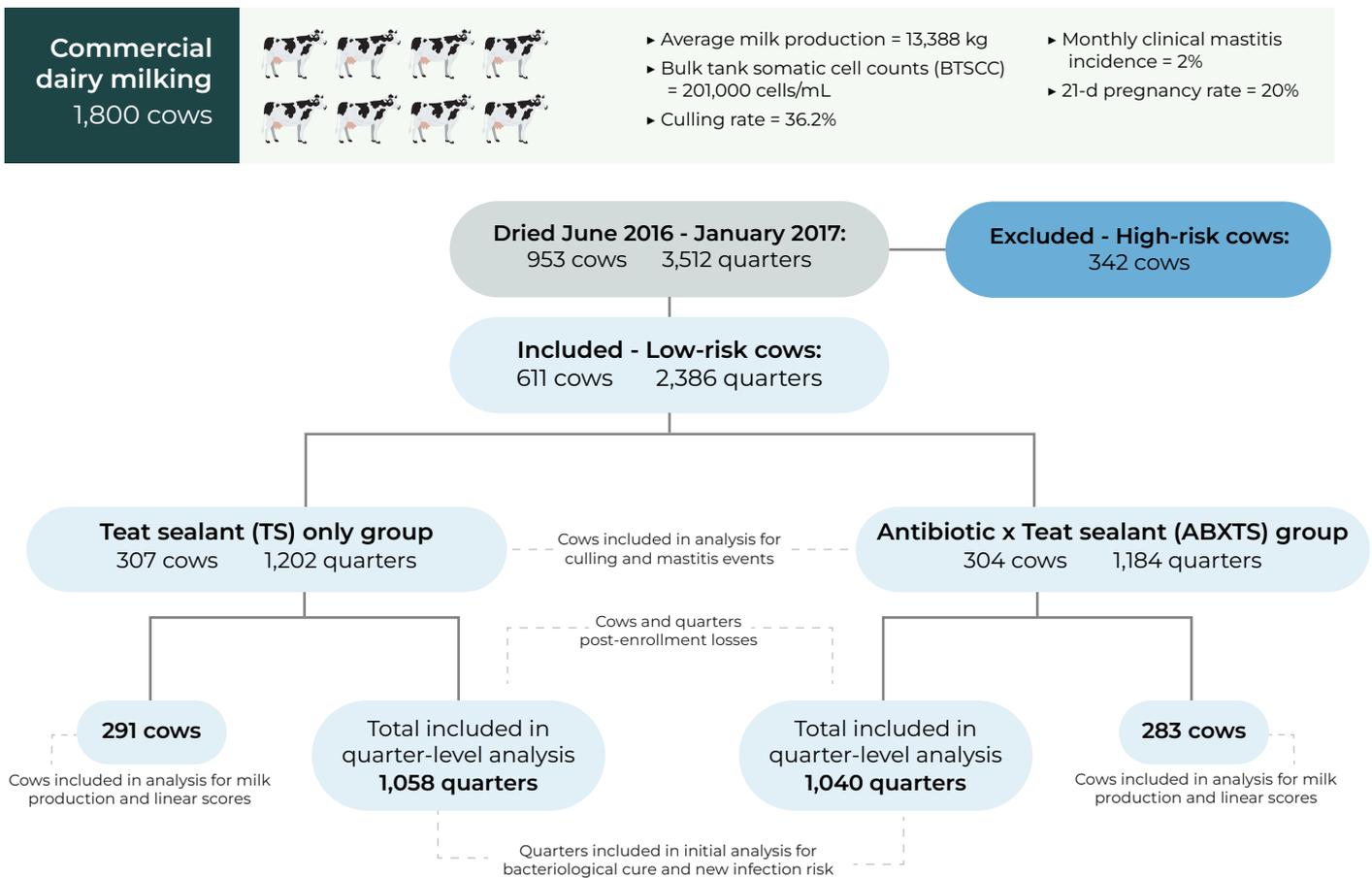# Evaluation of a culture-independent, on-farm algorithm for the use of selective dry cow antibiotic therapy

Objective

To develop an algorithm using computer-based records to support selective dry-cow therapy—by identifying cows at low or high risk of intramammary infection (IMI) during the dry period—for targeted use of antibiotics and/or external teat sealants (Blue V Seal®).

Study design

Commercial dairy milking 1,800 cows		
► Average milk production = 13,388 kg	► Monthly clinical mastitis incidence = 2%	
► Bulk tank somatic cell counts (BTSCC) = 201,000 cells/mL	► 21-d pregnancy rate = 20%	
► Culling rate = 36.2%		

Dried June 2016 - January 2017:
953 cows   3,512 quarters

Excluded - High-risk cows:
342 cows

Included - Low-risk cows:
611 cows   2,386 quarters

Cows included in analysis for culling and mastitis events

Teat sealant (TS) only group
307 cows   1,202 quarters

Antibiotic x Teat sealant (ABXTS) group
304 cows   1,184 quarters

Cows and quarters post-enrollment losses

291 cows
Cows included in analysis for milk production and linear scores

Total included in quarter-level analysis
1,058 quarters

Total included in quarter-level analysis
1,040 quarters

283 cows
Cows included in analysis for milk production and linear scores

Quarters included in initial analysis for bacteriological cure and new infection risk

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High-risk cows

- ► High average SCC
- ► High last test SCC
- ► Anticipated dry period >100 days
- ► >1 mastitis event in the current lactation
- ► Clinical mastitis on dry-off day
- ► <3 functional quarters

IMM antibiotics + **BLUE V SEAL**®

Low-risk cows

- ► Average SCC over the last tests before dry-off = ≤200,000 cells/mL
- ► SCC ≤200,000 cells/mL on the last test
- ► No more than 1 case of clinical mastitis in the current lactation
- ► Not treated with antibiotics in the last 30 days

Two groups:

- ► TS group: only external teat sealant (**BLUE V SEAL**®)
- ► ABXTS: IMM antibiotics + **BLUE V SEAL**®
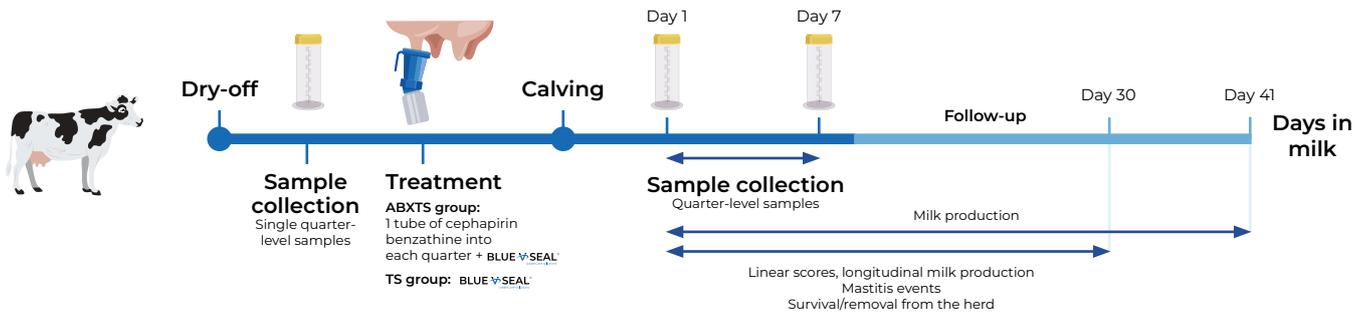
Quarters assessment

▸ **Bacteriological cure** The initial pathogen present at enrollment is not present in the fresh quarter sample.
▸ **New infection** The organisms cultured at dry-off and at freshening are different.
▸ **Contamination** Isolation of ≥3 different colony types from the milk sample.

Results

Infection status at dry-off and freshening

Cow-level intramammary infection (IMI) prevalence at dry-off and post-partum for high-risk and low-risk cows.

Dry-off	High-risk cows	Low-risk cows
Cow-level IMI prevalence	70.7% (n=99/140)	29.4% (n=178/605)
Quarter-level IMI prevalence	29.8% (n=165/553)	9.6% (n=229/2,379)

Post-partum	High-risk cows	Low-risk cows
Quarter-level IMI prevalence	7.3% (n=36/495)	8.2% (n=182/2,225)

At dry-off, the most commonly isolated organisms for both low- and high-risk cows were coagulase-negative staphylococci (CNS). Infection proportion with *Corynebacterium* spp. was similar, but *Lactococcus* spp. were more prevalent in high-risk quarters.

Fresh quarter-level culture results for low-risk cows, receiving either Blue V seal (TS) or antibiotics and Blue V Seal (ABXTS) at dry-off.

	TS		ABXTS		
Culture result	No.	%	No.	%	*p*-value
Negative	983	87.1	998	91.0	0.004
CNS	68	6.0	34	3.1	0.001
Contamination	35	3.1	27	2.5	0.370
Mixed growth	12	1.1	7	0.6	0.360
Lactococcus spp.	13	1.2	7	0.6	0.260
Streptococcus spp.	8	0.7	10	0.9	0.640
Corynebacterium spp.	2	0.2	6	0.5	0.170
Other	7	0.6	8	0.7	0.800
Total IMI	110	9.8	72	6.7	0.0701

At post-partum, the most common positive culture result was CNS, both in low-risk and high-risk quarters.

Treatment effects

Bacteriological cure rates

	Quarters showing bacteriological cure n=171
High-risk cows	94.9% (n=112/118)
Low-risk cows, TS	83.7% (n=72)*
Low-risk cows, ABXTS	92.9% (n=79)*
Overall bacteriological cure	88.3% (n=151/171)

p = 0.09
When including variables (etiology of infection and DIM at retrieval of fresh quarter sample), the bacteriological cure was approximately 3.1 times higher for ABXTS quarters than for TS quarters.

Coagulase-negative staphylococci comprised 95% of the non-cures on the trial dairy, yet these minor pathogens contributed only one case of clinical mastitis in low-risk cows over the trial period.

New infections risk

	Quarters showing new IMM risk
High-risk cows	6.8% (n=31/456)
Low-risk cows, TS	7.3% (n=77/1,058)*
Low-risk cows, ABXTS	5.5% (n=57/1,040)*
Overall bacteriological cure	6.4%

p = 0.09
When including variables (parity and dry-off quarter growth), the odds of new infection for TS versus ABXTS was 1.29.

Culling and mastitis events

▸ 94.6% of enrolled cows remained in the herd until they reached 30 DIM.

▸ 33 cows were culled or died (TS=15; ABXTS=18).
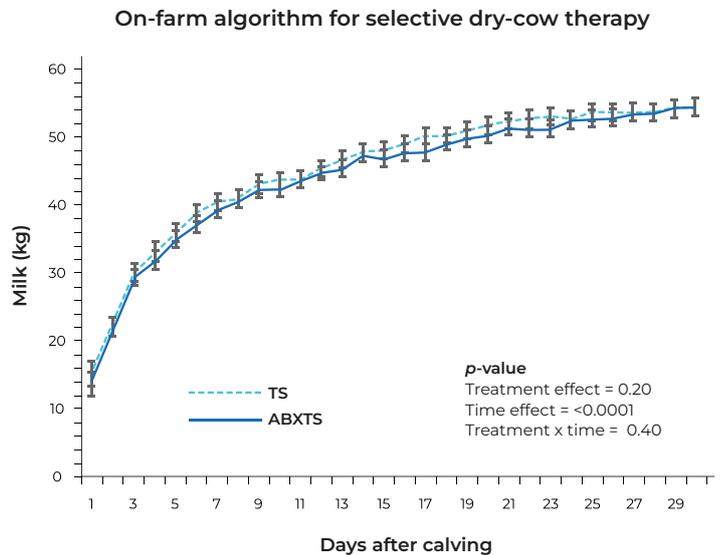
▸ There were no cases of clinical mastitis during the dry period for cows in either group.

▸ There were 14 cases of clinical mastitis in the first 30 DIM (TS=5; ABXTS=9).

▸ When including variables (linear scores (LS) at first test and whether the cow had a mastitis event during the lactation of enrollment):

• The odds for mastitis were numerically higher for a cow that had experienced one case of mastitis during the lactation of enrollment than for a cow that had not (p = 0.08).

• As first test-day LS increased, the odds of clinical mastitis increased (p = 0.003).

Milk production and LS

In a mixed linear regression model (n=574; TS=290, ABXTS=284):

▸ The TS cows produced 0.69 kg more milk (TS=41.2 kg; ABXTS=40.5; p = 0.35)

▸ As LS at first-test day increased, milk production decreased (p>0.001).

▸ As milk production at last test-day or DIM at first test-day increased, milk production increased (p<0.001).

Means for milk production were numerically greater in the TS group for each of the first 26 DIM, but neither the effect of treatment nor the treatment by time interaction was important in the model.

On-farm algorithm for selective dry-cow therapy

p-value
Treatment effect = 0.20
Time effect = <0.0001
Treatment x time = 0.40

- - - TS
—— ABXTS

Days after calving

Milk (kg)

Conclusions

Intramammary infections present at calving have significant economic consequences, including reduced milk yield and quality, as well as increased incidence of clinical mastitis.

▸ Implementation of the algorithm resulted in a **~60% reduction in dry cow antibiotic use** without adverse effects on production parameters or health indicators, such as new intramammary infections, milk yield, first-test LS, clinical mastitis, or culling.

▸ The use of **selective dry cow therapy protocols**, such as the algorithm evaluated in this trial, reduces the risk of antimicrobial residues in bulk tank milk and lowers the potential for antimicrobial resistance.

▸ **Blue V Seal®** is effective at preventing new IMIs during the dry period when applied regularly and according to the label.

References
Vasquez, A.K., Nydam, D. V., Foditsch, C., Wieland, M., Lynch, R., Eicker, S. and Virkler, P.D. Use of a culture-independent on-farm algorithm to guide the use of selective dry-cow antibiotic therapy (2018). Journal of Dairy Science 101 (6): 5345-5361.

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