Scenario: You manage youngstock on a large operation

As youngstock manager, you need to be able to explain the "why’s" sufficiently to:

– Establish standard operating processes (SOP’s) for youngstock
– Hire, train, motivate, monitor and evaluate employees following the SOP’s
– Explain ‘why’ sufficiently to employees to reduce protocol drift

What do you need to know to explain the ‘Nuts & Bolts’?
Resources to use?

Question and IOED exercise feedback

- Problems occur in systems that have flows, inputs and outputs
  - Systems have many interconnections and consequences
- Problems are much like onions
  - Crucial details are often in the deeper layers
  - Construct concept maps, try 5 ‘why’ questions to drill down
- What questions would a manager ask a candidate?
- Solving problems requires developing the deeper questions
  - What is the process? Is it done the same way for everything?
  - What are the pros and cons of the alternatives?
  - What is value? What are the cost-benefits?
  - What is quality? How is it measured?
  - What ways can the process be monitored? Pros and cons?
  - What ways can the process go wrong? What are the consequences of going wrong? How can these ways be prevented?

Undifferentiated Bovine Respiratory Disease Complex (BRD)

Aka:
- "Shipping Fever" - beef industry
- Enzootic Calf Pneumonia - dairy industry
- Bovine Pasteurellosis - technical

Google "Cornell Consultant" for recent literature

BRD is one of the most costly cattle diseases

Google "wsu jmgay index"
BRD causes a significant % of pre-weaning calf deaths

<table>
<thead>
<tr>
<th>Cause</th>
<th>Beef</th>
<th>Dairy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving Problems</td>
<td>33%</td>
<td>14%</td>
</tr>
<tr>
<td>Scours</td>
<td>17%</td>
<td>60%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>10%</td>
<td>24%</td>
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</tbody>
</table>

BRD causes a higher % of post-weaning calf deaths (USDA NAHMS)

<table>
<thead>
<tr>
<th></th>
<th>Beef Feedlot</th>
<th>Beef Replacement</th>
<th>Dairy Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digestive</td>
<td>13%</td>
<td>7%</td>
<td>14%</td>
</tr>
<tr>
<td>Respiratory</td>
<td>64%</td>
<td>7%</td>
<td>45%</td>
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</table>

BRD is caused by a sequence of events

- Interaction between pathogens, environment and the bovine host
  - Complex set of causal factors (ammonia, dust, stress, . . .)
- Final stage:
  - Pneumonia – acute, severe lung bacterial infection
  - Normal host flora in the wrong place

Another disease of Man(agement) with clinical signs in the bovine

Five steps lead to BRD occurrence:

1. Stress and upper respiratory ciliary damage
2. Growth of normal bacteria in upper airways
3. Failure of mucociliary mechanism to clear the ventral lung (gravity)
4. Proliferation of normal nasal bacteria (Mannheimia hemolytica A1) out of place in ventral lung
5. Vicious cycle of infectious inflammation in dependent ventral lung

The parts involved

Mannheimia hemolytica is the most common BRD pathogen

Bacteria Mannheimia (Pasteurella) hemolytica serotype A1
- Normal bacterial flora in tonsillar crypts
- Spreads easily between calves
- Proliferates when:
  - Animal is stressed (weaning, trucking, mixing)
  - Viral upper respiratory infection (IBR, PI3, . . .)
  - Certain feeds are fed (silage)
The mucociliary clearance mechanism removes particles from lungs

Based on Cilia waves:
- Moves mucous from respiratory tract to throat
  - swallowed
- Moves at 1.5 cm / min with 1,500 waves / min
- Clears 90% of bacteria in 4 hrs
- Damaged by infectious agents, dust and fumes
  - IBR, PI3 virus (commingled salebarn calves)
  - Ammonia (enclosed dairy calf barns)
  - corral dust, diesel smoke (weaned beef calves)

Ciliary damage slows or stops the clearance mechanism

In BRD normal bacteria proliferate, move to lung, are not cleared, and cause inflammation

BRD lung damage is due to a vicious cycle of inflammation

Animal’s natural response causes the lung damage!
Old whole antigen bacterins make the problem **worse** by attracting more white cells.

Know what BRD looks like in the dead animal and check for it.

Doing full necropsies is important for diagnosis and tracking. Without one, ~50% of assigned causes are wrong.

Digital camera recording is easy and inexpensive.


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https://www.cvmbs.colostate.edu/lm/proinfo/necropsy/notes/INDEX.HTML

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Pneumonia is in the ventral lung due to mucociliary clearance mechanism failure and gravity.

In chronic cases, abscesses form that contain pus.

What are the best ways to deal with herd infectious disease problems?

Given that most infectious agents remaining as problems (we’ve gotten rid of the easy ones):

- **Are ubiquitous (holoendemic)**
  - If they haven’t been found on a farm, they likely haven’t been looked for hard enough
- **Are opportunists**
  - Survive well in the environment, often months
  - Aren’t reliably curable with drugs
  - Establish carrier states in herdmates who then shed it
  - Vaccines are not 100% effective (if even available)
  - Often co-evolved with their bovine host
- What is the best approach and what is needed for that approach?
Vaccination program recommendations are local and herd specific

“Vaccine Program Recommendations” in: Basic Concepts for Cow-Calf Herd Health Programs
http://people.vetmed.wsu.edu/jmgay/courses/FDIUCowCalfHH.htm

Google search for TAMU Ranch to Rail: Value Added Calf (TexVAC) Vaccination Management Guidelines

The disease "Iceberg" means most diseased animals are not detectable visually

• Most infections are subclinical
  • Typically > 10:1
  • Can’t identify every infected animal easily
  • Important because some animals are more susceptible than normal
    – Neonates
    – Animals with other diseases

The economic loss from subclinical disease is usually greater than from clinical disease

469 steers followed from birth to feedlot to slaughter
• 35% (164) treated for BRD
• Pulmonary lesions at slaughter:
  – 78% (128) of treated steers
  – 68% (207) of untreated steers (subclinical!)
  – 0.2 lb ADG reduction
  – 46 lb slaughter weight reduction

Prevention is key to preventing production loss!

Clinical cases are the “tip of the iceberg” red flags

Consider clinically affected animals Red Flags!
They indicate the presence of a serious herd problem
They are not the full extent of the problem

For more, see “Epidemiology Concepts for Disease in Animal Groups” at
http://people.vetmed.wsu.edu/jmgay/courses/EpiMod2.htm

Reduce infection transmission between infected and susceptible in a herd

• Reproductive Ratio ($R_0$) is the number of secondary infections due to each infection
  • $> 1$: Infection spreads
  • $= 1$: Infection is stable
  • $< 1$: Infection dies out

• Hard to reduce in intensive management
  – agents co-evolved and survived with hosts when they were extensive, free-ranging

Goal: Get $R_0$ less than 1 so agent disappears from herd

Transmission has three attack points – escape, environmental survival, and infection

Goal: Separate the susceptible from the potential subclinical
Looking at the question another way

**Farm Level Reality – Most diseases are endemic**

<table>
<thead>
<tr>
<th>Non-Exposed Farms</th>
<th>Exposed Farms</th>
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<tbody>
<tr>
<td><img src="4" alt="Image" /></td>
<td><img src="5" alt="Image" /></td>
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The most important question: If almost all herds have these infectious agents, why do few herds have animals sick with them?

The answer – the presence of risk factors in those herds

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Production systems are dynamic relationships between animals, infectious agents, and their environments

When disease problems occur:

- After asking “What’s wrong?”, ask “How did the system get to this point?”
- Ask “What changed?” – A change in one point of the system often leads to unintended consequences elsewhere
- “A common error is to define the problem not by what’s happening in the system but by the lack of our favorite solution” (D Meadows)


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A particular infectious dose results in differing severity in a herd

![Graph](6)

**Goal:** Reduce infectious dose, increase host resistance

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Clinical disease doesn’t occur when resistance is high relative to exposure dose

![Graph](7)

Both vary over time and location as seasons change and animals move through the production cycle

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Pattern of Host Resistance - Calves

![Graph](8)

Pattern of Host Resistance - Cows

![Graph](9)

Most Infectious Diseases are **Opportunists**!

Note that there are more opportunists than there are vaccines!
Most vaccines provide marginal protection but not absolute protection.

Clinical disease outbreaks result from a breakdown that initiates a vicious cycle.

Focus on the entire husbandry system rather than individual diseases.

Horizontal Transmission Chain

Block infectious agent flow through the transmission chain links at multiple control points.

Apply the general principles to the entire farm system.

The neonatal calf is the most susceptible animal on most farms:

- Maximize the calf’s natural resistance and acquired immunity
- Delay and minimize the infectious dose the calf is exposed to
  - Because these agents are ubiquitous, calf must eventually acquire the infection and develop an active immunity
Know key characteristics of the prevalent infectious agents

Example - Corona & Rotoviral Diarrhea:
- Virus kills cells of intestinal villi, causing malabsorption diarrhea
- Calf begins shedding $10^{11}$ virus per gram of feces 3 days after infection
- Carrier cows continually shed low numbers of virus
- Virus survives weeks in the environment
- Vaccines available, labeled “aid in preventing”
- Antibiotics are ineffective (virus)

Handle colostrum and liquid calf feed like grade A milk for sale
- Disease-causing bacteria grow just as well in colostrum as in milk
- These bacteria are transferred with the colostrum into the blood stream
- Harvest into sanitized containers and refrigerate or freeze it if not used immediately
- Don’t pool!
  - BLV, Salmonella, and Johnes are transferred by colostrum

Good food handling practices apply everywhere

Minimize time liquid feed is between 140°F and 41°F after cooking (< 6 hrs)
- Thaw in refrigerator
- Rapid heating
- Rapid cooling
  - In freezer or refrigerator
  - In shallow pans
  - Sufficient air space

Avoid food (or feed) temperature abuse

Maximize passive transfer by monitoring it

To avoid overlooking critical points, look at every step in a process

These practices apply to farm situations, such as colostrum management!
Apply sufficient cleaning and sanitizing criteria

**General Rules:**
1. Look Clean
2. Feel Clean
3. Smell Clean

If it doesn’t, it ain’t

Agents die by exponential decay in the environment

**Proper sanitation breaks the half-life curve**

**Chemical disinfection requires an effective agent at concentration with full contact time**

- Use a disinfectant with labeled effectiveness against target agents
  - Many are not effective, such as Pinesol
  - Environmental surfaces – 1-stroke Environ, chlorine dioxide
  - Tissue contact - Nolvasan or tamed iodine
  - General use - Virkon S or chlorine dioxide
- Allow adequate contact time (temperature dependent) at sufficient concentration
  - Organic material (milk, manure, blood) inactivates most disinfectants, especially chlorine-based
  - Chlorine begins evaporating when mixed (detectable odor)

**For sanitation success doing each cleaning and disinfection step is critical**

- **First Step** - Thorough rinsing and cleaning, whether hutch, hands, or nipples
- Remove all organic matter (feces, blood, milk, milk stone, milk fat, saliva)
  - Protects infectious agents from action of disinfectants (chemical or direct sunlight)
- Soap, water, and scrubbing are the most important; mechanically removing the agents

People often want to skip this step because of the “elbow grease” often involved
VirkonS is one of the best overall disinfectants

- 1.3 ounces of Virkon S per gallon of water
- One gallon of solution treats 135 square feet
- ~$80 per 10 lbs
- Chlorine dioxide is an emerging disinfectant

For more information, see CFSPH “Disinfection 101” at http://www.cfsph.iastate.edu/BRM/resources/Disinfectants/Disinfection101.pdf

The final step of full drying is critical!

- Some agents are not killed by common disinfectants, only full drying
- Low levels of other agents will likely remain that can begin replicating later
  - Salmonella will grow on a wet board!

A common error is to leave the items in the final tank with the disinfectant, assuming they will be sterile when removed

For more, “Sanitation in the control of livestock infectious disease” at http://people.vetmed.wsu.edu/jmgay/courses/FDIUSanitation.htm

Most important is cleaning hands frequently and effectively

To wash hands:
- Wet hands (avoid HOT water – dries skin -> cracking)
- Apply soap
- Rub hands together for at least 15 seconds
- Cover all hand surfaces
- Rinse with water and dry thoroughly
- Use a paper towel to turn off faucet

Apply full pump stroke, rub until dry

When hands are not visibly soiled, alcohol-based rubs are more effective than soap and water


Groups with effective hand sanitation programs had 50% as many respiratory and gi episodes as others!

Why all the fuss about Hand Washing?

A most common mode of pathogen transmission is via hands!

- CDC estimates proper hand washing reduces foodborne illness by 50%
- Proper hand washing reduced respiratory illness 45%
- Infections acquired in dense settings (classrooms, offices, daycare)
  - 31% gi reduction, 21% respiratory reduction. AJPH106(8)1372-1381. (2008)
- Infections acquired in healthcare

Proper hand washing is the single biggest weapon against transmission of common human infectious diseases

Although 92% of people say they washed their hands, only 66% of men and 88% of women do (www.washup.org)
The House Fly *Musca domestica*

Mouth Parts

½ of “fly spots” are regurgitation of previous meal

Puparium (Pupal Case)

Flies transmit dangerous disease agents

What do you suppose the calf ingests besides water when drinking?

Colostrum cooling on the parlor floor

Dead Flies!

Don’t overlook the cycles of the vermin (flies, rodents, birds!)

Damp straw bedding is a fantastic fly incubator

Parasitic wasp raisers grow their flies in damp straw!

Most of all, avoid PPM!

Bad Management overwhelms the Best Vaccine every time!

General Livestock Food and Water Safety Rule

If you wouldn’t eat off of it or drink out of it, don’t expect a cow to either!