The Impact of Transition Cow Disease: Why Its Greater Than We Realize

Michael Overton, DVM, MPVM
Elanco Animal Health
Advisor – Dairy Analytics
moverton@elanco.com

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Elanco Cattle Business
moverton@elanco.com

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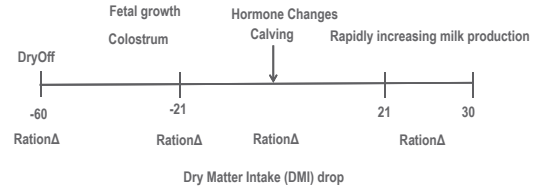
Transition Cow



A 90 day collection of transition periods that have interrelated events influencing either productive or non-productive outcomes in the lactation

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To Quantify the Financial Impact of Milk NOT Produced Due to Disease…What Information is Needed?

- How much disease is present?
- What is the typical or expected impact of disease on milk production?
- What is the value of the milk that is not produced?
- Value and quantity of feed that is not consumed due to milk not being produced

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- When estimating the feed cost associated with incremental milk, we do not have to consider maintenance feed; we only have to account for the energy required to produce the marginal milk
- To produce 1 liter of milk with 3.8% fat, 3.1% protein, and 4.8% lactose:
  - Each gram of fat requires 9.3 kcal gross energy: 38 g milk fat * 9.3 = 353 kcal
  - Each gram of protein requires 5.5 kcal gross energy: 31 g protein * 5.5 = 171 kcal
  - Each gram of lactose requires 4.0 kcal gross energy: 48 g lactose * 4.0 = 192 kcal

  Total 716 kcal
- 716 kcal/ liter = 0.72 Mcal NE_L/ liter or 0.33 Mcal NE_L/ lb of marginal milk
- If TMR energy density = 0.78 Mcal NE_L/ lb

  ➔ 1 lb TMR DM supports 0.78/0.33 = 2.36 lb milk
- If feed cost = $0.11/lb, 1 lb marginal milk requires 0.11/2.36 = $0.05 feed
- $0.05 of feed to produce an *extra* or incremental lb of milk

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(NRC. 2001. 7th ed. National Academy Press, Washington, p. 19.)

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What Can We Do in Early Lactation to Combat Transition Challenges?

- Use high quality feed ingredients (properly balanced with sufficient fiber) to promote feed intake
- Manage environment to minimize stress and weight loss during fresh period
- Provide adequate and comfortable resting access
- Remove other stressors (overcrowding, mixed parities, excessive standing times, excessive walking distances, etc)
- Consider specific feed additives, pharmacologic interventions
- Be careful with pen moves
- Promptly identify and appropriately treat fresh cow disorders

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Management in The Vital 90™ Days is Critical:

*RISK, **COSTS**, and OPPORTUNITY*

Two Major Types of Costs During The Vital 90 Days

Investment Costs (Expenditures)

- Dairy producers often invest heavily to mitigate the *RISK* associated with calving
- Many products and procedures are justifiably used to reduce disease and optimize performance

Consequence Costs (Losses)

- Direct and indirect costs of disease are a major source of economic loss and frustration for dairy producers
- Lowering consequence costs through reducing disease and refining treatment decisions is a great opportunity to improve profitability

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When Estimating the Cost of Disease, There are a Number of Issues that Need to be Considered

- **Direct disease costs (losses)**:
  - Diagnostics – is there any kind of special screening or lab test that is performed?
  - Therapeutics – what are the various antimicrobials, supportives, anti-inflammatories, etc that are used in treatment?
  - Discarded milk – how much milk is being discarded and for how long? What is the true value of this milk? Is it used to feed calves or discarded?
  - Veterinary service – is the vet involved with either diagnosis or treatment of this issue?
  - Labor – how much of my on-farm labor's time is used to diagnose or treat this issue?
  - Death – how many cows die as a consequence of this disease and what is the true economic impact to the dairy?

Estimating Cost of Disease: Issues that Need to be Considered

- **Indirect disease costs (lost opportunity)**:
  - Milk production loss – how much marginal milk is NOT produced throughout lactation as a result of this disease issue and what is that worth?
  - Culling loss – how many cows leave the herd prematurely as a consequence of this issue and what is the economic impact to the dairy?
  - Reproductive loss – how much is my reproductive performance negatively impacted by this issue and what could that be costing the herd?
  - Losses due to other attributable disease issues – are there any other disease issues that are impacted by the occurrence of this issue?

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How Do We Monitor Transition Cows?

- NEFAs or BHBAs
- Urine pH
- Stocking density
- Ca +/- Mg at calving
- Daily milk (start up milk)
- Early lactation milk (first test milk)
- Peak milk
- p305ME milk
- SCC
- 1st test fat or fat:protein
- Feed intake
- Disease incidence
- % Sold and Died
- Rectal temperature
- Ruminations
- Resting time

Cow vs. herd level metrics; Leading vs. lagging metrics;
Some metrics are better than others for making timely decisions

Recorded Disease Incidence in US Holstein Cows in the DDAS System (Herd-level)

	Mastitis (1st 30 DIM)		Metritis		Retained Placenta		LDA (1st 30 DIM)	
	Lact = 1	Lact > 1	Lact = 1	Lact > 1	Lact = 1	Lact > 1	Lact = 1	Lact > 1
"X" Herds	6.8%	6.6%	22.7%	13.6%	3.7%	7.5%	1.3%	3.3%
"Y" Herds	5.0%	6.5%	9.5%	4.6%	2.6%	4.0%	1.8%	2.1%

Variables included in model included Herd, Month of Calving, Year of Calving, Calf (male, female, twin) and Lactation Group

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Milk Production for Holstein Cows in the DDAS System

	Cumulative Milk 30		Projected 305 Milk	
	Lactation = 1	Lactation > 1	Lactation = 1	Lactation > 1
"X" Herds	1,698 lb	2,526 lb	22,779 lb	26,372 lb
"Y" Herds	1,585 lb	2,244 lb	20,192 lb	23,331 lb
Difference	113 lb	282 lb	2,587 lb	3,041 lb

Variables included in model included Herd, Month of Calving, Year of Calving, Calf (male, female, twin) and Lactation Group

Culling in First 60 DIM

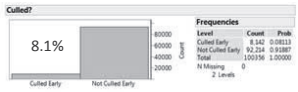
Lactation = 1

"X" Herds

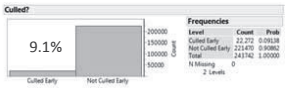
"Y" Herds

Lactation > 1

"X" Herds



"Y" Herds



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Variables included in model included Herd, Month of Calving, Year of Calving, Calf (male, female, twin) and Lactation Group

All of these herds were Holstein herds
"X" herds appeared to more consistently record mastitis and metritis
"Y" herds failed to consistently record mastitis, metritis, or both on a consistent basis

Accurately Recording Disease Occurrence, Even if it is NOT Treated, is Critical for Understanding the Impact of Disease on a Herd and for Improving Management

- In the previous examples:
  - The "X" herds produced more milk and had lower culling risk despite having MORE *recorded* disease
  - Disease incidence is much more susceptible to detection and recording bias as compared to more subjective outcomes such as milk production and culling (sold & died)
- Most herds only record what they treat as opposed to what actually occurs
  - To better understand the impact of disease on a herd, we need to identify all disease whether treated or left untreated

How Much Does the Failure to Record Disease Affect the *Measurable* Impact of Disease?

- Introduces bias into the system
- Types of bias/recording issues:
  - Failure to record any disease
  - Failure to correctly distinguish mild from severe
  - Failure to record mild disease
  - Misclassification of a normal cow as "diseased"

Metritis Severity Score *Misclassification* Under Predicts Consequence Cost Of Disease*

- Convenience sample of DC305 data from 1 Mid-Western Holstein herd
  - 1 year of calvings (n = 3,485)
- Herd chosen because it does an excellent job of recording metritis incidence & severity
  - No metritis recorded (**NR**)
  - Mild metritis
  - Severe metritis

*McCarthy, M. M. and M. W. Overton (2018). Journal of Dairy Science 101(6): 5434-5438.

Metritis score classification (misclassification)

Metritis severity as recorded
Normal herd recorded data 1. No metritis recorded 2. Mild metritis 3. Severe metritis

Cow Numbers (by Metritis severity)	Number	% of herd
None	2,353	71.8%
Mild	810	24.7%
Severe	114	3.5%
Total	3,277	100.0%
Total metritis	924	28.2%
Mild "under-recorded"		

McCarthy, M. M. and M. W. Overton (2018). Journal of Dairy Science 101(6): 5434-5438.

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Metritis score classification (misclassification)

Metritis severity as recorded	Mild cases under-recorded
Normal herd recorded data 1. No metritis recorded 2. Mild metritis 3. Severe metritis	Randomized 45% of mild cases to "not recorded" 1. No metritis recorded 2. Mild metritis 3. Severe metritis

Cow Numbers (by Metritis severity)	Number	% of herd	Number	% of herd
None	2,353	71.8%	2,716	82.9%
Mild	810	24.7%	447	13.6%
Severe	114	3.5%	114	3.5%
Total	3,277	100.0%	3,277	100.0%
Total metritis	924	28.2%	561	17.1%
Mild "under-recorded"			363	44.8%

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Metritis score classification (misclassification)

Metritis severity as recorded	Mild cases under-recorded	Mild cases not recorded
Normal herd recorded data 1. No metritis recorded 2. Mild metritis 3. Severe metritis	Randomized 45% of mild cases to "not recorded" 1. No metritis recorded 2. Mild metritis 3. Severe metritis	All mild metritis cases reclassified as "not recorded" 1. No metritis recorded 2. Severe metritis

Cow Numbers (by Metritis severity)	Number	% of herd	Number	% of herd	Number	% of herd
None	2,353	71.8%	2,716	82.9%	3,163	96.5%
Mild	810	24.7%	447	13.6%	0	0.0%
Severe	114	3.5%	114	3.5%	114	3.5%
Total	3,277	100.0%	3,277	100.0%	3,277	100.0%
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Statistical Approach for Analyzing Milk Production

- 2nd Test 305 ME milk was analyzed via multi-variable regression models for each of the metritis score classifications
- Explanatory variables included in the models
  - Lactation group
  - Month fresh
  - Twin or singleton
  - Dystocia Y/N
  - Early disease in first 30 DIM Y/N
    [Mastitis, RP, Ketosis, DA, Metritis (severe, mild)]

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Predicted 305M and Associated Losses

	Metritis Severity as Recorded (Actual)	
Cow Numbers (by Metritis severity)	Number	% of Herd
None	2,353	71.8%
Mild	810	24.7%
Severe	114	3.5%
Total	3,277	100.0%
Total metritis	924	28.2%
Mild "under-recorded"		
Milk Production (by Metritis Severity)	**305ME (lb)**	**Diff vs. None**
Herd Average	26,930	573
None	27,204	0
Mild	26,357	-847
Severe	25,338	-1866
Milk Loss Due to Metritis		
Actual Milk Loss		-898,826
Apparent Milk Loss		
Cost of *Apparent* Milk Loss		-$110,427
Difference from Actual (Value)		base
Difference from Actual (lb)		base

Based on milk price of $0.17/lb, feed cost of $0.11/lb, and 0.43 lb of feed (DM) per lb of milk

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Severe	114	3.5%	114	3.5%
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Total metritis	924	28.2%	561	17.1%
Mild "under-recorded"			363	44.8%
Milk Production (by Metritis Severity)	**305ME (lb)**	**Diff vs. None**	**305ME (lb)**	**Diff vs. None**
Herd Average	26,930	573	26930	541
None	27,204	0	27083	0
Mild	26,357	-847	26389	-695
Severe	25,338	-1866	25412	-1671
Milk Loss Due to Metritis				
Actual Milk Loss		-898,826		-898,826
Apparent Milk Loss				-501,134
Cost of *Apparent* Milk Loss		-$110,427		-$61,568
Difference from Actual (Value)		base		$48,859
Difference from Actual (lb)		base		397,692

Based on milk price of $0.17/lb, feed cost of $0.11/lb, and 0.43 lb of feed (DM) per lb of milk

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Predicted 305M and Associated Losses

	Metritis Severity as Recorded (Actual)		Mild Cases Under-recorded		Mild Cases NOT Recorded	
Cow Numbers (by Metritis severity)	Number	% of Herd	Number	% of Herd	Number	% of Herd
None	2,353	71.8%	2,716	82.9%	3,163	96.5%
Mild	810	24.7%	447	13.6%	0	0.0%
Severe	114	3.5%	114	3.5%	114	3.5%
Total	3,277	100.0%	3,277	100.0%	3,277	100.0%
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Milk Production (by Metritis Severity)	**305ME (lb)**	**Diff vs. None**	**305ME (lb)**	**Diff vs. None**	**305ME (lb)**	**Diff vs. None**
Herd Average	26,930	573	26930	541	26930	26930
None	27,204	0	27083	0	26985	0
Mild	26,357	-847	26389	-695	0	-26985
Severe	25,338	-1866	25412	-1671	25485	-1499
Milk Loss Due to Metritis						
Actual Milk Loss		-898,826		-898,826		-898,826
Apparent Milk Loss				-501,134		-170,941
Cost of *Apparent* Milk Loss		-$110,427		-$61,568		-$21,001
Difference from Actual (Value)		base		$48,859		$89,426
Difference from Actual (lb)		base		397,692		727,885

Based on milk price of $0.17/lb, feed cost of $0.11/lb, and 0.43 lb of feed (DM) per lb of milk

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Implications

- Misclassification of metritis results in greater bias and underestimates the true association between metritis and milk production, reproductive performance and culling risk
  - Misclassification leads to an underestimate of the consequence costs of diseases like metritis
- Improved definition and recording of metritis herds can lead to better interpretation of the true impact of metritis (and other diseases) on individual herds

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The Subsequent Data are from the Previously Mentioned "X" Herds

- All herds use either DC305 or PCDART
- Selected an 18-month period of calvings (1/1/15 - 6/30/16)
  - Eliminated herds that had unreasonably low recorded incidences of mastitis, metritis, RP and DA
  - Eliminated herds that did not have milk production information
  - Filtered to include only Holstein cows
- Result: 158,676 lactation records from 28 herds in 12 states:
  - CA, CO, FL, GA, ID, IN, KS, MI, MN, NC, NY, and WI
- REMEMBER: This is observational analyses of farm reported information

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Disease Incidence – Cow-level (within 30 DIM)

All Cows:

Lactation = 1:

Lactation > 1:

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High-Level Overview of the Analyses Performed

- Separate models for lactation = 1 and lactation > 1
- Multivariable models to examine:
  - Projected 305d Milk
  - Time-to-removal by 60 DIM (sold or died)
  - Time-to-pregnancy by 250 DIM
- Estimated the value of milk not produced using concept of marginal milk value
- Estimated losses associated with culling using depreciated cow model
- Estimated losses associated with reproductive losses using median days open

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Summarization of Estimated Disease Impacts in this U.S. Data Set (using projected 305 Milk)

	Variable	305 Milk Milk Loss	Early Culling Loss	Repro Loss	Milk, Early Culling & Repro Losses/Case*	Incidence
Lactation = 1	Early Mastitis	($164)	($97)	($27)	($288)	4.5%
	Metritis	($114)	($9)	($99)	($222)	22%
	RP	($157)	($19)	($149)	($325)	4%
	DA	($413)	($130)	($82)	($625)	0.9%
	Any Early Disease	($109)	($35)	($52)	($196)	42%
Lactation > 1	Early Mastitis	($243)	($79)	($42)	($365)	6.4%
	Metritis	($188)	($22)	($129)	($340)	12.7%
	RP	($124)	($11)	($156)	($291)	7.2%
	DA	($453)	($130)	($77)	($660)	3.4%
	Any Early Disease	($180)	($66)	($82)	($327)	38%

These losses are based on dairy-reported disease incidence and do NOT include labor, treatment, or veterinary services costs. Also, culling losses were considered only through 60 DIM.

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Even the Best Economic Models are Severely Limited in Utility if the Input Data are Inconsistent or Inaccurate

- Disease records are extremely variable. Inconsistencies may preclude us from making faster advances in
  - understanding the impact of disease on cow performance
  - understanding the relationship between diseases
  - rate of genetic progress
- What if the disease definition used was different?
- What if the detection approach used was different?
- What if the herd inconsistently recorded it?
- It is CRITICAL that we work towards more consistent disease definitions, detection and recording
  - Disease treatment protocols with standardized recording can really help this effort

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Management in the The Vital 90™ Days is Critical: *RISK, COSTS, and **OPPORTUNITY***

- Opportunity:
  - With improved risk management and disease prevention efforts during The Vital 90 Days…
    - Reduced disease incidence
    - Lower treatment costs
    - Reduced mortality and culling
    - Higher milk production throughout lactation
    - Opportunity for improved reproductive performance
  - Healthier transition cows = greater profit potential
- Better disease information (more accurate and complete records) could help our efforts towards healthier transition cows

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Summary

- The RISK of disease is very high during The Vital 90 Days
- The COST of both clinical and subclinical disease is often higher than we might imagine
  - We often are unaware of the magnitude of the opportunity costs of disease
  - With incomplete disease records, the *apparent* impact is less than the *true* impact
- Consequently, there is a huge OPPORTUNITY for most dairies to improve performance and profitability
  - Improvements in disease detection, recording and interpretation of records can help accelerate our progress

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Thanks For Your Attention!

Michael Overton, DVM, MPVM
(706) 248-4664
moverton@elanco.com

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