Current State of BRD in the Dairy Industry

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VETERINARY MEDICINE

Challenging Paradigms

*"A **paradigm** is a standard, perspective, or set of ideas; a way of looking at something."*

Are the paradigms challenging us,

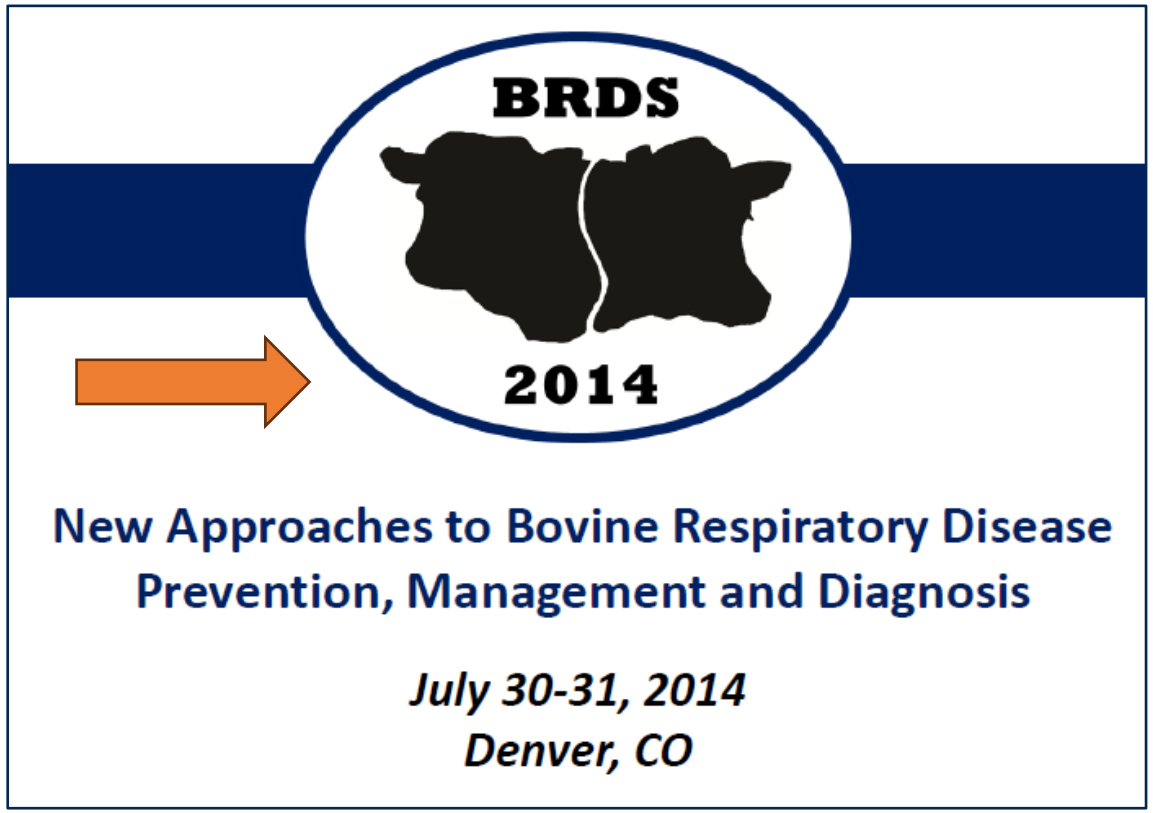
or are we challenging the paradigms?

Caveat

Focus on BRD in dairy calves instead of cows

My journey in calf raising and calf health

Promise & Peril

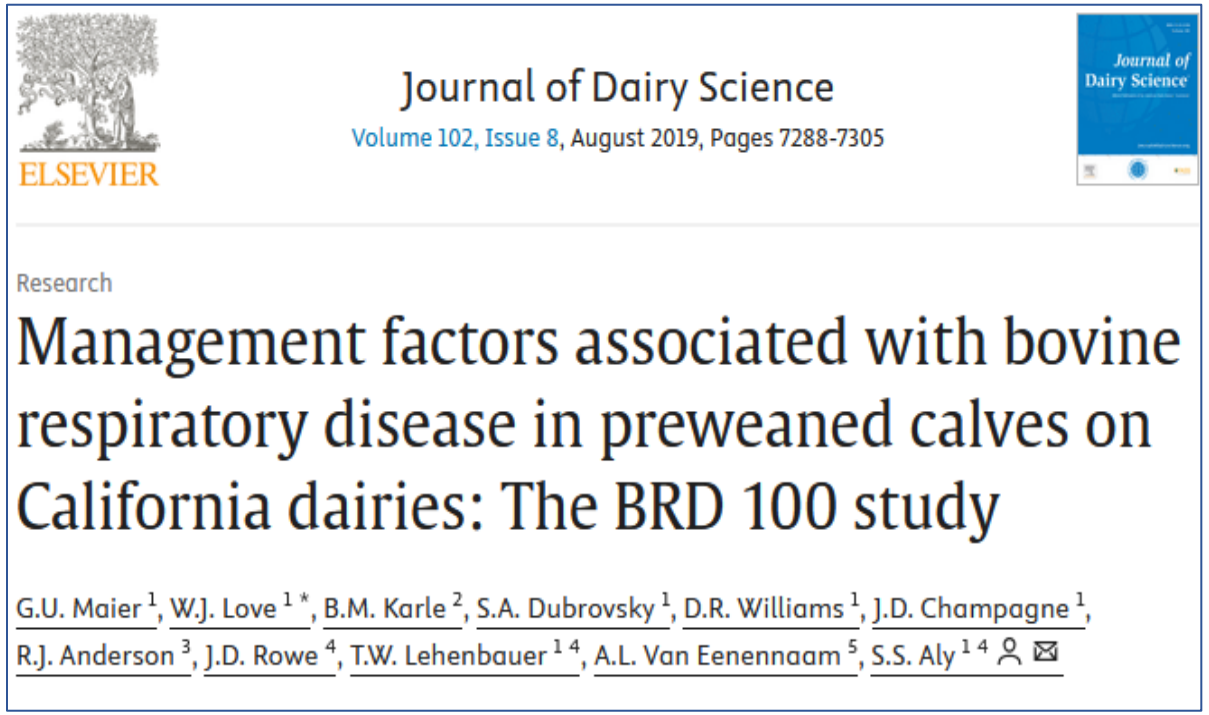


Dr. Walt Guterbock: The Impact of BRD – The Current Dairy Experience

"Most of the data on **prevalence of BRD** in dairy calves comes from studies on a limited number of farms near a university. Most of the herds in these studies have been small by modern dairy standards."

BRD Research

BRD Research – Large Studies



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Journal of Dairy Science

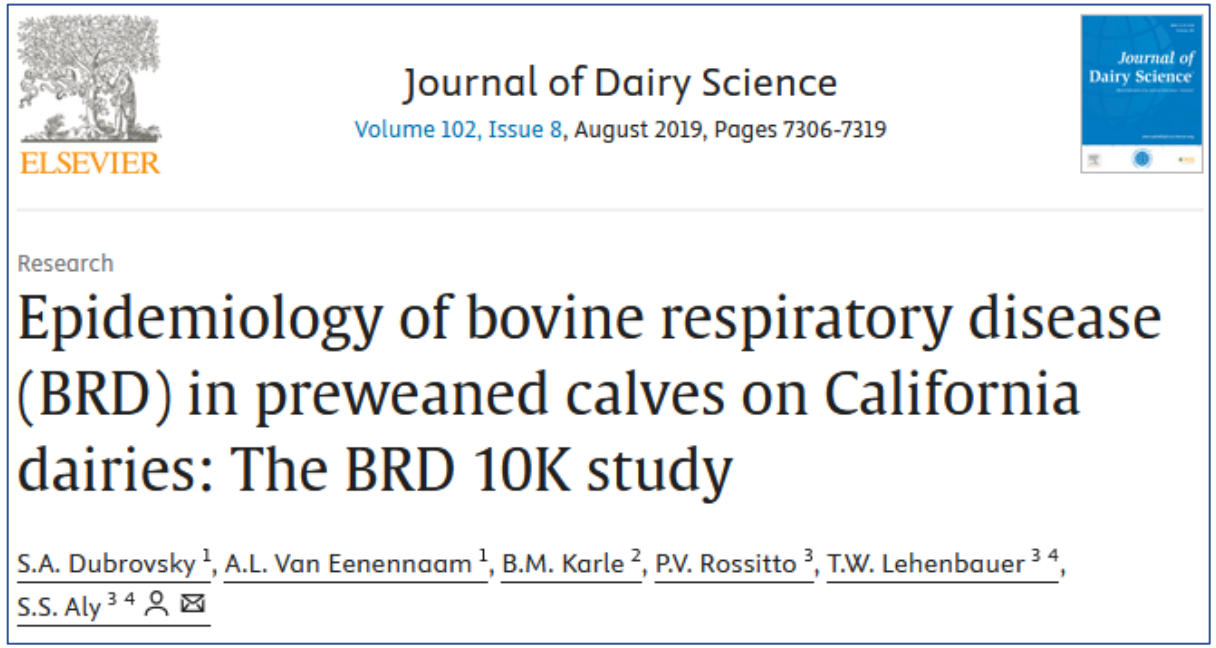
Volume 102, Issue 8, August 2019, Pages 7288-7305

Research

Management factors associated with bovine respiratory disease in preweaned calves on California dairies: The BRD 100 study

G.U. Maier [1], W.J. Love [1 *], B.M. Karle [2], S.A. Dubrovsky [1], D.R. Williams [1], J.D. Champagne [1], R.J. Anderson [3], J.D. Rowe [4], T.W. Lehenbauer [1 4], A.L. Van Eenennaam [5], S.S. Aly [1 4]

>4,600 preweaned calves were studied from **100 dairy herds**



ELSEVIER

Journal of Dairy Science

Volume 102, Issue 8, August 2019, Pages 7306-7319

Research

Epidemiology of bovine respiratory disease (BRD) in preweaned calves on California dairies: The BRD 10K study

S.A. Dubrovsky [1], A.L. Van Eenennaam [1], B.M. Karle [2], P.V. Rossitto [3], T.W. Lehenbauer [3 4], S.S. Aly [3 4]

>10,000 preweaned calves were studied from **5 dairy herds**

How are dairy calves raised?

- Dairy heifer calves
  - 1 in 10 raised at a “calf ranch”
  - (Most bull calves → calf ranch)

- Calf Ranches
  - ~80% of facilities – Eastern & Midwest U.S.
  - ~70% calves – Western states
    - (Bigger calf ranches in the West)

[USDA-NAHMS 2007 & 2011]

Changing Demographics

- Beef on Dairy
  - 2011: ~10% dairy-type carcasses
  - 2016: ~16%
    - Holsteins – challenging in feedlots
    - Beef supply began to normalize
    - Holstein bull calf lost value
  - (2014 – Milk prices dropped:
    - Holstein heifer calf values dropped)

[Baseil & Felix, 2022]

Photo: Beef on Dairy Industry Report; Purina Animal Nutrition, 2024

Changing Demographics

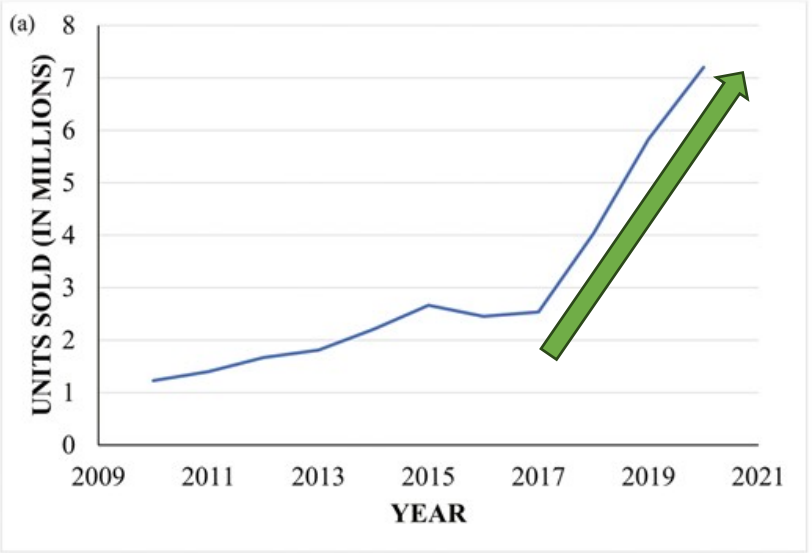
"beef-cross calves have fetched astounding vales of more than $1,000 per head in some markets." (Dairy Herd Management, July 12, 2024)

Photo: Beef on Dairy Industry Report; Purina Animal Nutrition, 2024

U.S. Semen Sales

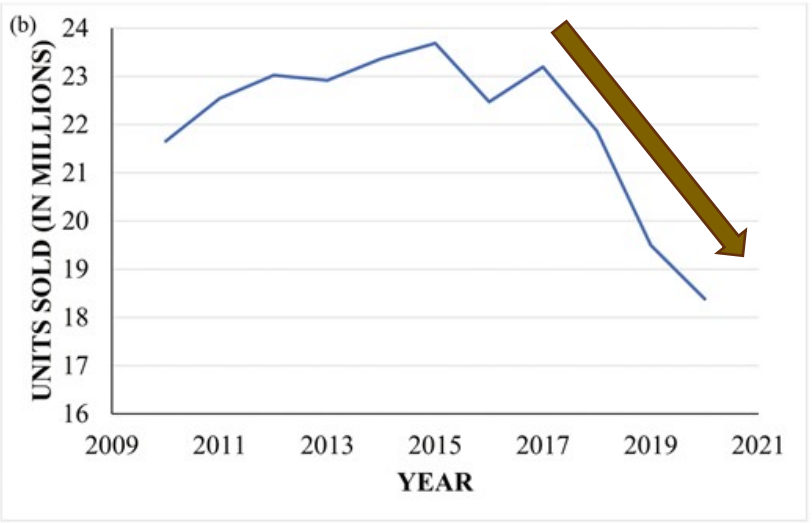
Beef

260% increase
from 2017 to 2021



Dairy

~22% decrease
from 2017 to 2021



[Basiel & Felix, 2022]

NAHMS Dairy 2014 – Health and Management Practices on U.S. Dairy Operations

- Heifer Calves - Treatment

Disease	% Affected	% Treated	% Affected that were treated
Preweaned Heifers			
Diahrrea / GI	21.1	16.0	78.9
Respiratory	**12.0**	**11.4**	**94.8**
Navel Infection	1.7	1.5	91.0
Other	0.1	0.1	65.8
Weaned Heifers			
Respiratory	**5.1**	**4.7**	**92.2**

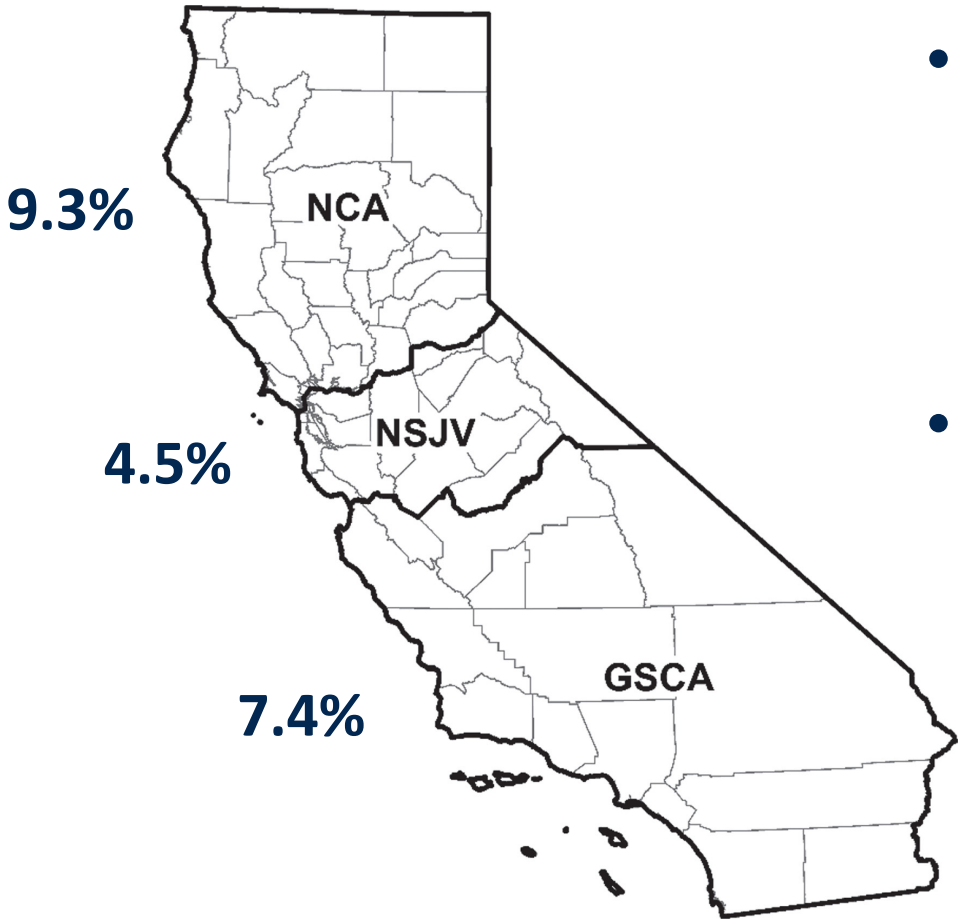
- Heifer Calves – Mortality

Percent Heifer Deaths

Producer-reported cause	Pre-weaned Heifers - %	Weaned Heifers - %
Diahrrea / GI	56.4	6.8
Respiratory	**24.0**	**58.9**
Other Causes	19.6	34.3
Total	100%	100%

Preweaned BRD Prevalence

Heifer Calves



- Prevalence varied by region
  - Based on California BRD scoring system
  - 100 herds; 4,636 calves
- Overall prevalence
  - **Holstein heifers = 7.2%**
  - **Jersey & other breeds = 5.7%**

(Karle, et al. , JDS 2019)

(Prevalence = Percent of heifers with BRD among preweaned calves at a point in time.)

Preweaned BRD Incidence

Dairy Calves

Stars represent county locations of study herds

- Incidence density rate **(IDR)**
  - Based on California BRD scoring system
  - >11,470 preweaned calves from 5 dairy herds
- Farm IDR ranged from .01 to .19 cases/mo
  - (Calf caretaker data had higher incidence rates)
  - **Overall IDR = .13 cases/mo**
    - For 100 calves over a 2-month period = ~26% incidence
    - Overall preweaned BRD prevalence = 8.2%
  - **Male calves > BRD IDR** (0.20 vs 0.16 females)
  - **Spring & summer > risk compared to winter and fall**

(Dubrovsky, et al. , JDS 2019)

(IDR = # of new BRD cases / sum of calf months at risk)

BRD Morbidity & Mortality

Dairy-Beef Crossbred Calves

Item	Transfer of Passive Immunity: TPI-IgG (g/dL) categories			
	Poor (<10.0)	Fair (10.0 – 17.9)	Good (18.0 – 24.9)	Excellent (≥25.0)
Number of calves, n (%)	153 (14.5)	248 (23.5)	284 (26.9)	370 (35.1)
Disease incidence* (%)				
Overall	90.2	87.9	83.1	81.9
Diarrhea	72.6	71.0	64.1	59.7
Respiratory disease	74.0	58.1	52.8	48.1
Mortality (%)	5.9	3.6	1.4	1.1

(Pereira, et al. , JDS 2024-preprint)

Association of morbidity, mortality, and average daily gain with transfer of passive immunity in dairy-beef crossbred calves up to **60 d of life**

- Calf ranch facility, Central Valley, California
  - 499 female & 556 male
  - ~ 50 : 50 ratio of Holstein-Beef and Jersey-Beef
- Diarrhea and respiratory cases were based on antibiotic therapy administered by 2 trained farm personnel

BRD in Weaned Dairy Calves

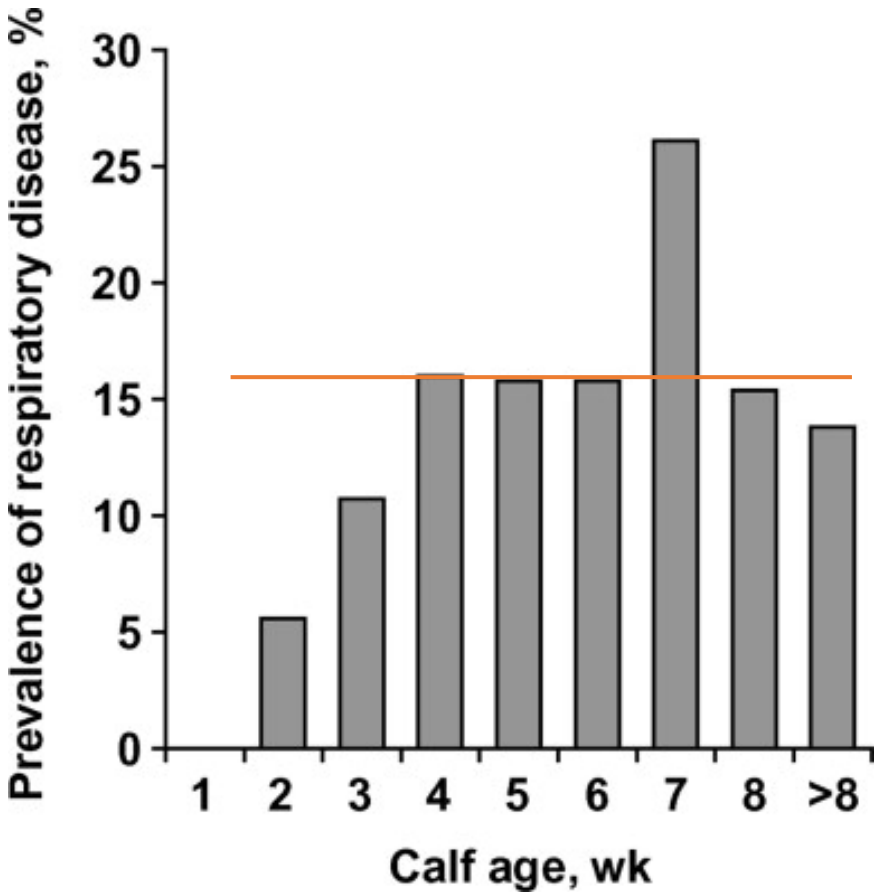
Development of a clinical scoring system for bovine respiratory disease in weaned dairy calves (Maier, et al., JDS 2019)

26% BRD Prevalence

- 689 post-weaned heifer calves

- Diagnosed by thoracic ultrasound and auscultation
  - 403 Holsteins and 286 Jerseys
  - 5 dairy farms in Tulare County
  - Herd size: 800 to 3,600 milking cows

BRD: Calf Barns in Winter (WI)



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Journal of Dairy Science
Volume 89, Issue 10, October 2006, Pages 4014-4025

Article

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

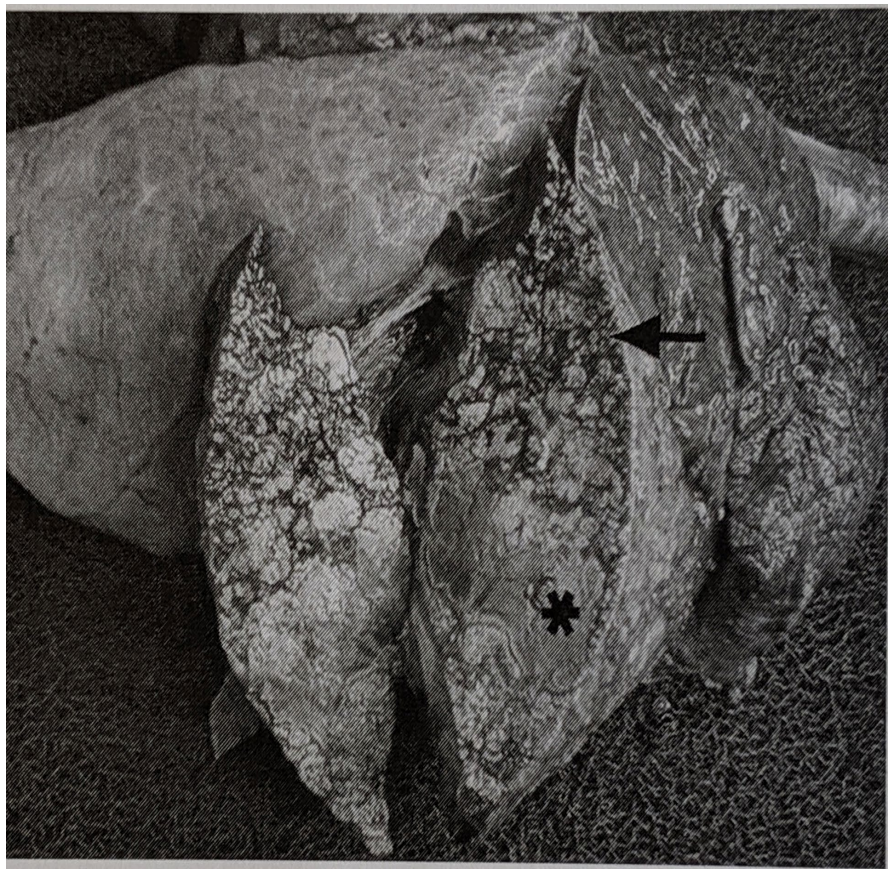
A. Lago, S.M. McGuirk, T.B. Bennett, N.B. Cook, K.V. Nordlund

Prevalence rates above 15% (4 weeks +)

Significant Factors:

- Pen bacterial counts
- Solid barriers between pens
- Deep bedding ("ability to nest")

Etiology



Veterinary Clinics of North America: Food Animal Practice

Viral pathogens

- Bovine respiratory syncytial virus (BRSV)[1]
- Bovine herpes virus type-1 (BHV-1)[2]
- Parainfluenza-3 (PI-3) virus[3]
- Bovine viral diarrhoea virus (BVDV)[4]
- Bovine coronavirus (BCoV)
- Bovine adenovirus
- Influenza D virus
- Avian Influenza H5 virus

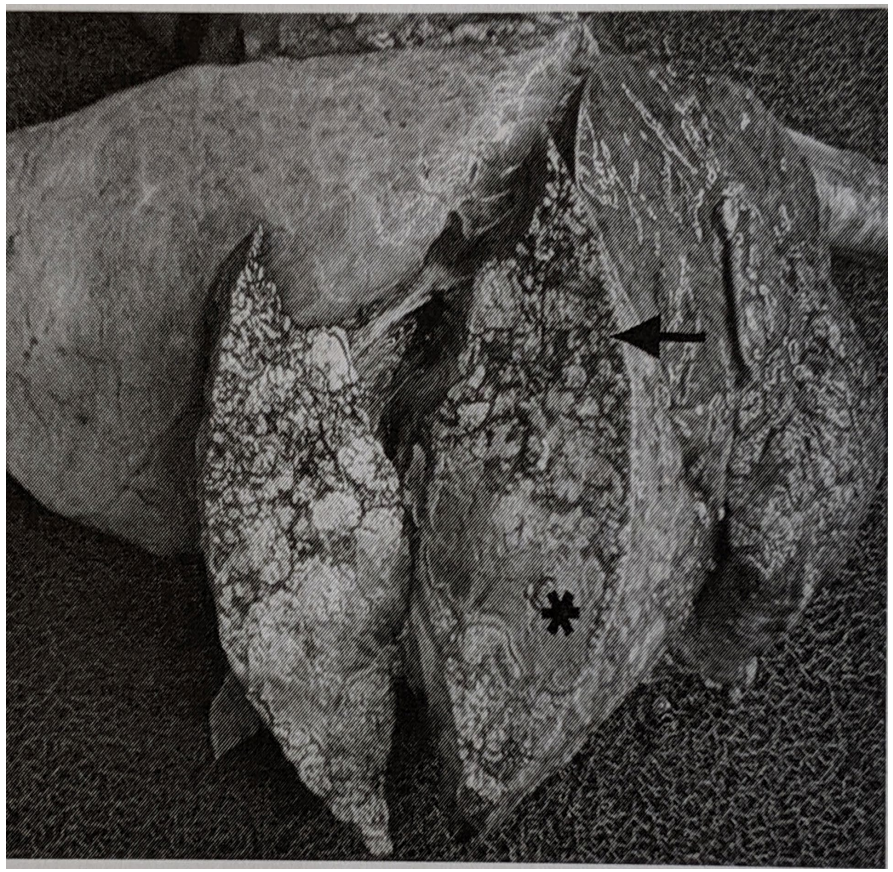
} Roles not clearly defined[5]

Bacterial pathogens

- *Pasteurella multocida*[6]
- *Mannheimia haemolytica*[6]
- *Histophilus somni*[6]
- *Mycoplasma bovis*[7]
- *Bibersteinia trehalosi* and *Trueperella pyogenes* - occasionally[5]

[1] Brodersen B. W. VCNA, 2010; [2] Jones C. and Chowdhury S. VCNA, 2010; [3] Ellis J. A. VCNA, 2010; [4] Ridpath J. VCNA, 2010; [5] Cummings D. B., Meyer N. F., Step D. L. VCNA, 2022; [6] Griffin D., Chengappa M. M., Kuszak J., and McVey D. S. VCNA, 2010.; [7] Caswell J. L., Bateman K. G., Cai H. Y., and Castillo-Alcala F. VCNA, 2010.

Transmission



Veterinary Clinics of North America: Food Animal Practice

- Aerosols
- Nose-to-nose contact
- Contaminated food, water, housing, and fomites
- Ingestion of infected milk in case of *Mycoplasma bovis*

Caswell J. L. and Archambault M. Mycoplasma bovis pneumonia in cattle. Animal Health Research Reviews/Conference of Research Workers in Animal Diseases, 2007.

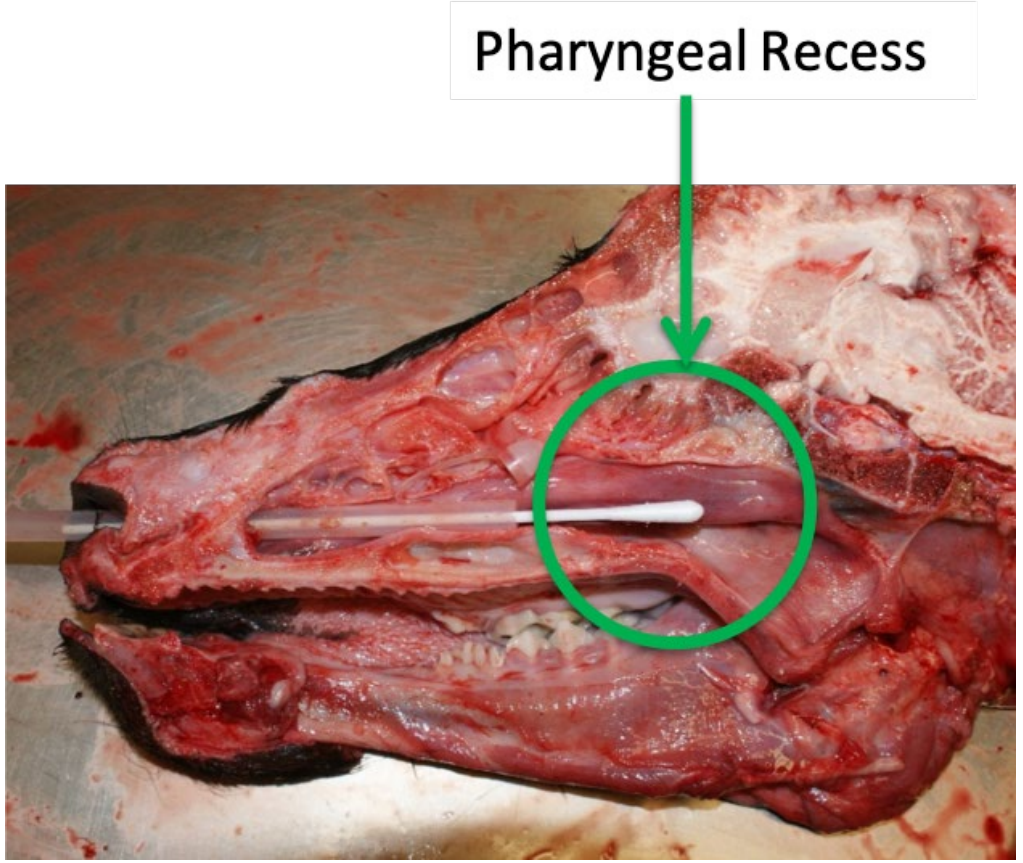
BRD: Association with Pathogens

Matched Case-Control Study

- Total 2,030 preweaned calves
  - 1,280 males and 750 females
  - 884 cases and 1146 controls
    - Based on BRD Scoring System
- Commercial calf-ranch in San Joaquin Valley
- Calves older than 22 days
  - (14 days post-vaccination)
- 10 days post-antibiotic treatment

BRD: Association with Pathogens

Intranasal Swab Sampling



BRD: Association with Pathogens

Results

- Age - from 0 to 86 days
- *M. bovis* + 60.8% of calves
- *P. multocida* + 30%
- *M. haemolytica* + 16%
- BRSV + 13%
- *H. somni* + 1%

Matched Case-Control Results

Parameter	Level of the parameter	Matched odds ratio	95% CI
Histophilus somni	Negative (referent)		
	Positive	8.80	2.50–30.70
Mannheimia haemolytica	Negative (referent)		
	Positive	6.80	4.50–10.20
Pasteurella multocida	Negative (referent)		
	Positive	6.40	4.40 – 9.40
Mycoplasma bovis	Negative (referent)		
	Positive	1.70	1.30 – 2.40
BRSV	Negative (referent)		
	Positive	4.60	3.00 – 6.90
Total protein status of calf	FTP (referent)		
	Adequate immunity	0.60	0.40 – 0.80

Not Isolated from any calf:

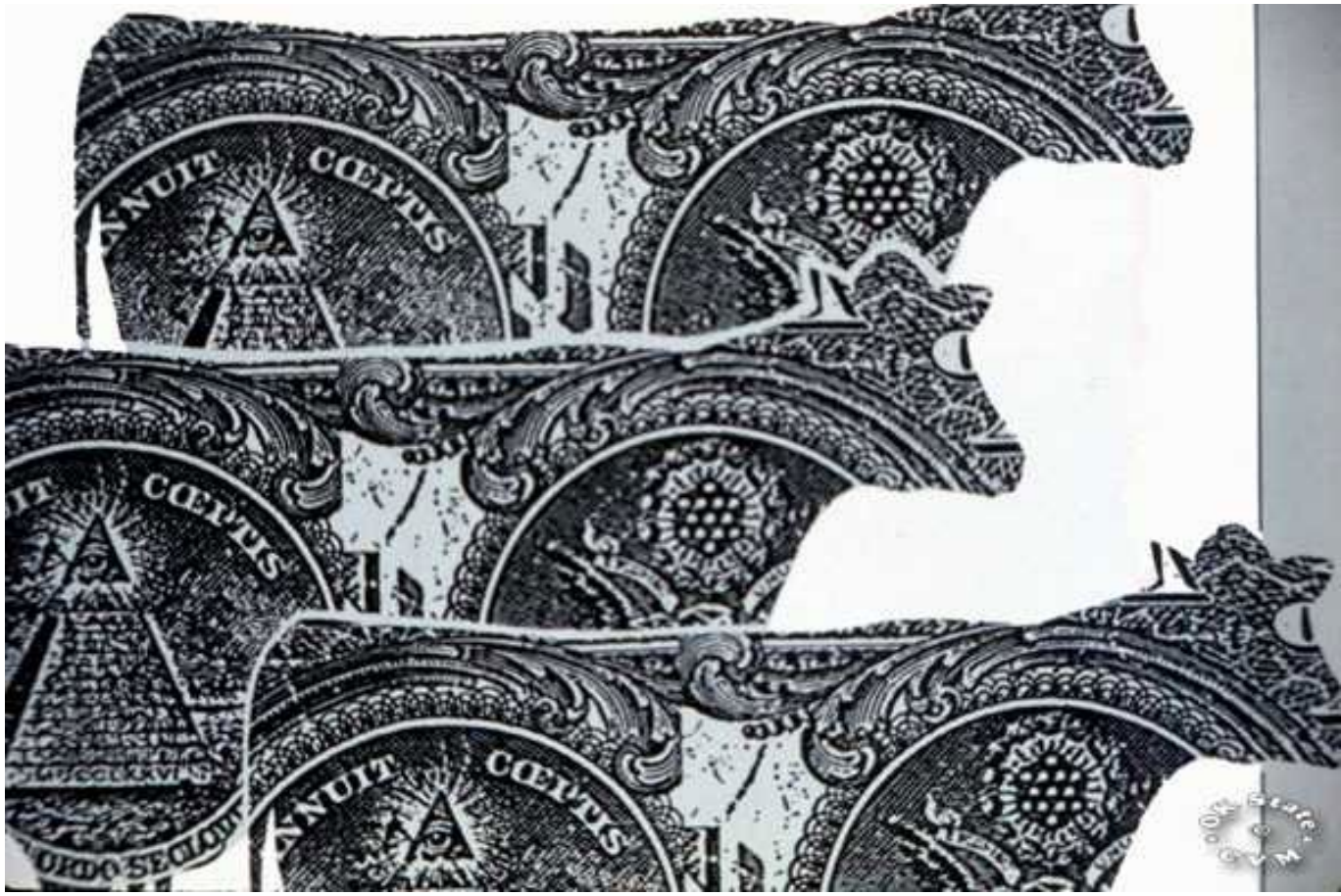
BVDV

BoHV-1 (IBR)

==========

BCoV – Odds Ratio: Not Significant

Economics of BRD



Economics of BRD

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Journal of Dairy Science
Volume 103, Issue 2, February 2020, Pages 1583-1597

Research

Preweaning cost of bovine respiratory disease (BRD) and cost-benefit of implementation of preventative measures in calves on California dairies: The BRD 10K study

S.A. Dubrovsky [1 2], A.L. Van Eenennaam [2], S.S. Aly [3 4] ✉, B.M. Karle [5], Paul V. Rossitto [3], M.W. Overton [6], T.W. Lehenbauer [3 4], J.G. Fadel [2] ✉

Average BRD preweaned calf treatment cost: ~$42

Economics of BRD

Economics of respiratory disease in dairy replacement heifers

Published online by Cambridge University Press
08 March 2021
Michael W. Overton

Cost of incident case of BRD

- Occurring during first 120 days of age
- **$252 - $282 / affected heifer**
- Driven by subsequent losses associated with selective culling
- (Data set = 104,100 dairy replacements across the U.S.)

AVMA Publications
JAVMA • Vol 248 • No. 10 • May 15, 2016

Economics

The association between calfhood bovine respiratory disease complex and subsequent departure from the herd, milk production, and reproduction in dairy cattle

Aaron P. Schaffer MS, Robert L. Larson DVM, PhD, Natalia Cernicchiaro DVM, PhD, Gregg A. Hanzlicek DVM, PhD, Steven J. Bartle PhD, and Daniel U. Thomson DVM, PhD

5,000 cow Utah dairy herd – 5+ years of data

Heifer calves with **BRD <120** days of age

- 1.6 to 5 times more likely to leave the herd before calving
- 233-kg (513-lb) lower 305-d ME 1st lactation milk production

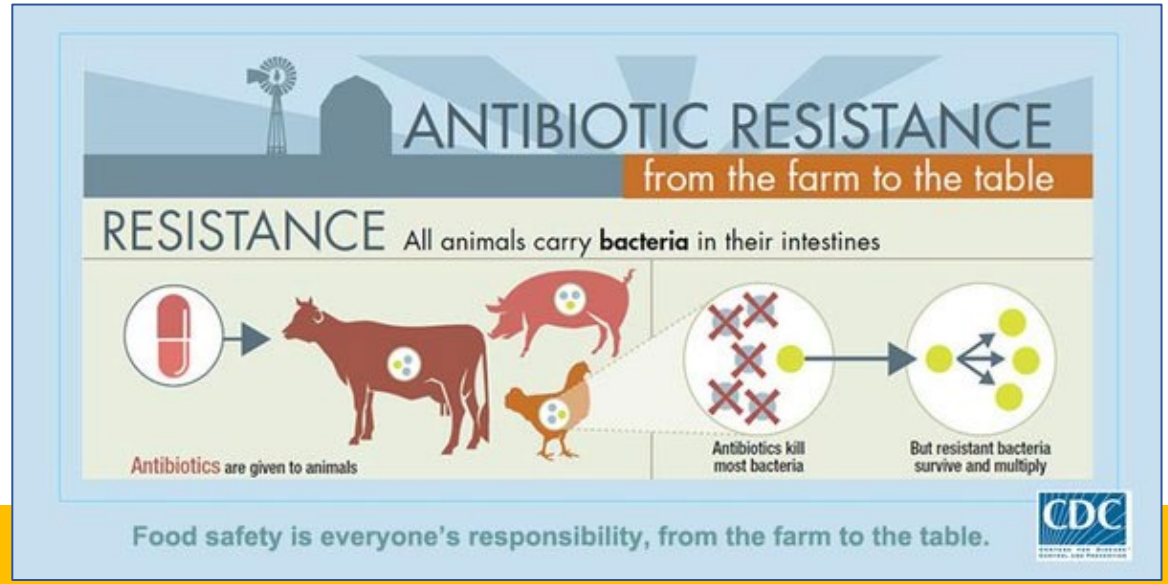
Heifer calves with **BRD prior to weaning**

- 2.6 times more likely to be culled before 1st calving compared to heifers with BRD detected after weaning

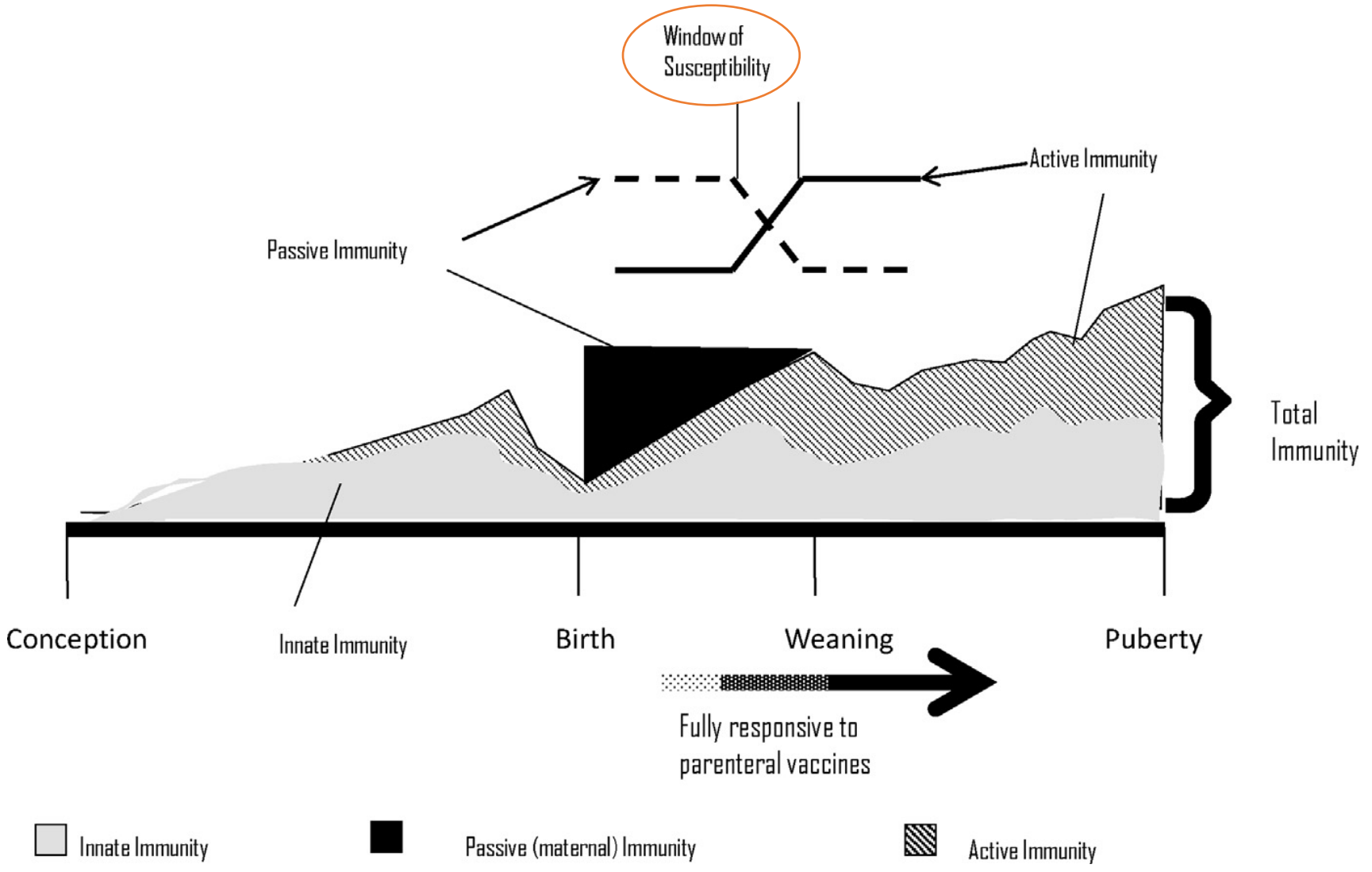
Antimicrobial Use & Resistance: BRD Therapy in Dairy Calves

- **Macrolides and amphenicols**
  -- primary antimicrobials used for BRD treatment
  -- other classes also used

(USDA-NAHMS, Dairy 2014)
(de Campos et al., JDS 2021)



Calf Immune Response Development



Immune response in the calf: from conception to puberty. Chase C., VCNA 2022.

Calf Immune Response Development

- Strategic vaccination programs – Important
- From Dr. Chase:

> Vaccines are often viewed as a catch-all solution for management and nutrition errors; the “best” vaccine can never overcome these deficiencies.

- From me:

> Excessive exposure to the pathogen can overwhelm an otherwise appropriate vaccination strategy.

BRD Research

BRD Research can be challenging & complicated

BRD Research

BRD Research can be challenging & complicated

"The great thing about studying tiny things is that no one knows what the hell you're doing."

Opportunities

BRD Risk Reduction

Sanitation

Opportunities

BRD Risk Reduction

Stress Reduction

Group housing trials:

- Improved behavior attributes
- More respiratory pathogen exposure

Opportunities

BRD Risk Reduction

Nutrition and Immune Health

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Journal of Dairy Science

Volume 99, Issue 4, April 2016, Pages 3199-3216

Stress, immunity, and the management of calves [1]

Lindsey E. Hulbert, Sonia J. Moisá

Whole blood transcriptome analysis reveals potential competition in metabolic pathways between negative energy balance and response to inflammatory challenge

Juliette Bouvier-Muller, Charlotte Allain, Guillaume Tabouret, Francis Enjalbert, David Portes, Céline Noirot, Rachel Rupp & Gilles Foucras

Scientific Reports **7**, Article number: 2379 (2017) | Cite this article

BRD Risk Reduction

Nutrition and Immune Health

Opportunities

- Limited nutrition, especially for preweaned calves, continues as a problem