Environment and udder health

Anja Sipka, QMPS

Quality Milk Production Services www.prodairy.cals.cornell.edu PRODAIRY

Goal of lecture

- Understand the connection between cow housing and udder health
- Importance of dry cow housing
- Evaluation of stalls
- Collection of bedding samples
- Interpretation of culture results

Quality Milk Production Services www.prodairy.cals.cornell.edu PRODAIRY

Udder health goals

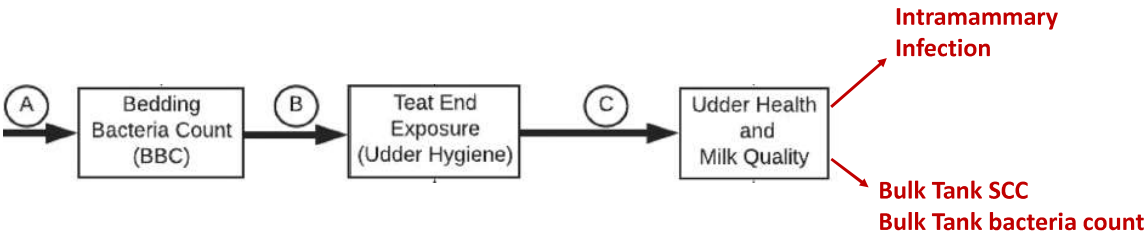
Prevention is overall goal -> reduce the incidence of mastitis

- What are the main organisms causing mastitis in the herd?
- **Where is the greatest opportunity area?**

-> Targeted Risk Assessment

Cow Environment is always part of this process!

Environment and udder health



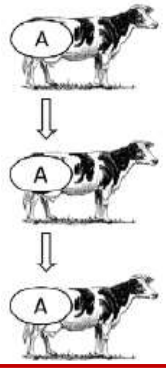
Reducing bacterial load in the cow's environment is one of the basic strategies in environmental mastitis control.

Patel et al. 2019

Infection dynamics

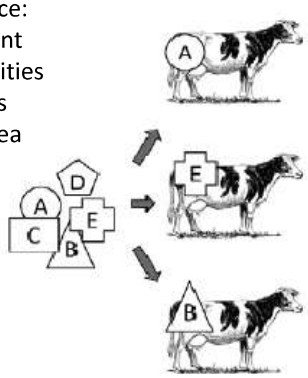
'Contagious mastitis'

Major source: Cow



'Environmental mastitis'

Major source:
Environment
Housing facilities
Walkways
Holding area
etc.



Dominant strain=cow to cow transmission?

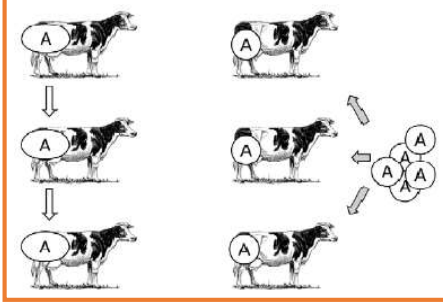
Klaas and Zadoks 2018

Dominant strains

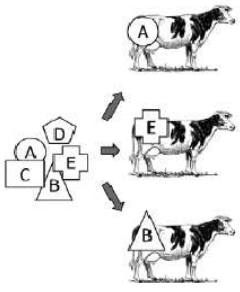
'Contagious mastitis'

'Environmental mastitis'

Dominant strain



Multiple strains



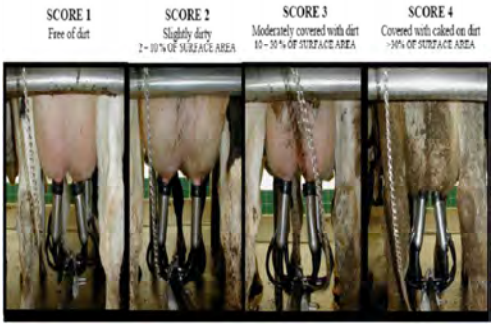
- Contagious versus Environmental spread
- Identification of a dominant strain does not exclude an environmental point source

Klaas and Zadoks 2017

Environment and udder health

- Reservoir of most major mastitis pathogens
  - *E. coli*
  - ***Klebsiella spp.***
  - *Streptococcus spp. (uberis, dysgalactia)*
  - ***Lactococcus***
  - Non-aureus *Staphylococcus species*
  - Other pathogens in certain situations

Udder Hygiene



Schreiner, D. A., P. L. Ruegg 2003. Relationship between Udder and Leg Hygiene Scores and Subclinical Mastitis. *Journal of Dairy Science.* 86:3460-3465

„Linear somatic cell scores increased as udder hygiene score increased."

„There was a significant association between the prevalence of intramammary contagious pathogens and udder hygiene score."

Udder Hygiene

Manure from stalls

Splashing in alley ways or walkways

Cow positioning

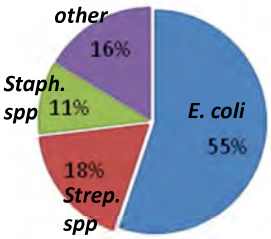
Alley ways

Targeted Risk Assessment

- When is the initial mastitis happening?
  - During the dry period
  - During lactation
  - Specific pen

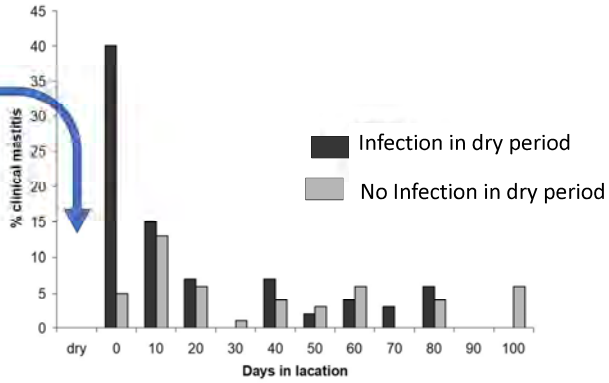
Dry period infections

Infection in the dry period



-> Acquired in environment!

Clinical mastitis in early lactation



Green et al. 2002

Susceptible points in the dry period

- Right after dry-off: high udder pressure -> leakage
- Right before calving: rising udder pressure, negative energy balance, immune dysfunction
- Clean environment during this time is crucial!

Challenges of dry cow housing

Evaluating milking cow facilities

- Stall cleanliness
- Cow positioning
- Bedding level
- Alley and walkway cleanliness
- Bedding samples

-> Goal: find opportunities to improve udder hygiene and reduce infections

Stall cleanliness

- Evaluate all functional stalls.
- Evaluate stall cleanliness as 1 or 2.
- 1 = mostly/completely clean no evidence of manure/urine, e.g. just looks used
- 2 = dirty piles of manure, urine pooling

Guideline: 20% or fewer stalls with score 2

Bedding quantity

- Evaluate the bedding quantity for deep beds.
  - 1 = adequate bedding: minimal curb exposure
  - 2 = inadequate bedding: visible curbs, holes where cows lay down
- Evaluate the bedding quantity for mattresses.
  - 1 = adequate bedding: none or only one small bare spot (<32 in), mattress not visible
  - 2 = inadequate bedding: no bedding, mattress visible in multiple spots

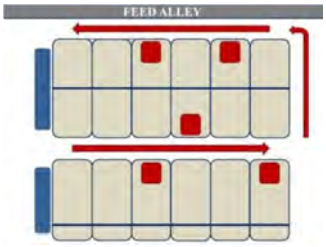
Bedding sampling strategy

- What is the bacterial load of fresh bedding?
- What is the bacterial load cows experience at the end of a bedding cycle -> 'worst case scenario'
- Is bedding stored on the farm before spreading in stalls -> 'pile'

Bedding sampling material

- Disposable gloves
- Sealable bags (1 gallon, e.g. zip lock)
- Cooler with ice for transportation
- Permanent marker

Selecting stalls



- DO NOT Walk behind the vehicle delivering new bedding.
- Have vehicle dump extra bedding in 5 stalls throughout pen.
- collect from the top of this pile
- avoid any used bedding.

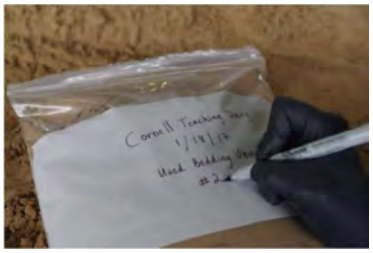
Sampling stalls

- Sample 3 to 5 representative stalls into one clean bag.
- Only sample bedding from the 2’ x 2’ section where the udder would touch the stall.
- Scrape 1 inch off the top of the bedding material.

Getting 'the worst-case scenario' stalls

- Answers the question: what is the bacterial load in clean stalls at the end of a bedding cycle.
- Sample right before new bedding is spread
- Select stalls that are used but DO NOT show any manure or urine accumulation

Sampling handling



- Label the bags with this information
  - Farm
  - Date
  - New or used bedding
  - Type of bedding (e.g. sand, manure solids)
- Place the samples in a cooler with ice for travel.
- Freeze, if they are not processed the same day.

Bedding culture results

What does it mean????
Cut off values?
Recommendations?

Sample ID:	NEW Bedding Material	USED Bedding Material
Streptococcus		
Streptococcus spp	833,333	21,149,425
Staphylococcus		
Staphylococcus spp	not detected	not detected
Coliform Bacteria		
E coli	not detected	1,839
Klebsiella spp	not detected	not detected
Other coliforms	not detected	not detected
Other Bacteria		
Gram negative bacillus	not detected	11,494
Gram positive bacillus	not detected	not detected
Corynebacterium spp	27,333,333	193,103,448
T pyogenes	not detected	not detected
Pseudomonas spp	not detected	not detected
Other Organisms		
Prototheca spp	not detected	not detected
Yeast	not detected	not detected
Mold	not detected	not detected
Other Fungus	not detected	not detected
Total (CFU) Streptococcus spp	833,333	21,149,425
Total (CFU) Staphylcoccus spp	not detected	not detected
Total (CFU) Coliforms	not detected	1,839
Total (CFU) Other Bacteria	27,333,333	193,114,943
Total (CFU) Other Organisms	not detected	not detected
Total Number (CFU)	**28,166,666**	**214,266,207**
Streptococcus agalactiae	not detected	not detected
Staphylococcus aureus	not detected	not detected

Bedding culture guidelines

- Data from 168 herds in 17 states across the country
- 4 common bedding types:
  - New sand
  - Recycled sand
  - Recycled manure solids
  - Organic bedding
- Udder health outcomes:
  - Test day average SCC
  - New infections

Patel et al. 2019, Rowe et al. 2019

Bedding bacteria load and udder health

- Unused and used bedding bacteria counts are associated with udder health
- Minimal differences between bedding types
- Benchmarks to monitor bedding hygiene -> orientation not cut off values!!

Patel et al. 2019, Rowe et al. 2019

CFU benchmarks

- Achievable benchmarks for bacterial counts associated with improved udder health

Pathogen group	Unused bedding	Used bedding
Klebsiella	0 cfu/cm^3	0 cfu/cm^3
Coliforms	≤ 500 cfu/cm^3	≤ 10,000 cfu/cm^3
Streptococcus-like organisms	0 cfu/cm^3 ≤ 1,000 cfu/cm^3 *	≤ 500,000 cfu/cm^3
Staphylococcus species	0 cfu/cm^3	0 cfu/cm^3

* Recycled manure solids

Patel et al. 2019, Rowe et al. 2019

Summary

- Bacterial load in the environment affects:
  - Intramammary infection
  - Bulk tank cell counts
  - Bulk tank bacteria counts
- Dominant mastitis strains can spread from point sources in the environment
- Targeted risk assessment of environment by lactation stage
  - Milking cows
  - Dry cows -> higher susceptibility during early dry-off and close to calving

Summary

- Evaluation of cow housing
  - Risk assessment tool
  - Stall cleanliness
  - Cow positioning
  - Bedding amount
  - Bedding culture
- Bacteria counts in bedding are associated with udder health.
- Benchmarks for bedding bacteria counts give guidelines.

Quality Milk Production Services

www.prodairy.cals.cornell.edu

PRODAIRY