Prime-boost respiratory vaccination

Optimizing immune response for protection against BRD post-weaning

Here we go again, why 'respiratory' vaccines?

"…for a 500 pound animal costing $1/lb, for every cent reduction in purchase price, the feedlot can 'afford' an additional 1% death loss…the highest potential rate of return is often associated with 'high risk' BRD scenarios…" *

World Health Organization | Health Topics | Countries | Newsroom | Emergencies

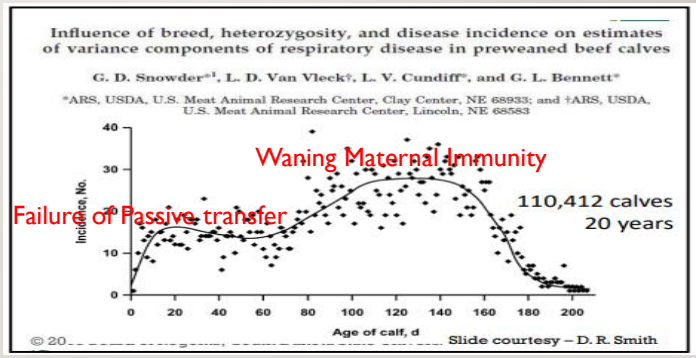
Stop using antibiotics in healthy animals to prevent the spread of antibiotic resistance

2017 – WHO recommendation

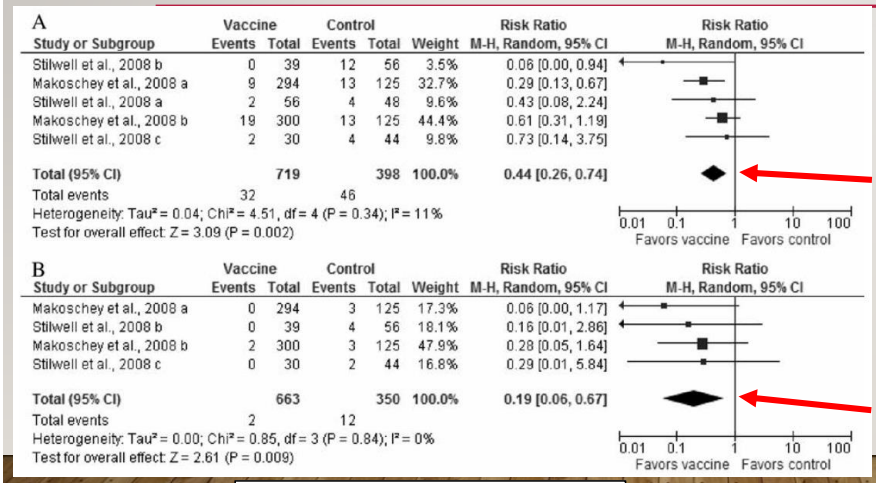
BRD accounts for **65-80% of the morbidity (sickness) and 45-75% of the mortality (deaths)** in some feedlots. Classical clinical signs of bacterial BRD include: fever of over 40°C (>104°F) Sep 19, 2022

https://www.beefresearch.ca › topics › bovine-respiratory-...

Bovine Respiratory Disease - BeefResearch.ca



Do commercial vaccines protect against natural disease?



JAVMA, Vol 246, No. 1, January 1, 2015

Reduction in risk from disease caused by BRD associated viruses:

1) Sickness (morbidity) = YES

2) Death (mortality) = YES

Why does immunization not always meet expectations?

- What is the effect of co-mingling?
- Not every calf has the same starting point

- Wide variety of risk factors
- Immunity can be overwhelmed

Goals of immunization (successful vaccination)

- Reduce severity and duration of disease
- Decrease virus production (viremia)
- Increase dose of virus needed to induce disease

What is optimizing vaccination?

Vaccination with the intent of maximizing the opportunity for immunization

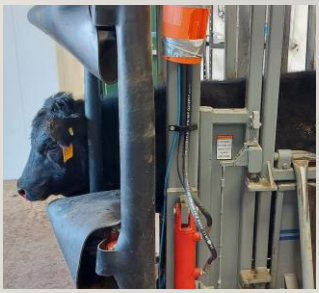
Maximize the what with what and the how?

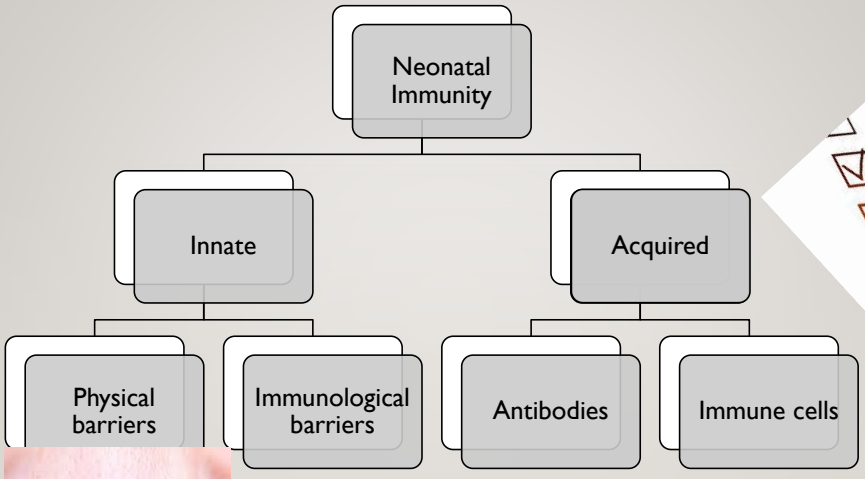
+

=

Immunized

OPTIMAL INITIATION OF IMMUNITY





Nose hair – Not just for sex appeal anymore!

DOWN REGULATION OF CALF IMMUNITY

Dam cortisol

High concentrations first few days of life

MATERNAL ANTIBODY

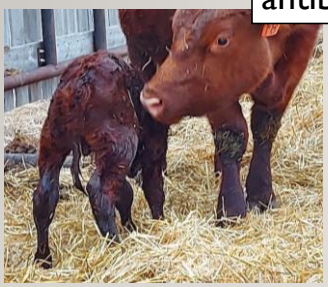
- Derived from colostrum
- Provides calf immunity
- Failure of passive transfer

DURATION OF MATERNAL IMMUNITY

- Varies depending on the antibody type
- Maternal antibody (IgG) interference

Viral Antigen	Time to seronegative (days)
BVD 1a	192.2 ±
IBR	122.9 ± 46.6
BPIV-3	190.6 ± 58.3
BRSV	186.7 ± 33.0

Inject vaccine = no antibody response



Nasal vaccine = **local** antibody response

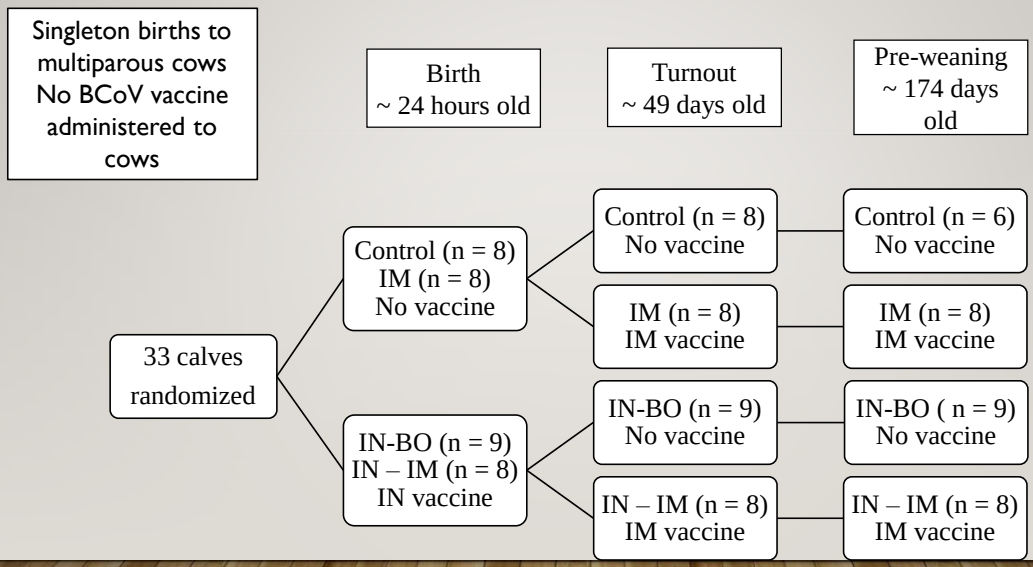
OPPORTUNITY IN INTRANASAL VACCINATION

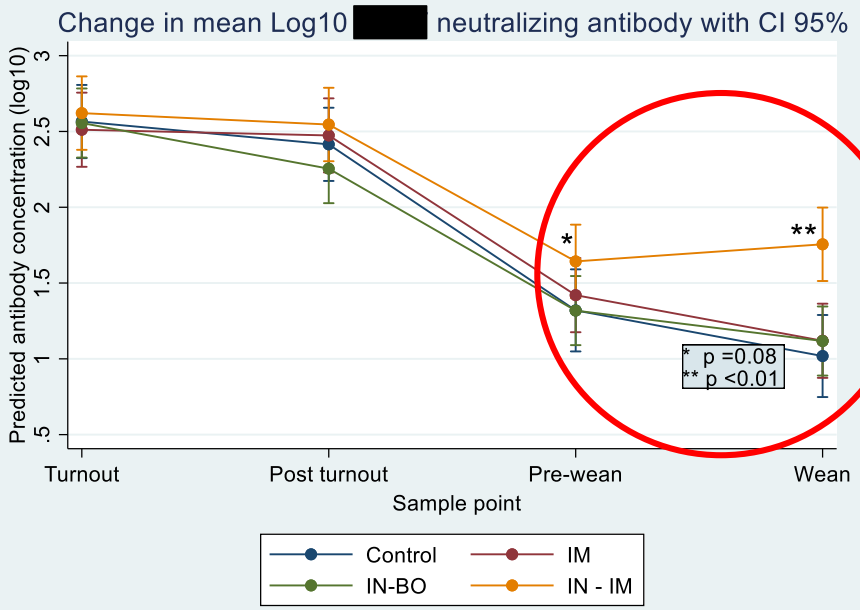
1. Mucosal immune system is fully developed at birth
2. Resistance to infection, shedding and mitigates clinical disease
3. Primes systemic immunity?

DEFINITIONS

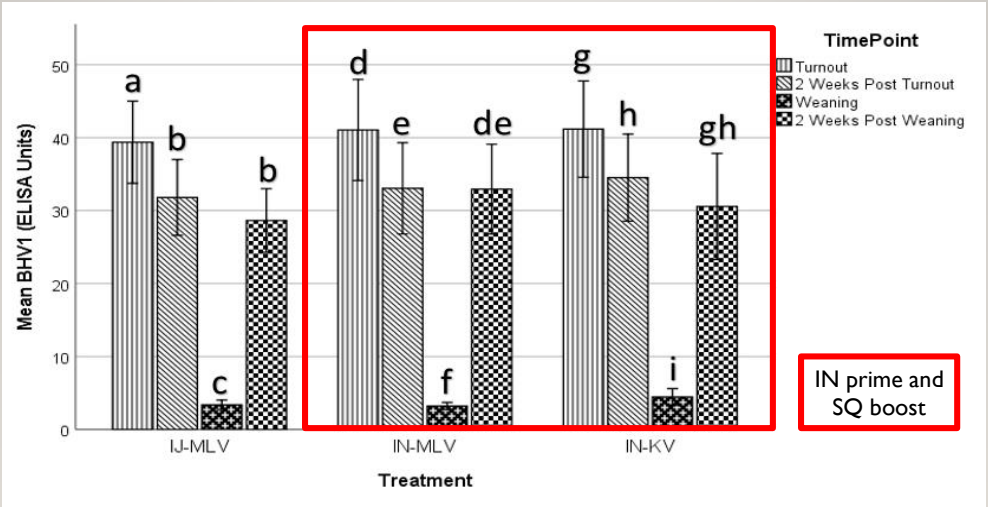
- MLV – modified live virus (the one you mix)
- Inactivated – killed virus/components of virus
- IN – intranasal – (the one you put in the calf's nose)
- SQ – subcutaneous – (the one you inject under the skin)
- IM – intramuscular – (the one you inject into the muscle)
- Prime – the first dose of vaccine administered
- Boost – subsequent doses of vaccine
- BCoV – bovine coronavirus

Experimental design

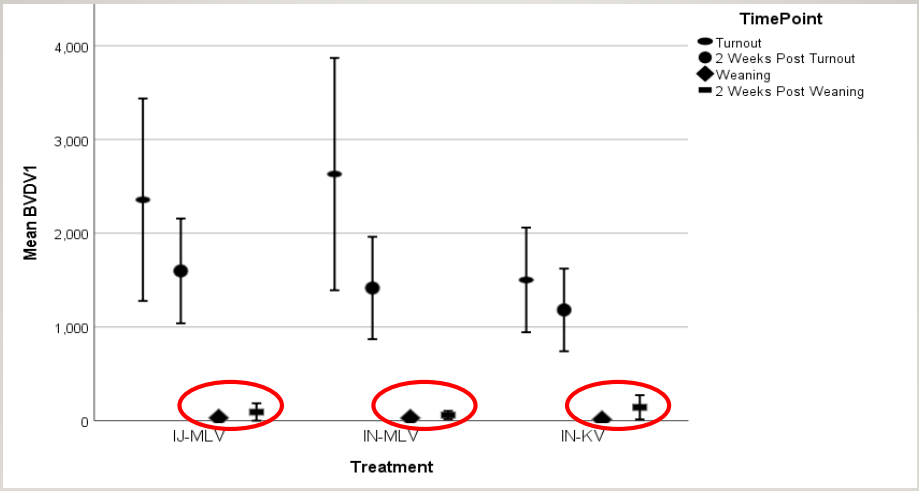




Change in **IBR** specific antibody concentration

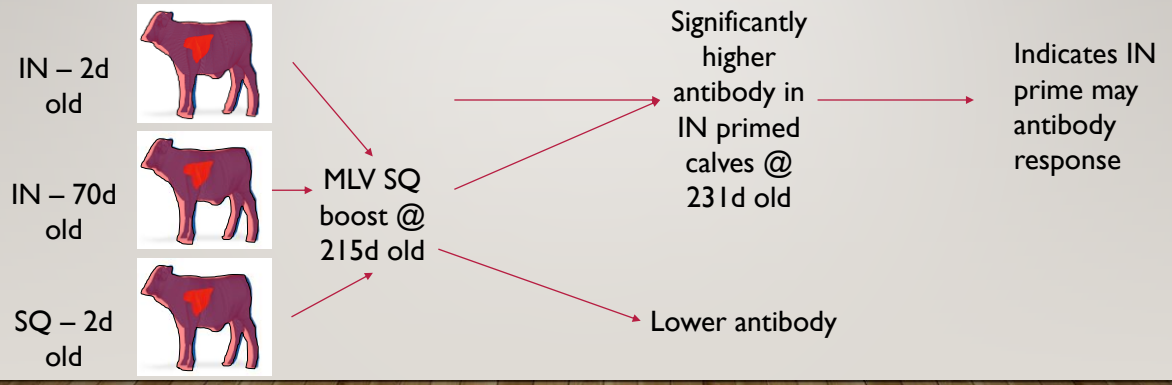


BVDV type 1 antibody response without mucosal priming

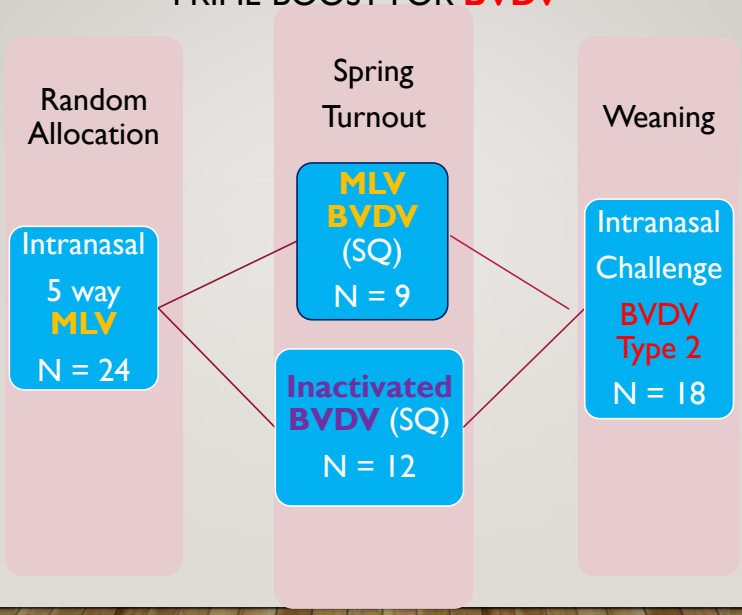


BVDV PRIME-BOOST RESPONSE (Woolums et al. 2013)

- Previous work showed BVDV seropositive calves:

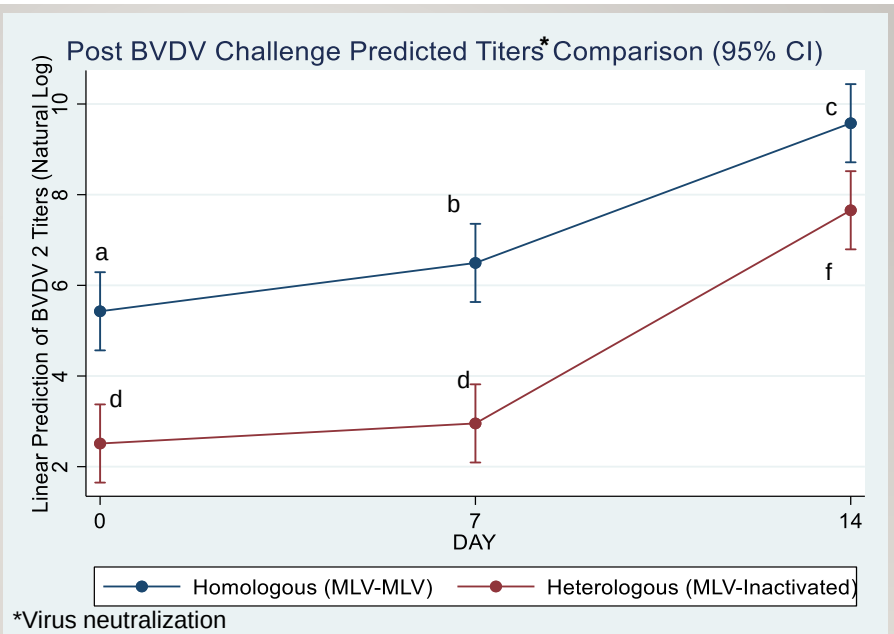


PRIME-BOOST FOR BVDV



Post BVDV exposure antibody response

Day 0 = day of BVDV exposure



Post challenge rectal temperature comparison

Shorter duration fever in MLV boost

Otherwise no clinical differences

	Rectal Temperature (F)		p Value
Day	Inactivated	MLV	
0	102.6	102.9	0.5
3	103.4	102.9	0.2
7	104.5	105.4	**0.02**
10	104.1	102.5	**<0.01**
14	103.6	102.6	**<0.01**

What does it mean?

- IN prime and SQ boost provides better protection out to weaning
- Some difference in immune response among viruses
- Advantage to neonatal prime IN – SQ boost protocols
  - Further exploration warranted: effect of pre-wean boost and/or co-mingling

Calf lifetime prime-boost vaccination adoption

- How will it be paid for? - the market will decide – (unless)
- Progress is not likely to be made if the mantra continues to be:

> "…for a 500 pound animal costing $1/lb, for every cent reduction in purchase price, the feedlot can 'afford' an additional 1% death loss…the highest potential rate of return is often associated with 'high risk' BRD scenarios…" *

*Smith A., Step D., and Woolums A. Bovine respiratory disease: looking back and looking forward, what do we see. Vet. Clin Food Anim 2020; 36:239 251.