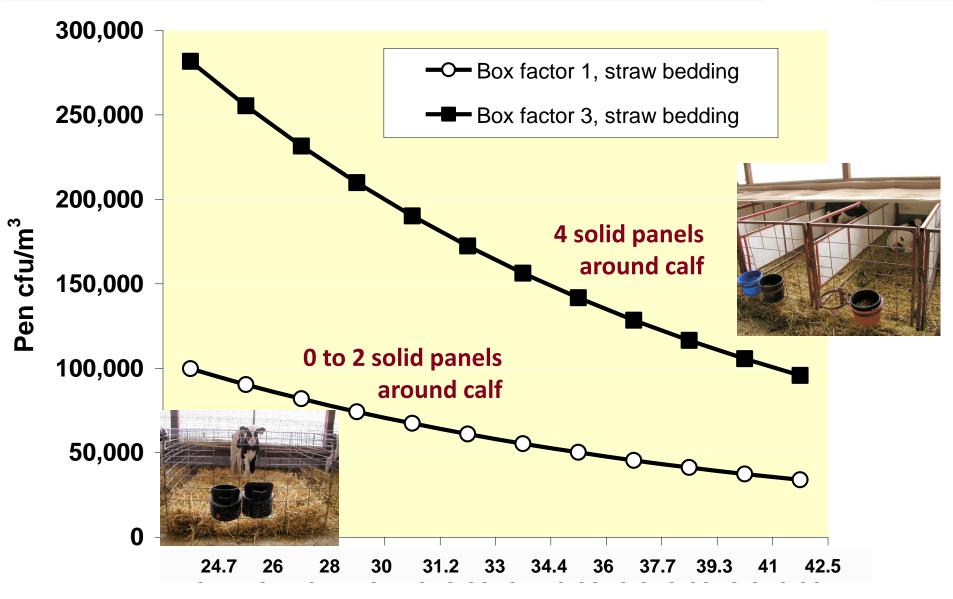


Factors to **\(\psi \) airborne bacteria** in pens

- 1) Lower temperature P<0.003
- 2) Larger pens P<0.02
 - > 30 square feet
- 3) Fewer solid sides P<0.006

Pen Size & No. Solid Sides





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Pen area, ft²



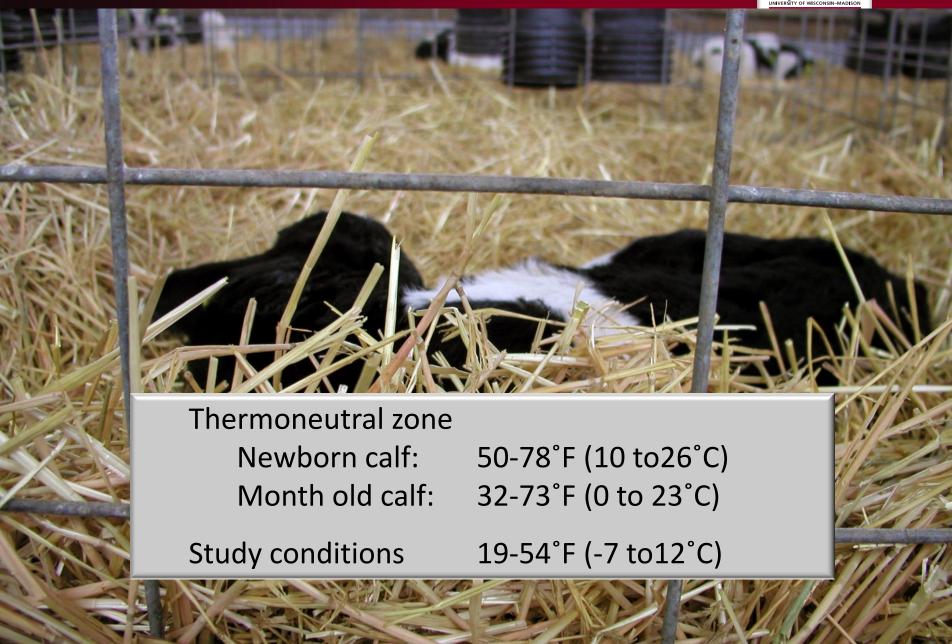
Key factors for respiratory health

- 1) Nesting in deep bedding P<0.002
- 2) Low pen airborne bacteria counts P<0.003

Total bacterial counts significant Coliforms (EMB) not significant

3) Solid panel between calves P<0.003









Legs entirely visible when lying down

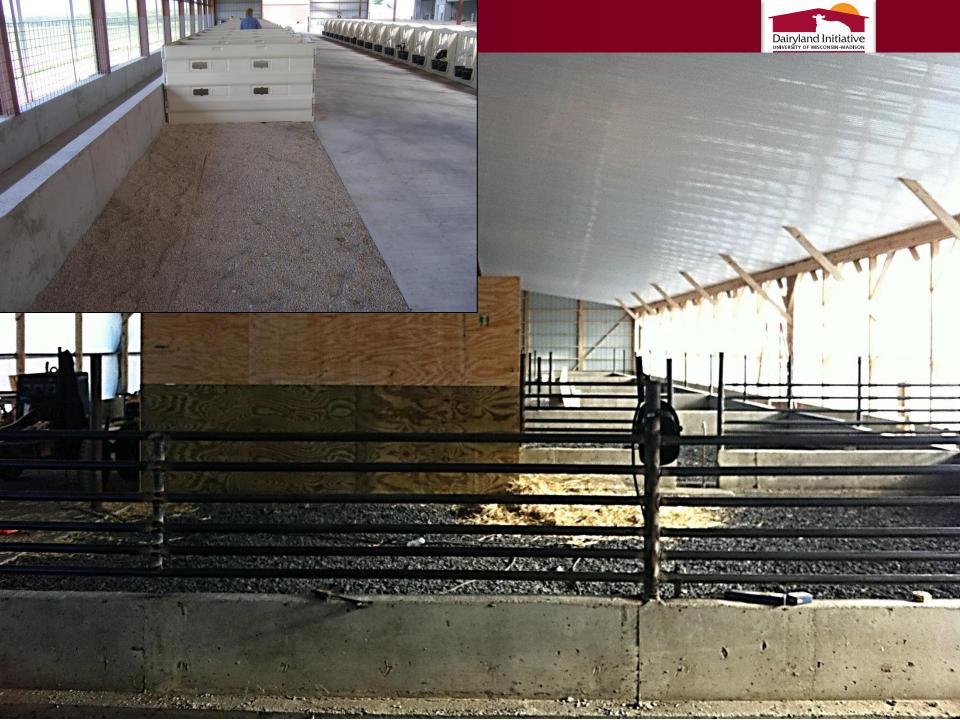












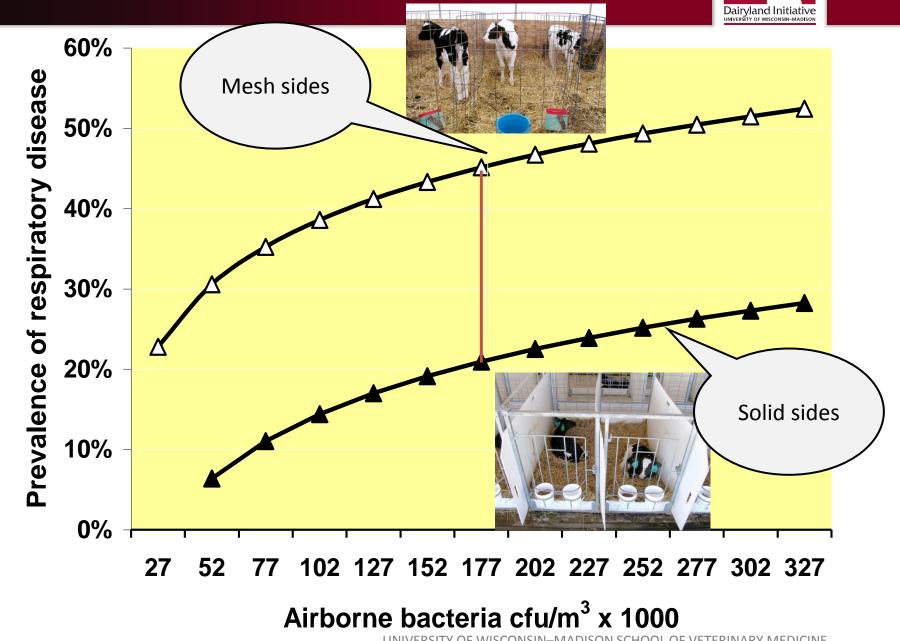


Key factors for respiratory health

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Total bacterial counts significant Coliforms (EMB) not significant

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— Mesh dividers, nesting score 2 — Solid dividers, nesting score 2



Field Study Results Summary

(a.k.a. "The story of the tubes")

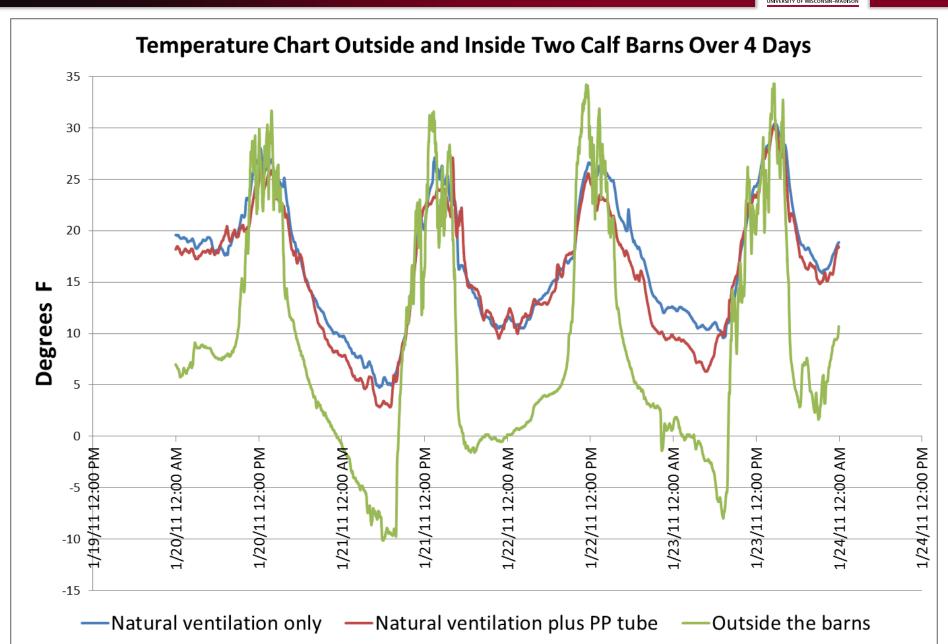
- \psi respiratory disease with lower airborne bacterial counts in pen
- Confounding finding:
 - Solid panels between calves ↑ airborne bacteria counts
 - Solid panels ↓ risk of respiratory disease
- Stimulated work to develop a "new generation" of positive pressure tubes to push fresh air between panels



"New Generation" Tubes

- Not the tubes of the 1980's!
- Supplement natural ventilation, not recirculation
- Technical differences in tube design
 - Entirely fresh air without recirculation
 - Uniform discharge along the length
 - "Throw" distance calculated to avoid drafts
- Accept the reality of cold air







Temperature data

	North Barn - With Tube	South Barn	Outside
Temp. (F), Min.	2.0	2.3	-10.1
Temp. (F), Max.	47.7	50.3	49.4
Temp. (F), Ave.	23.1	23.0	17.0



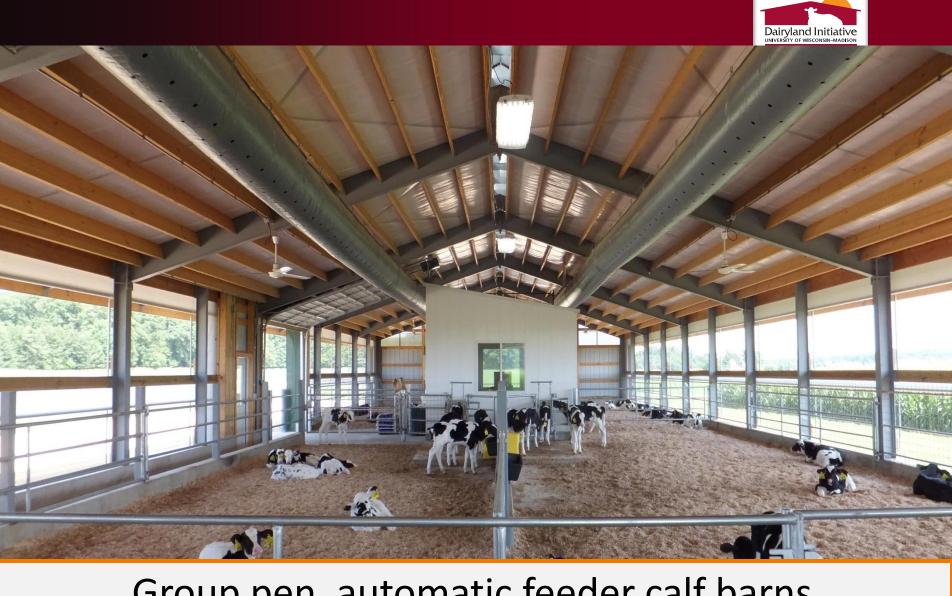
Supplemental positive pressure ventilation tube

Very healthy calves!

Natural ventilation with curtain sidewalls and open ridge





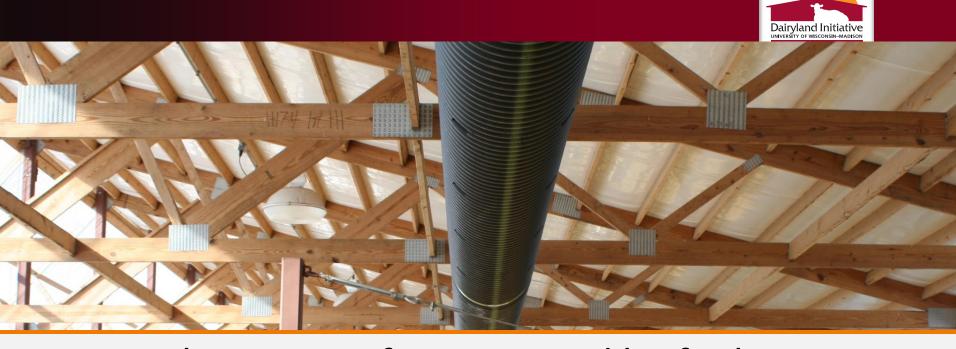


Group pen, automatic feeder calf barns



Tubes in old stall barn retrofitted for calves





Tube in open-front weaned heifer barn







Tube in dead-ended "BANK" barn



http://thedairylandinitiative.vetmed.wisc.edu



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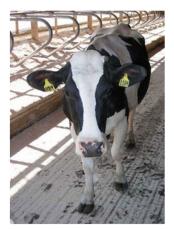
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The Guide to Welfare Friendly Dairy Cattle Housing

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To preview the site, click on the tabs at the top of the page.

Download a printable preview of the Dairyland Initiative website & services.

Upcoming Events

- 2014 PDPW Business Conference
 - Home Sweet Home for Heifers and Postweaned Calves

Dr. Rebecca Brotzman, Associate Outreach Specialist for the Dairyland Initiative, will discuss the important components of heifer housing such as facility size, feed and resting space, ventilation method, and grouping strategy for the transitioning, post-weaned calf through springing heifer.

Finding and Targeting High Risk Fresh Cows
 Dr. Gary Oetzel, Associate Professor in the Food
 Animal Production Section of the School of

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