

# TRANSITION COW MANAGEMENT AND OUTCOMES IN NORTHEAST HERDS

A. B. Lawton<sup>1</sup>, W. S. Burhans<sup>1</sup>, D. V. Nydam<sup>2</sup>, and T. R. Overton<sup>1</sup>

<sup>1</sup>Department of Animal Science and PRO-DAIRY, Cornell University

<sup>2</sup>Department of Population Medicine and Diagnostic Sciences, Cornell University

## Introduction

- Many management and nutritional factors contribute to transition cow success
- Recommendations driven by field experience
- Concepts from small n controlled research often applied
- Limited large-scale data exist
- Need for an observational study involving well-managed farms
- Overall study objective:
  - To determine the effect of transition cow nutritional and non-nutritional management on health, culling, milk production, reproductive outcomes, and energy and inflammation blood biomarkers

## Presentation objective

- Objective for today
  - To describe factors pertaining to the transition cow that may have an effect on performance in large, high producing Northeastern herds
  - Compare performance factors with previous research and NYSCHAP achievable and alarm rates

## Herd Enrollment

- Enrolled based on farm's willingness to participate
- Enrolled in 1 of 6 nutritional strategies

Dry Cow Strategy	Early Lactation Strategy
Low Energy (<16% starch)	High energy (>25% starch)
Step-up (far-off <16% starch, close-up >16% starch)	Step-up (fresh <25% starch, high >25% starch)
High Energy (>16% starch)	

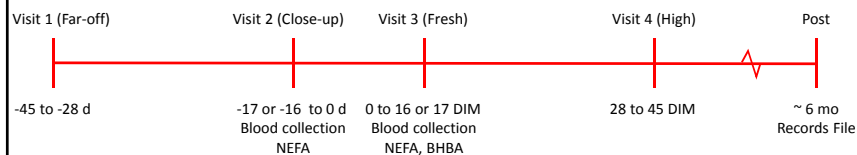
## Herd Requirements

- 1) Holstein
- 2)  $\geq 400$  milking cows
- 3) Free-stall housing
- 4) TMR-fed
- 5) Milk weights recorded
- 6) DC305 or PCDART

## Data Collection

- Enrolled 72 herds located in NY and VT
- Herds visited between November 2012 and August 2015
- Visited each herd 4 times
- Routine visit data collection included:
  - BCS and locomotion scoring
  - TMR and forage samples collection and analysis
  - Particle size distribution by PSPS
  - Forage analyses and rations entered into CNCPS v.6.1 (information exported with NDS software)

## Timeline



- Blood Sampling:
  - 1/3 primiparous, 2/3 multiparous
  - Targeted to sample 24 animals pre- and post-calving (median: 21.5; range: 11-24)
- Blood analyzed for BHBA using the Precision Xtra Meter (Abbott)
- Plasma analyzed for NEFA (Wako Pure Chemical Industries)

## Statistical Analysis

- Continuous data - UNIVARIATE procedure of SAS 9.4
- Categorical data – FREQ procedure
- PROC MEANS and PROC FREQ was used to calculate the prevalence of elevated blood metabolites
- Associations of elevated metabolites during the transition cow period at the cow and herd level were analyzed by  $\chi^2$  test using the FREQ procedure

## Annual herd reported health events and production

Production Characteristics	n herds	Mean ± SD
Herd size, n milking cows	72	935 ± 486
Dairy Herd Improvement herd milk average, lbs	50	27,080 ± 2,318
Annual rolling herd average, lbs	69	27,942 ± 2,690
Herd average milk yield/cow, lbs/d	69	83.3 ± 8.3
Health Events		
Stillborn heifer rate, %	72	5.9 ± 1.8
Twinning, %	72	4.1 ± 1.4
Retained Placenta, %	71	6.5 ± 3.8
Metritis ≤ 30 DIM, %	71	6.4 ± 8.5
Displaced Abomasum ≤ 60 DIM, %	71	2.0 ± 1.6
Ketosis ≤ 30 DIM, %	71	6.6 ± 8.9

Parameter	NYSCHAP Achievable Rate	% herds w/in achievable	NYSCHAP Alarm Rate	% herds above alarm
Displaced Abomasum (n=69 farms)	< 3%	76.8%	≥ 6%	1.4%
Milk Fever (n=56 farms)	< 2%	71.4%	≥ 5%	7.1%
Retained Placenta (n=71 farms)	< 8%	63.4%	≥ 10%	12.7%
Ketosis: (n=72 farms)				
Clinical (BHBA >2.7 mmol/L)	< 3%	65.3% <sup>1</sup>	> 8%	20.8% <sup>1</sup>
Sub-clinical (BHBA > 1.2 mmol/L)	< 15%	51.4% <sup>1</sup>	> 25%	25.0% <sup>1</sup>
Mastitis: (n=55 farms)				
All cows 1 <sup>st</sup> test LS>4	< 10%	25.5%	≥ 14%	41.8%
Heifer 1 <sup>st</sup> test LS>4	< 7%	16.4%	≥ 10%	67.3%
Stillborns (heifer calves): (n=72 farms)				
Primiparous	< 10%	65.7%	> 12%	15.7%
Multiparous	< 6%	78.9%	> 7%	0%
Dead and Sold ≤ 3m of age (n=72 farms)	< 8%	77.8%	≥ 12%	12.5%
Length of Dry Period: (n=72 farms)				
40 – 60 days	75.0% <sup>2</sup>			<40d: 0.0% <sup>2</sup>
≥ end of 2 <sup>nd</sup> lactation				>60d: 25.0% <sup>2</sup>
Length of Dry Period: (n=72 farms)				
50 – 60 days	59.7% <sup>2</sup>			<50d: 18.1% <sup>2</sup>
Between 1 <sup>st</sup> and 2 <sup>nd</sup> lactation				>60d: 22.2% <sup>2</sup>

<sup>1</sup> Animals 3-14 DIM sampled during study. NYSCHAP parameter includes cows 3-21 DIM.  
<sup>2</sup> Average length of dry period

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## Herd management factors

Item	Level	% of herds
Use of recombinant bovine somatotropin (rbST)		40.3%
Herd moves animals to maternity pen 0 to 3 d before calving		27.8%
Herd moves animals to calving pen when showing signs of calving		72.2%
Dry cow grouping system	1-group	9.7%
	2-group	90.3%
Early lactation grouping system	1-group	6.9%
	2-group	93.1%
Dry cow feeding strategy	1-ration	34.7%
	2-ration	65.3%
Early lactation feeding strategy	1-ration	19.4%
	2-ration	80.6%
Percentage of herds separating primiparous and multiparous animals	Far-off period	71.3%
	Close-up period	31.5%
	Fresh Period	25.7%
Times per week animals moved into pens housing close-up animals	High Period	86.8%
	< 1 x	2.1%
	> 1 x	25.3%

## Herd reported management measures

Item	N herds	Primiparous	Multiparous
		Median (range)	Median (range)
Time spent in calving or maternity pen after calving, h	72	2.0 (0 – 24) <sup>a</sup>	2.0 (0 – 24)
Time spent in first moved to pen after calving, d	72	12.0 (0.10 – 305) <sup>a</sup>	6.0 (0.10 – 110)
Average days dry, d	72	Mean ± SD	Mean ± SD
		56.0 ± 6.7	57.0 ± 6.3
Voluntary waiting period, d	72	58.0 ± 9.3	58.7 ± 9.8
Herd mean cull and death rate ≤ 60 DIM, %	72	Primiparous	All Lactations
		5.9 ± 4.5 <sup>a</sup>	8.4 ± 4.3
Overall herd mean cull and death rate, %	72	20.6 ± 7.8 <sup>a</sup>	35.7 ± 7.2

<sup>a</sup> n = 71 herds due to 1 farm not raising heifers and purchasing primiparous animals

## Densities for stocking, water, and bunk

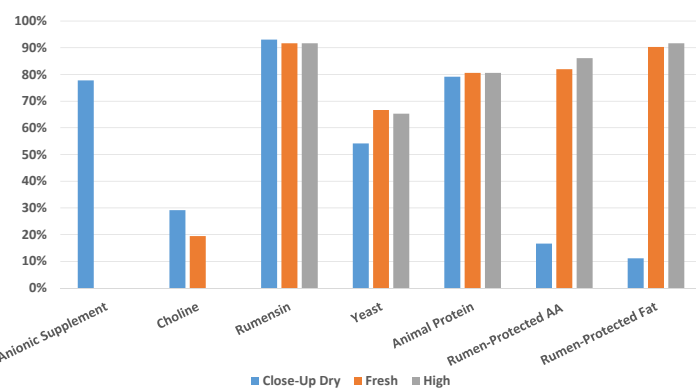
Item	Period			
	Far-off (n pens)	Close-up (n pens)	Fresh (n pens)	High (n pens)
Stocking density (cows / stall), %	94.4 ± 21.2 (102)	92.9 ± 34.5 (75)	102.5 ± 21.5 (90)	118.8 ± 16.4 (187)
Linear Water Space, in/cow	2.6 ± 1.7 (110)	3.6 ± 2.5 (90)	3.9 ± 1.8 (93)	2.8 ± 0.9 (187)
Overall bunk density (cows/headlock spaces <sup>1</sup> ), %	122.5 ± 41.1 (110)	98.8 ± 44.1 (90)	121.8 ± 37.7 (93)	156.5 ± 34.7 (187)

<sup>1</sup> Headlock spaces = (length of neck rail (cm) / 60.96 cm) or 1 headlock (1 headlock = 60.96 cm of neck rail space)

## Feeding Management: feeding frequency

Feeding Frequency / d	Period			
	Far-off n = 112	Close-up n = 91	Fresh n = 94	High n = 190
≤ 1	92.9%	93.4%	68.1%	53.7%
>1, ≤ 2	7.1%	6.6%	28.7%	38.4%
3	–	–	–	1.6%
4	–	–	3.2%	3.2%
5	–	–	–	1.6%
6	–	–	–	1.6%

## Percentage of Farms (n=72) with Ingredient of Interest in Rations



## Predicted chemical composition by CNCPS v.6.1

Nutrient	Period			
	Far-off n = 91 pens	Close-up n = 79 pens	Fresh n = 74 pens	High <sup>1</sup> n = 92 pens
ME, Mcal/kg DM	2.07 ± 0.11	2.11 ± 0.09	2.49 ± 0.07	2.51 ± 0.07
MP, g/kg DM	77.4 ± 10.2	89.4 ± 7.9	107.4 ± 6.5	110.2 ± 5.6
Met, %MP	2.12 ± 0.18	2.20 ± 0.21	2.36 ± 0.20	2.32 ± 0.18
Lys, %MP	6.88 ± 0.40	7.02 ± 0.29	6.69 ± 0.23	6.59 ± 0.21
His, %MP	2.60 ± 0.30	2.86 ± 0.28	2.81 ± 0.16	2.80 ± 0.16
CP, %DM	13.6 ± 1.9	14.5 ± 1.4	16.4 ± 0.9	16.5 ± 0.8
Starch, %DM	14.5 ± 4.6	17.8 ± 2.7	26.3 ± 2.8	27.7 ± 1.8
Sugar, %DM	3.0 ± 1.0	3.3 ± 1.0	4.1 ± 1.3	4.2 ± 1.3
EE, %DM	3.3 ± 0.5	3.3 ± 0.7	5.1 ± 0.7	5.2 ± 0.7
NDF, %DM	47.0 ± 4.7	43.1 ± 3.8	31.8 ± 2.2	30.7 ± 1.9
Forage NDF, %DM	44.3 ± 6.3	37.5 ± 4.7	23.9 ± 2.2	22.8 ± 2.1
Fermentable total carbohydrate, %DM	38.3 ± 3.2	39.4 ± 2.3	39.9 ± 1.6	39.4 ± 1.7
Fermentable starch, % DM	12.8 ± 4.1	15.8 ± 2.4	21.1 ± 2.2	21.7 ± 1.6
Fermentable sugar, %DM	2.3 ± 0.8	2.6 ± 0.8	3.0 ± 0.9	3.0 ± 0.9
Fermentable NDF, % DM	17.6 ± 2.4	15.9 ± 1.7	11.2 ± 1.3	10.4 ± 0.8

## Population parameters of Ospina et al., 2010 study

- 104 dairy herds in NY, PA, and VT (4 herds excluded)
  - >250 milking cows
  - Free-stall housing
  - TMR-fed herd
  - Participated in DHIA or used DC305
- Herd sized ranged from 265 to 2,770 milking cows (median: 767; mean: 840)
- Convenience sample of healthy heifers and cows were selected
  - 2 cohorts of approximately 15 animals were sampled:
    - 14 to 2 d prepartum -> 1,440 animals sampled
    - 3-14 DIM -> 1,318 animals sampled



## Herd-level impacts of elevated NEFA/BHB

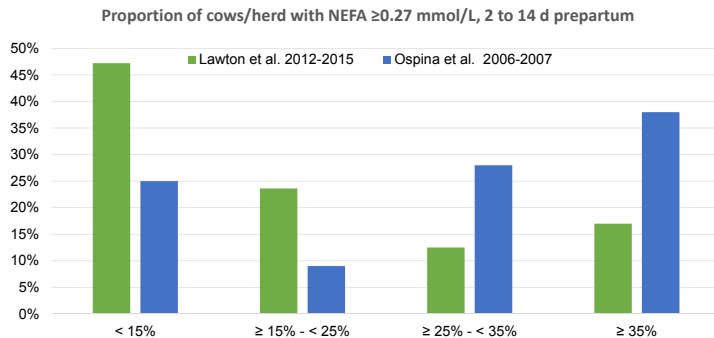
Metabolite level	Herd Alarm	Associated with:
<b>PRE-Partum</b> NEFA $\geq 0.27$ mmol/L	15%	+3.6% Disease incidence -1.2% Pregnancy rate - 529 lbs ME305 milk (both heifers and cows)
<b>POST-Partum</b> NEFA $\geq 0.6^a - 0.7^b$ mmol/L	15%	+1.7% Disease incidence <sup>b</sup> - 0.9% Pregnancy rate <sup>a</sup> Heifers: -640 lbs, Cows: - 1,272 lbs
BHB $\geq 1.0^a - 1.2^b$ mmol/L	15%  *20%	+1.8% Disease incidence <sup>b</sup> -0.8% Pregnancy rate <sup>b</sup> Heifers: -1,179 lbs*, Cows: - 732 lbs <sup>a</sup>

\*15% of 15 = 2-3 animals

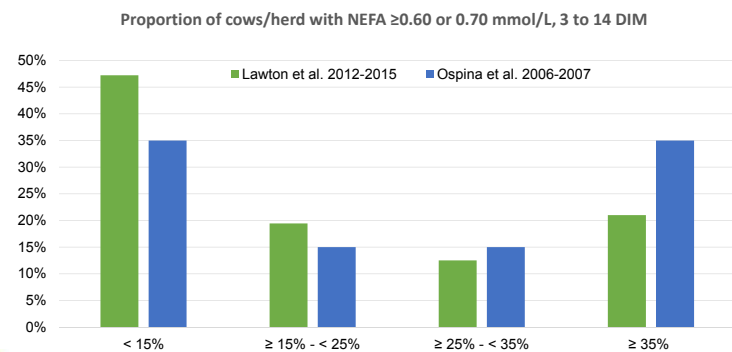
Ospina et al., 2010



## Prevalence of elevated prepartum NEFA

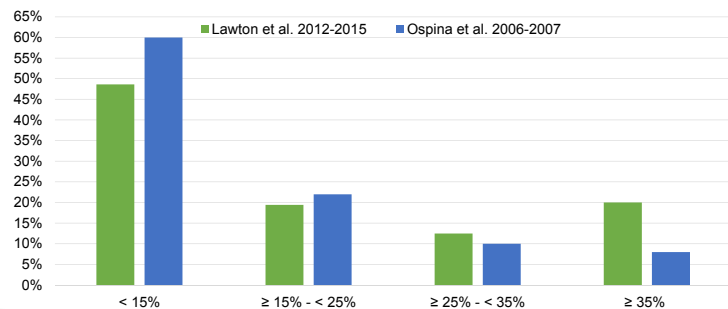


## Prevalence of elevated postpartum NEFA



## Prevalence of elevated postpartum BHBA

Proportion of cows/herd with BHBA  $\geq 1.0$  or  $1.2$  mmol/L, 3 to 14 DIM



## Prepartum NEFA vs. Postpartum NEFA – Herd Level

Prepartum NEFA	Postpartum NEFA		
	Not High	High	
Not High	27.78% (n=20)	19.44% (n=14)	47.22% (n=34)
High	19.44% (n=14)	33.33% (n=24)	52.78% (n=38)
	47.22% (n=34)	52.78% (n=38)	

$P = 0.06$  \*High defined as  $\geq 15\%$  of herd has elevated metabolite

### Interpretation

- Herd level risk categories for prepartum NEFA tended to be associated with herd level risk categories for postpartum NEFA

## Prepartum NEFA vs. postpartum BHBA – Herd Level

Prepartum NEFA	Postpartum BHBA		
	Not High	High	
Not High	27.78% (n=20)	19.44% (n=14)	47.22% (n=34)
High	20.83% (n=15)	31.94% (n=23)	52.78% (n=38)
	48.61% (n=35)	51.39% (n=37)	

$P = 0.10$  \*High defined as  $\geq 15\%$  of herd has elevated metabolite

### Interpretation

- Herd level risk categories for prepartum NEFA tended to be associated with herd level risk categories for postpartum BHBA

## Postpartum BHBA vs. Postpartum NEFA – Herd Level

Postpartum BHBA	Postpartum NEFA		
	Not High	High	
Not High	26.39% (n=19)	22.22% (n=16)	48.61% (n=35)
High	20.83% (n=15)	30.56% (n=22)	51.39% (n=37)
	47.22% (n=34)	52.78% (n=38)	

$P = 0.24$  \*High defined as  $\geq 15\%$  of herd has elevated metabolite

### Interpretation

- Herd level risk categories for prepartum BHBA were not associated with herd level risk categories for postpartum NEFA

## Prevalence of cows above metabolic threshold

Metabolite Cut-Point	Sampling time relative to parturition	Overall Prevalence	Prevalence for Primiparous	Prevalence for Multiparous
NEFA $\geq 0.27$ mmol/L	2 to 14 d prepartum	<b>19.2%</b> (n=1229)	<b>23.3%</b> (n=382)	<b>17.4%</b> (n=847)
NEFA $\geq 0.60^a$ or $0.70^b$ mmol/L	3 to 14 DIM	<b>19.8%</b> (n=1100)	<b>18.3%</b> (n=338)	<b>20.5%</b> (n=762)
BHBA $\geq 1.0^a$ or $1.2^b$ mmol/L	3 to 14 DIM	<b>19.7%</b> (n=1100)	<b>15.7%</b> (n=338)	<b>21.5%</b> (n=762)

<sup>a</sup> Metabolic cut-point used for primiparous cows.

<sup>b</sup> Metabolic cut-point used for multiparous cows.

## 2x2 Metabolite Frequency Tables – Cow Level

Prepartum NEFA	Postpartum NEFA		Postpartum BHBA	
	Not High	High	Not High	High
Not High	63.96%	13.15%	64.92%	12.19%
High	17.85%	5.04%	17.64%	5.25%
Postpartum BHBA				
Not High	71.86%	10.74%		
High	9.99%	7.41%		

High defined as:

- Prepartum NEFA  $\geq 0.27$  mmol/L, 2-14 d prepartum
- Postpartum NEFA  $\geq 0.60^a$  or  $0.70^b$  mmol/L, 3-14 DIM
- BHBA  $\geq 1.0^a$  or  $1.2^b$  mmol/L, 3-14 DIM

All 2x2 tables:  $P < 0.05$

<sup>a</sup> Metabolic cut-point used for primiparous cows.

<sup>b</sup> Metabolic cut-point used for multiparous cows.

### Interpretation

- There were associations between cow level risk categories for metabolites

## Conclusions and Implications

- Health events likely underreported
- Possible room for improvement in nutritional program based on grouping strategies
- Compared to Ospina et al. data, there was a shift in the percentage of farms above the alarm rate for prepartum and postpartum NEFA
- Percentage of farms above the alarm rate for postpartum BHBA, compared to 2007, did not improve
  - Possibly due to sample selection criteria
- A lot of variability exists in current practices and health related outcomes
- Results can be used for comparison and advisement purposes

## Future Direction

- Exploring associations that may exist between different management and nutritional factors with:
  - health
  - culling
  - milk production
  - reproductive outcomes
  - energy and inflammation blood biomarkers

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## Thank You!

