How long is long enough? Longevity and extended lactations

Stephen LeBlanc

DAIRY at GUELPH
CANADA'S DAIRY UNIVERSITY

In 2004, a young(ish) professor was invited to give a talk:

Reproduction and its impact on cow survival and replacement

Stephen LeBlanc

ADSA Discover conference

October 4, 2004

Nashville, IN

GET
PREGNANT
OR
DIE

The major reproductive disease of dairy cattle is semen deficiency

In 2023…

- That same professor, embracing his own longevity, was invited to give another talk:

Health aspects of survival of dairy cows

Disease kills.

Disease kills (sometimes).

It depends…

on milk and pregnancy

How should we measure reproductive performance?

- The key outcome is pregnant cows
- We wish to measure the efficiency of making open cows pregnant
- Pregnancy rate is the best single measure of current herd performance
- Conception risk only tells part of the story
- Most traditional measures (calving interval, herd average days open, services per conception) do not accurately measure performance

Is there something wrong with our cows or our management?

- High metabolic rate is associated with lower circulating progesterone & estrogen, and decreased expression of heat

(Sangsritavong et al, 2002; Lopez et al , 2004)

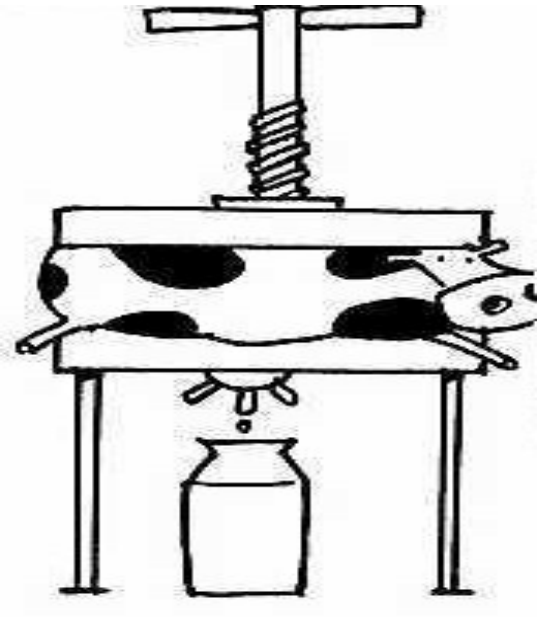
- Severity and duration of negative energy balance are associated with delayed ovulation

(Butler & Smith 1989; Butler, 2003)

- BUT – should we feed cows less, or only breed low producers?

Is “high” production a problem?

- Biology vs. management effects
- Measured at the herd or cow level?
- High producing cows will be bred more times and for longer than low producing cows
- Low producing cows will be given fewer chances before being culled
- Therefore, high producing cows may have longer intervals to pregnancy



Framing the question

- **Fertility** = the biological capacity for reproductive function
  - Cyclicity (ovulation)
  - Expression of estrus
  - Fertilization
  - Pregnancy maintenance
- **Reproductive performance** = probability, timing, and efficiency of pregnancy
  - Estrus detection
  - Management program compliance
  - AI technique
- **Prior health interacts with both**

Is this the goal?

Lactanet
CANADIAN NETWORK FOR DAIRY EXCELLENCE

LONGEVITY

annual herd 3rd+ lactations: 100 points

Longevity is calculated through the annual average percentage of cows in the herd on test day that are in their third or greater lactation. It is a measure of good management in regards to cow comfort, herd health, productive life, and a 'problem free' herd.

Increased **longevity** allows for higher production, decreased animal replacement costs, and excess animals to sell as replacements.

What is the goal?

- "Breaking" cows is bad because it diminishes
  - Welfare
  - Social license
  - Realizing economic potential
- Quality vs quantity of life
- Environmental impact/GHG footprint
    - Per cow
    - Per hectare
    - Per calorie
    - Per kg of protein or essential AA

Is this the right perspective on cow longevity?

"A shortened cow lifespan is recognized as evidence of reduced animal welfare. The natural lifespan of dairy cattle is approximately 20 years. Analysis by DeVries indicates that the economically optimal lifespan should be about 7 years of age, but currently in the US it is about 5 years of age. Few people would be satisfied to live in a society where the life expectancy was only slightly past puberty. As such, this shortened lifespan would appear to violate the last of the Farm Animal Welfare Committee's 5 freedoms, which is to have the freedom to express normal behaviors."

Bartlett JAVMA 2025

Career enders

- Non-pregnancy
- Low milk
- Chronic mastitis/high SCC
- Chronic lameness

Premises

- Culling is an economic decision*. Sell a cow when her net present value is < an available replacement animal
  - * Or a decision to override economic rationale

- Poor health will reduce productive lifespan, but longevity is a poor measure of health or welfare
- Ethics and social license require quality of life for cows, not quantity
- ‘Metabolic athletes’ live demanding, not distressed lives

Do you have ≥40 kg of milk per cow tank average?

Do you have ≥40 kg of milk per cow tank average and consistently < 20% annual culling?

Do you have ≥ 40 kg tank average and consistently 20% annual culling?

If not, is it because

a) high production is the result of “pushing” cows with the collateral damage of “breaking” cows

Do you have ≥ 40 kg tank average and consistently 20% annual culling?

If not, is it because

a) high production is the result of “pushing” cows with the collateral damage of “breaking” cows

b) A supply of (on average) genetically superior heifers increases selection pressure for production and health

Do you have any below-average cows in your herd?

- Are there cows in the herd now that you be better-off without?
  - Chronic lameness
  - Repeated mastitis
  - High SCC
  - Open > 150 d

2023 to … ? plot twist

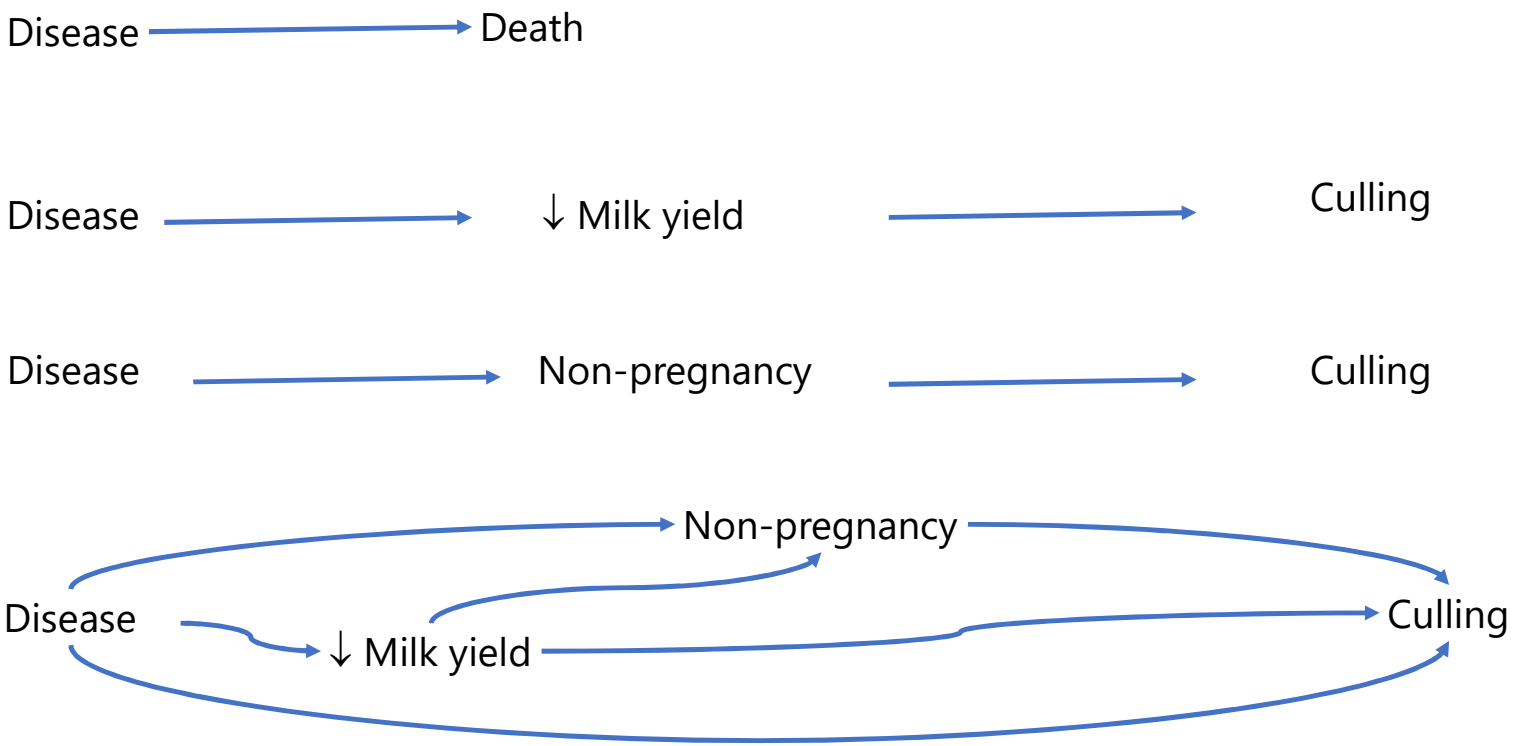
Change in US dairy herd and related factors			
Year	Milk cows	Replacement heifers	Dairy cows culled
	% change during year		
2021	-0.7	-2.7	2.1
2022	0.3	-2.4	0.0
2023	-0.5	-6.4	-0.8
2024	0.3	-3.5	-11.9
2025	2.0	-0.1	-3.0

Hoard's April 2026

- > $1500+ beef-on-dairy calves
- → substantial reduction in supply of dairy replacements
  - → retention of cows
  - → increasing average age of lactating cows

So…
Keeping cows for longer
a) Is evidence of improving health and welfare?
b) Will increase profits by increasing lifetime production per cow?
c) Means more heifers will "pay for themselves"?

The relationship of health with survival is complex



Transition health problems are common
But healthy cows have good fertility

5719 cows in 7 US herds

Table 2. Impact of health problems in the first 60 d postpartum on pregnancy at first postpartum AI of dairy cows[1]

Health status	Prevalence	Pregnant, %	Adjusted OR (95% CI)[2]	*P*
Health problem				
Healthy	56	51.4	1.00	
1 case of disease	27	43.3	0.79 (0.69 – 0.91)	0.001
> 1 case of disease	17	34.7	0.57 (0.48 – 0.69)	< 0.001
Type of health problem[3]				
Calving problem	15	40.3	0.75 (0.63 – 0.88)	< 0.001
Metritis	16	37.8	0.66 (0.56 – 0.78)	< 0.001
Clinical endometritis	20	38.7	0.62 (0.52 – 0.74)	< 0.001
Fever postpartum	21	39.8	0.60 (0.48 – 0.65)	< 0.001
Mastitis	12	39.4	0.84 (0.64 – 1.10)	0.20
Clinical ketosis	10	28.8	0.50 (0.36 – 0.68)	< 0.001
Lameness	7	33.3	0.57 (0.41 – 0.78)	< 0.001
Pneumonia	3	32.4	0.63 (0.32 – 1.27)	0.20
Digestive problem	2	36.7	0.78 (0.46 – 1.34)	0.38

Santos et al RepDomRum 2010

Transition health problems are common

Economic burden of time lost due to injury in NHL hockey players

Laura Donaldson,[1,2] Bing Li,[3] Michael D Cusimano[1,2]

▸ Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/injuryprev-2013-041016).

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ABSTRACT

Objective To determine the economic burden of salary costs lost due to injury in the National Hockey League (NHL).

Methods All NHL players who engaged in at least one regular season game during the 2009–2010 to 2011–2012 seasons comprised the study population. We performed a retrospective cross-sectional analysis of publically available media sources to collect injury and salary data. Outcome measurements were games missed during regular season play due to hockey-related injury and lost salary.

Results A total of 50.9% of all NHL players missed at least one game within a season of play, and injuries represented a total salary cost of approximately US$218 million per year. Concussions alone amounted to a salary

Data collection

Data sources

Full rosters and the number of games participated in by each player were obtained from the NHL website (http://www.nhl.com). Injury data were obtained from nhl.com, and official team injury reports. When more information was required, a variety of other publically available sources including The Sports Network (http://www.tsn.com), Yahoo Sports (http://sports.yahoo.com) and Rotoworld (http://www.rotoworld.com) were consulted. Annual player salaries (US$) were obtained from http://www.capgeek.com.

The increasing popularity of fantasy sports has resulted in a huge demand for information on the

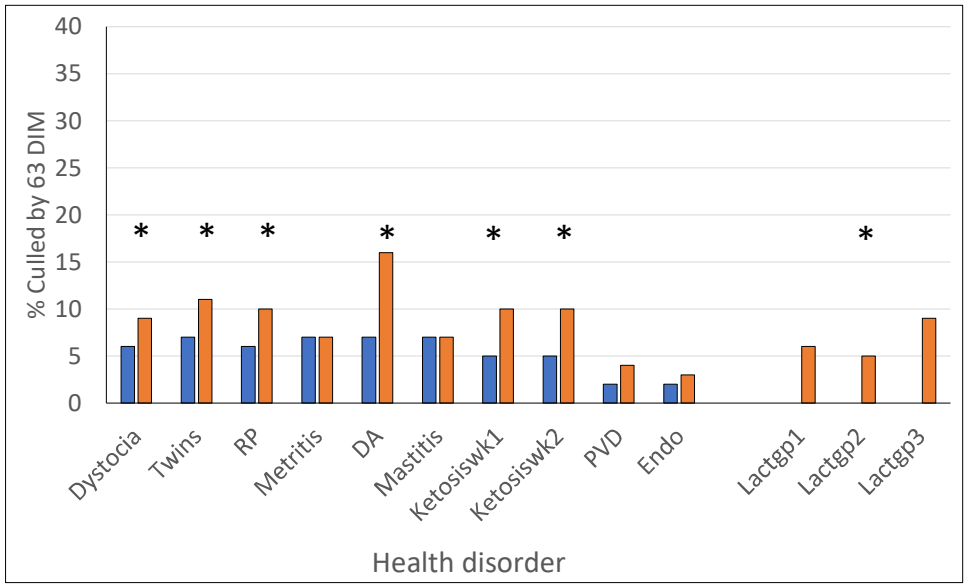
Santos et al RepDomRum 2010

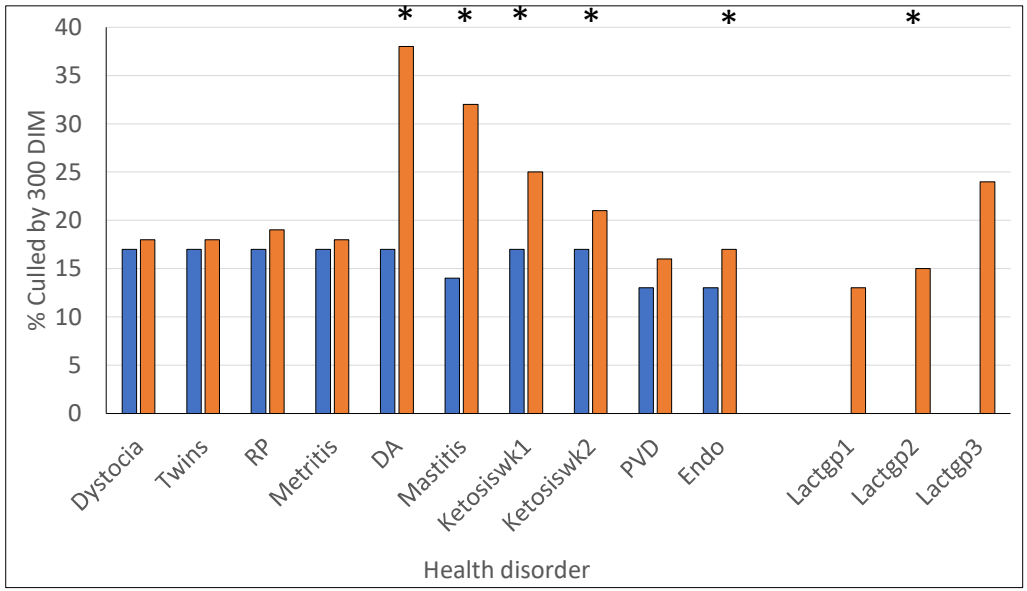
Simple associations of health with culling

2070 cows from 6 herds in NY and Ontario

Clinical and metabolic data actively collected

No lameness data





Data from Dubuc et al JDS 2011

… but this changes when controlling for other variables

Multivariable model Culled by 63 DIM

Variable	LSM Risk		P
	No	Yes	
DA	3%	8%	0.02
Ketosis wk2	4%	7%	0.06
Milk TD1	-7% lower odds per 1 kg > mean (37 kg)		<0.01
SCC TD1	-1% lower odds per 100 > mean (281)		<0.01

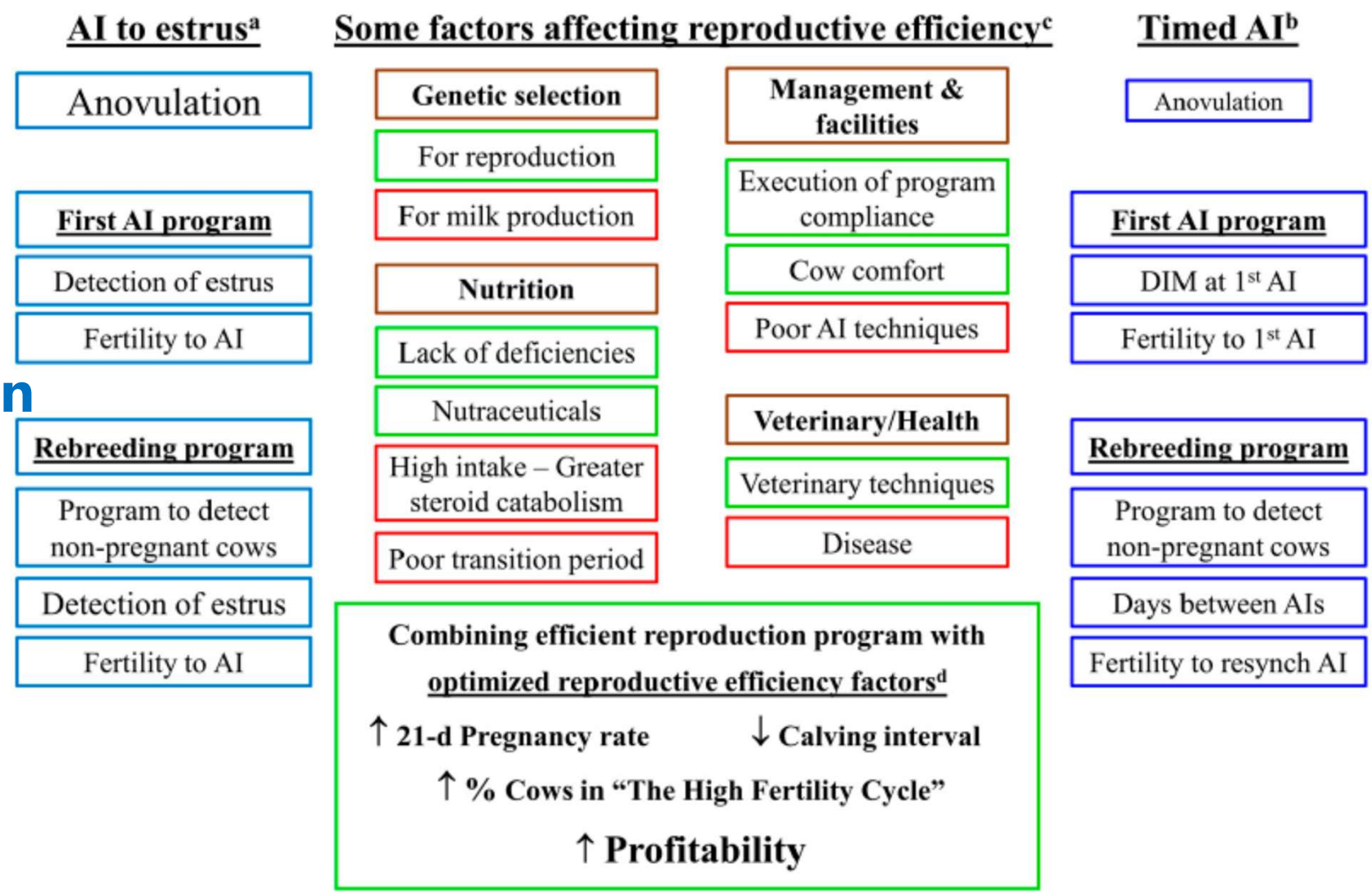
Not different by parity

Multivariable model Culled by 300 DIM

Variable	LSM risk		P
	No	Yes	
DA	10%	40%	<0.01
Mastitis	14%	31%	<0.01
305 projected **milk** TD 3	-36% lower odds per 1000 kg > mean (11,800 kg)		<0.01
Pregnant	63%	4%	<0.01
Lact1	13%		<0.01
Lactgp2	26%		
Lactgp3	28%		

Data from Dubuc et al JDS 2011

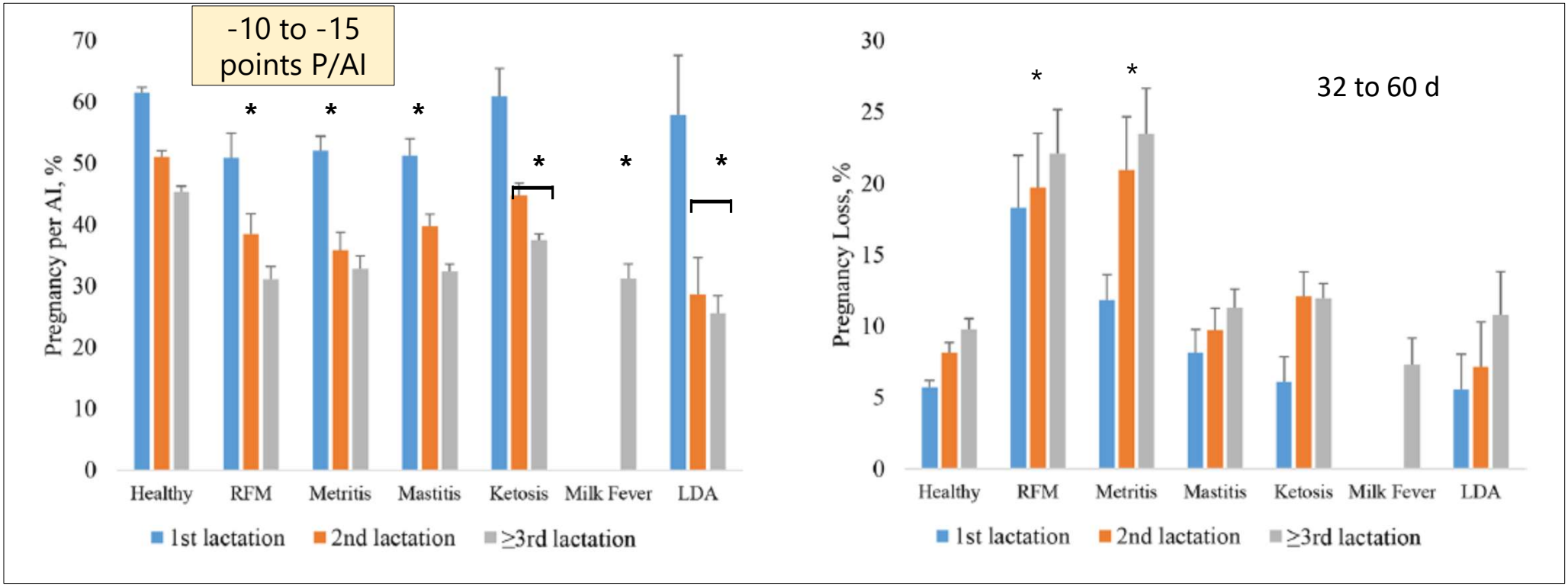
Health is critical no matter how reproduction is managed



Consentini et al Animals 2021
doi.org/10.3390/ani11020301

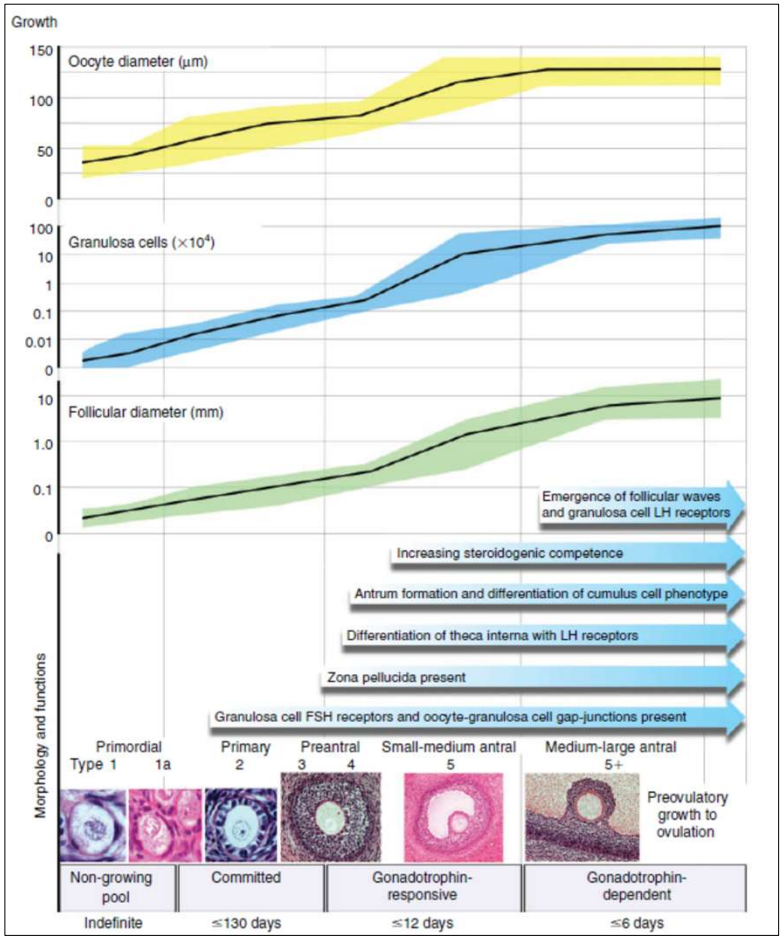
Transition health affects fertility even with Double Ovsynch

7 y of data from 1 herd in Germany; 15,040 cows; all Double Ovsynch for 1st AI ~ 72 DIM



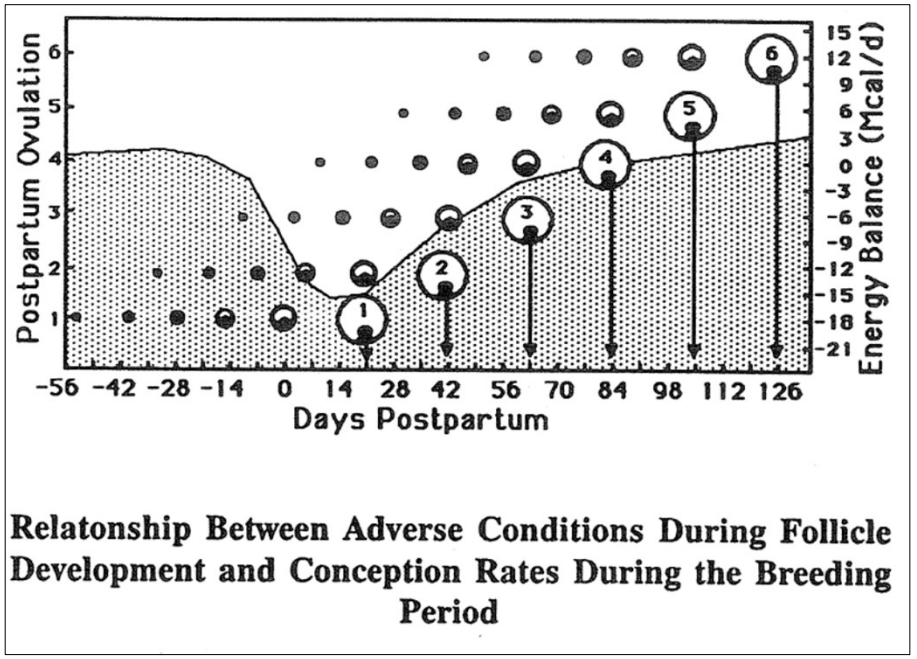
Frenkel et al JDSC 2024

Follicular development occurs over 2 to > 4 months



Ewe model - Scaramuzzi et al RFD 2011

Britt hypothesis (1992)

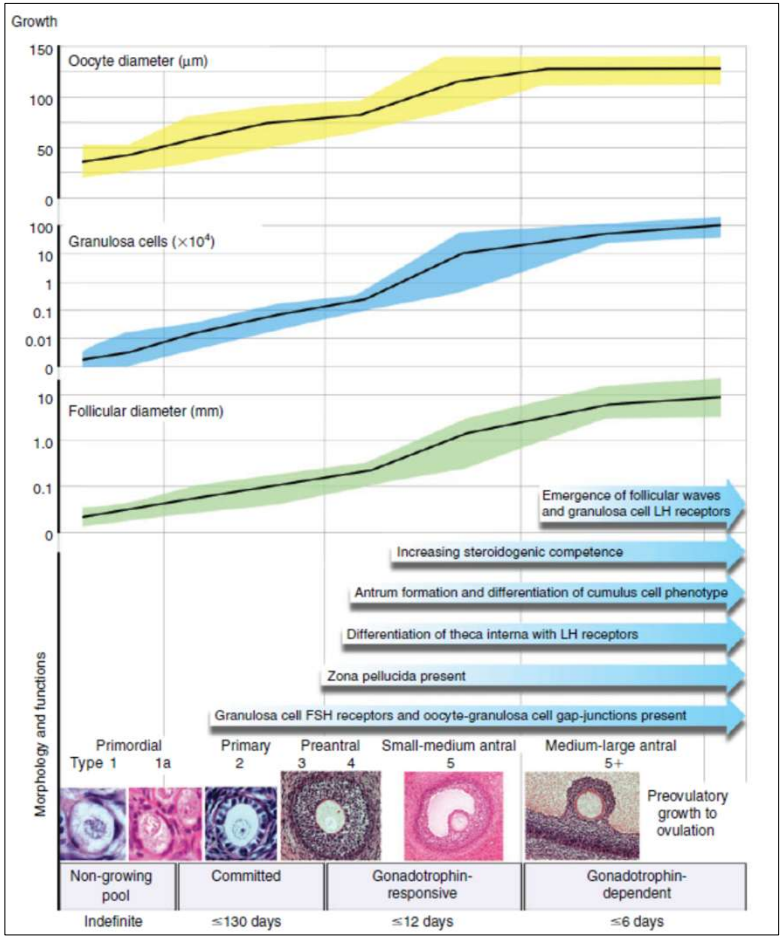


Relatonship Between Adverse Conditions During Follicle Development and Conception Rates During the Breeding Period

Follicular development occurs over 2 to > 4 months

Britt hypothesis (1992)

LeBlanc hypothesis (2024) ☺



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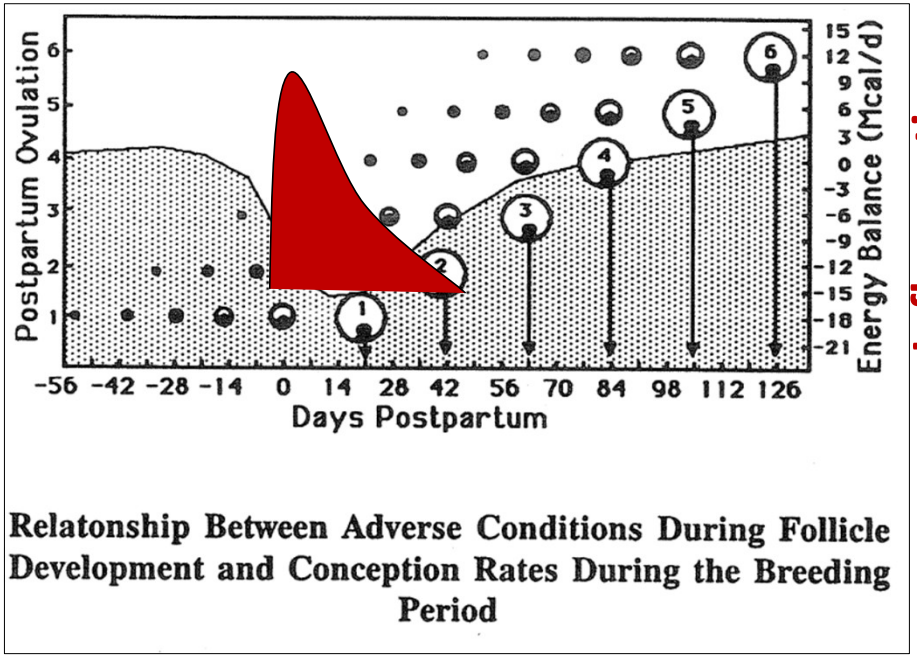
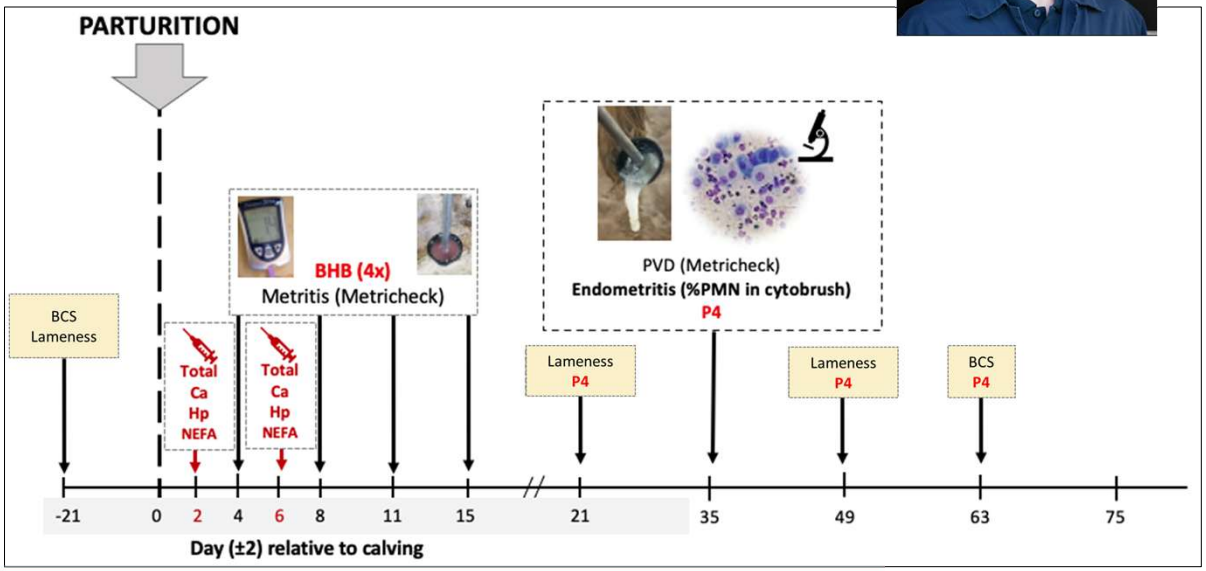


Inflammation

Transition health and estrus detection

- Prospective observational study in 2 commercial dairy herds in Ontario, Canada (~450 lactating cows each) from May 2019 to April 2021
- Prepartum Holstein cows (n = 1,357) were enrolled and examined
- **1st AI primarily based on detection of estrus** by AAM from 50 to 75 d, or timed AI thereafter

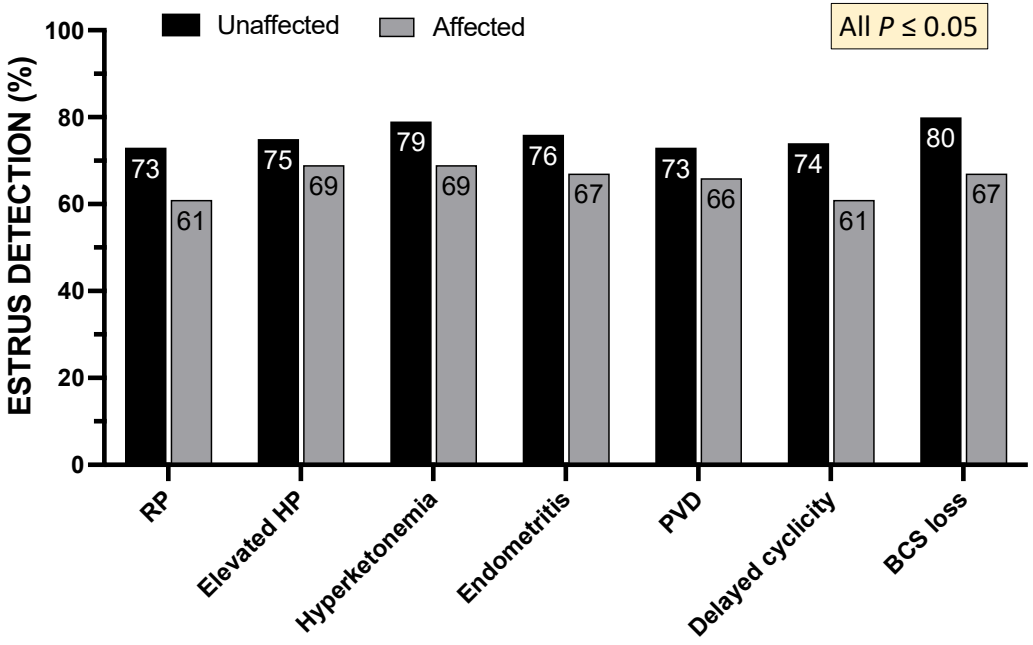


Prevalence of risk factors			
Retained placenta (RP)	**10%**	Lameness (49 d)	**14%**
Haptoglobin at d6 (≥ 0.5 g/L)	**48%**	Acyclic by 49 d	**15%**
Hyperketonemia (≥ 0.7 m*M*)	**50-55%**	BCS Loss (≥ 0.50 point by 63 d)	**53%**
Endometritis (≥ 2.4% PMN)	**44%**	One clinical disease	**29%**
Purulent vaginal discharge (PVD)	**21%**	Multiple clinical diseases	**18%**

Bruinjé et al JDS 2024

Transition health associations with estrus and pregnancy at 1st AI

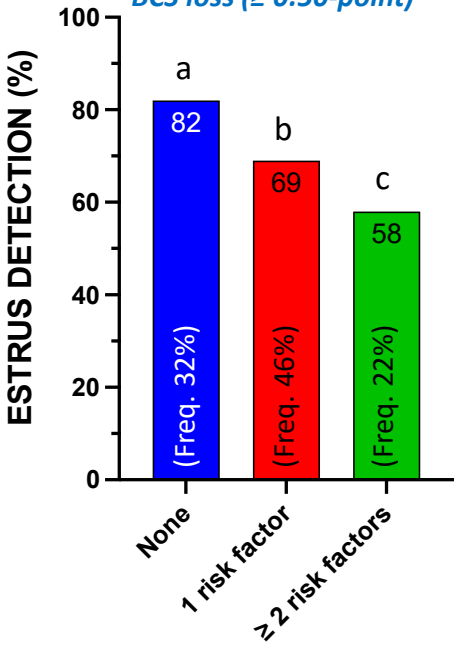
70% of cows detected in estrus by 75 DIM

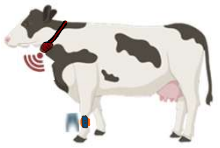


- *Elevated haptoglobin (HP): ≥ 0.5 g/L at 6 (± 2) DIM*
- *Hyperketonemia: ≥2 samples of BHB ≥0.9mM (4 DIM) or ≥0.7mM (8, 11, or 15 DIM)*
- *Endometritis: ≥ 2.4% PMN at 35 (± 3) DIM*
- *Delayed cyclicity: Acyclic by 49 (± 3) DIM*
- *BCS loss: ≥ 0.50-point loss from 3 wk prepartum to 9 wk postpartum vs. no loss*

ONLY RISK FACTORS DIAGNOSED ON FARM

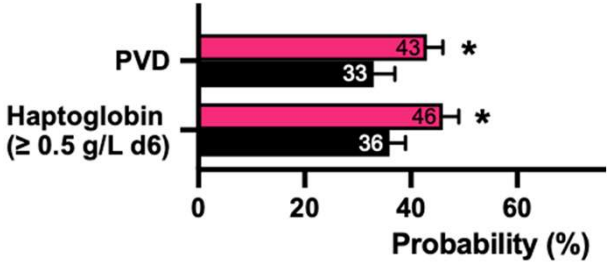
RP, PVD, lameness
BCS loss (≥ 0.50-point)



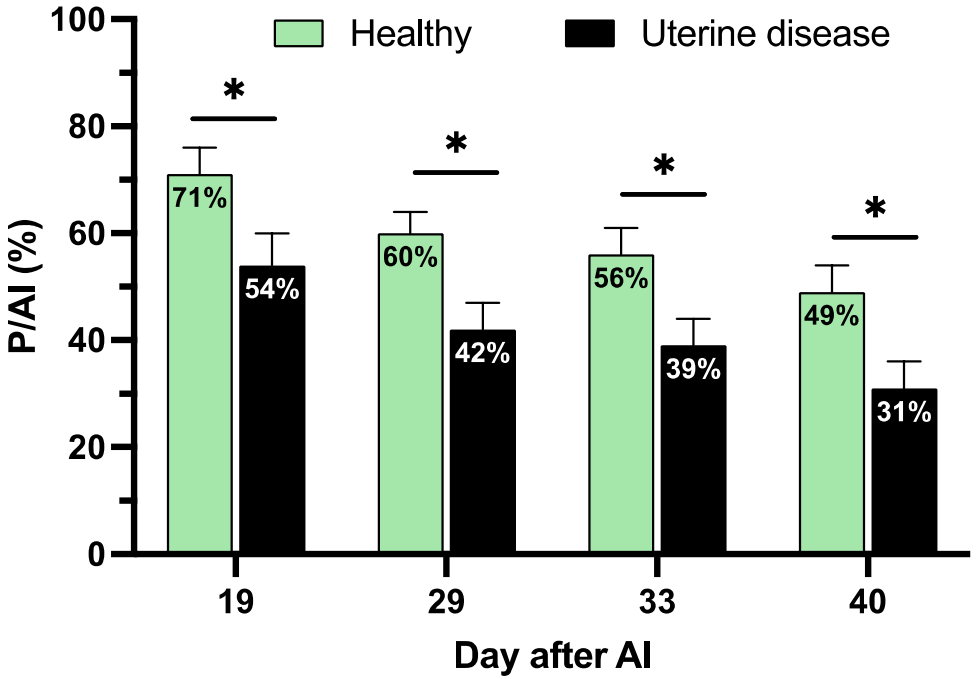


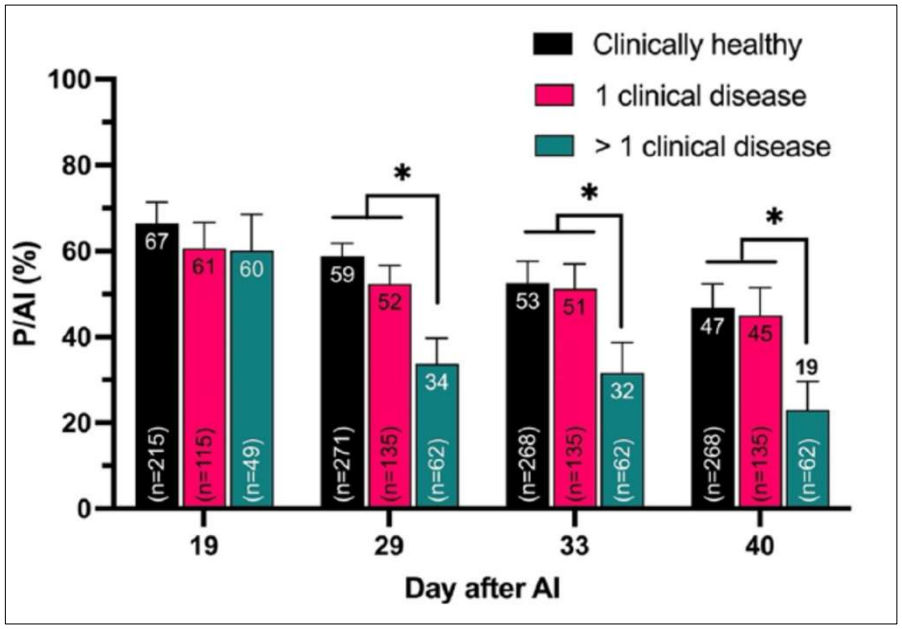
n = 1,210

Pregnancy at 1st AI



Postpartum Health & Pregnancy Loss



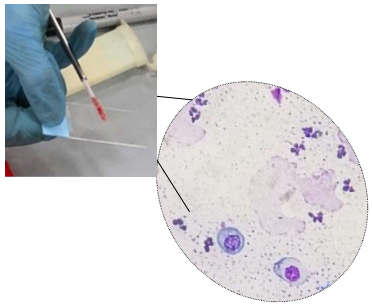


1. RP

2. Metritis

3. PVD

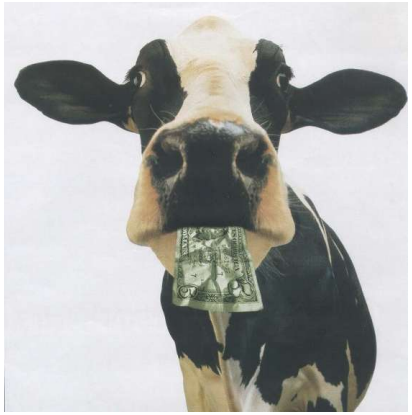
4. Endometritis (cytology)



Bruinjé et al JDS 2024

When do you want cows to be pregnant?

Ways to lose money on reproduction – Simplistic view



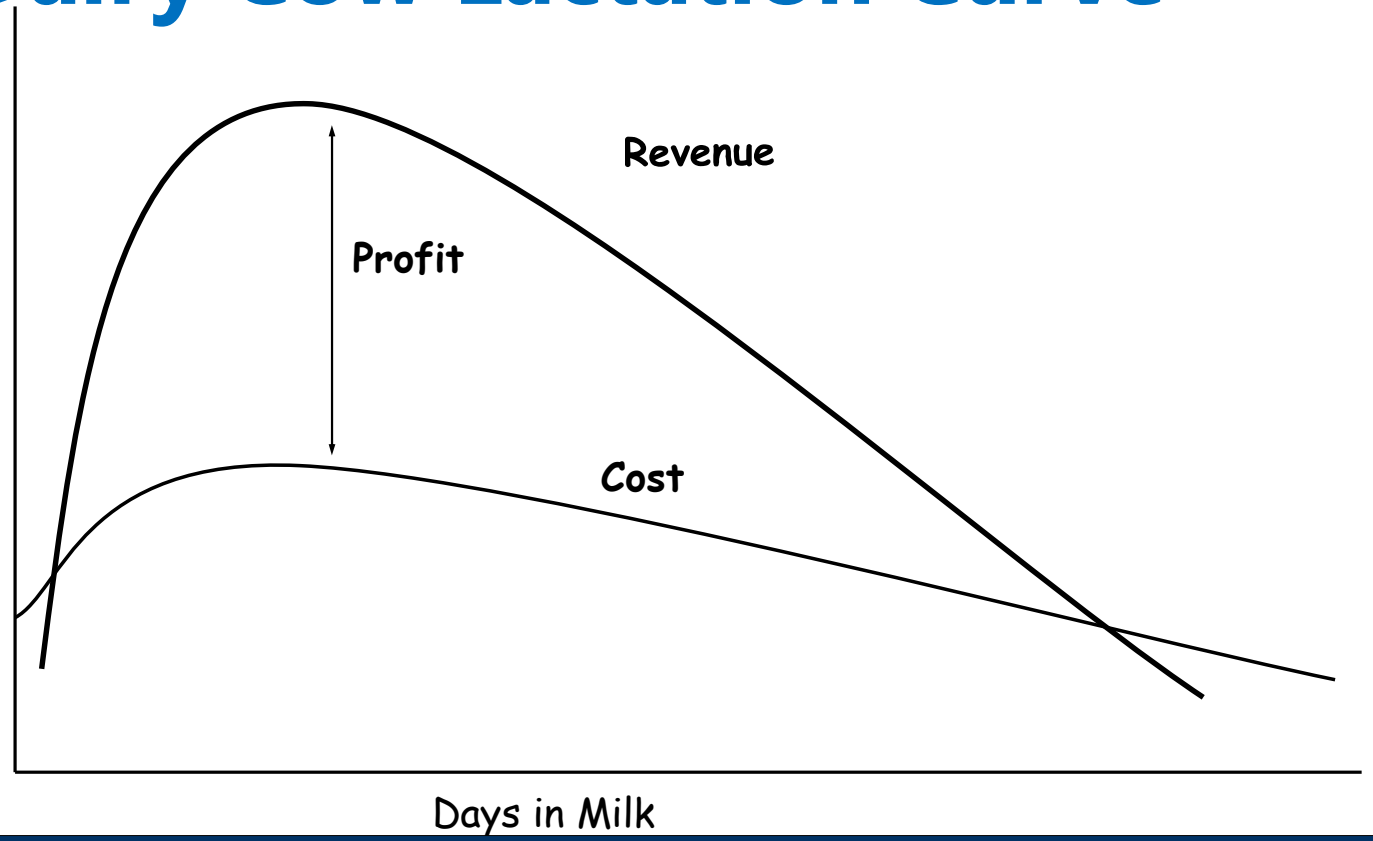
- **Opportunity cost of days open past ~100-120 DIM**
  - Forgone profit from not having cows spend more of their lifetime in the most profitable part of the lactation curve
  - Approximately $1-4 cow/day >100 DIM
- **Culling of otherwise profitable cows due to inability to get them pregnant**
  - =[(Cost of new heifer – cull price) × remaining proportion of expected herd life]

Where does the money go?

- Semen
- Labor
- Drugs
- Vet
- Culling
- **Calf value**
- ***MILK check***

Opportunity cost

Dairy Cow Lactation Curve



The objective is to optimize profit/slot/year by maximizing the proportion of a cow's life in the most profitable stage of lactation

Show me the money

Payback comes from

1. Marginal milk
   - a more productive, nearer-peak cow filling the average slot on the farm
   - Reflected in lower herd DIM and increased milk/d per cow in the herd (in fact, more milk per slot)
2. More calves
3. More selective culling – as more pregnant cows are produced, tail-end producers can be removed, contributing to more milk per slot as herd distribution shifts
4. Fewer long-DOPN fat cows ➔ better transition

- When pregnancy rate increases
  - Cows spend more of their life in early lactation
  - Replacement is likely to be more optimum
    - which cows and when

VWP principles

- Economic optimum has been to have cows get pregnant between ~ 85 and 125 DIM based on maximizing lifetime profit
  - Most time spent near peak
  - Optimize profit per 'slot' per year
- Lower end set by biology (and management – transition health)
- Upper end set by economics - Depends on:
  - Milk price
  - Milk yield
  - Persistency
  - Insemination rate and probability of pregnancy/AI
  - Health risk at calving
  - Calf value
- Practice set by low efficiency of insemination and low probability of pregnancy/AI
- Does that change if "100%" of cows are bred by a deadline?
  - With up to 50% (?) P/AI?

Controlled trial in NY (Stangaferro et al 2018)
2426 cows – Double Ovsynch then ED and ReSynch
First AI at 60 or 88 DIM
→ Minimal $ differences over 18 months
→ Slightly favors 88 d VWP in Lact=1, 60 d in older

What metric(s) should be used to assess whether to extend lactation?

a) Conception risk?

b) Milk per cow per year?

c) Milk per cow per 2 or 3 years?

d) Milk per expected lifetime?

What metric(s) should be used to assess whether to extend lactation?

- **Profit per most limiting resource**
  - Per "slot"
    - Stall
    - Milking space in the parlor or robots
  - Per kg of quota
  - Per acre
  - Per cubic meter of water
  - Per tonne of N or P
  - Per tonne of GHG

- Not per cow
- Not per insemination

J. Dairy Sci. 108:3764–3779
https://doi.org/10.3168/jds.2024-26055

Associations between days open and dry period length versus milk production, replacement, and fertility in the subsequent lactation in Holstein dairy cows

Michael W. Overton[1]* and Steve Eicker[2]
[1]Zoetis, Parsippany, NJ 07054
[2]Valley Ag Software, King Ferry, NY 13081

- Data on 109,374 cows from 60 large herds in the US
- Parity group, previous lactation time to pregnancy (PDOPN), previous dry period length (PDDRY) associations with milk, pregnancy, culling to 90 DIM
- Survivorship bias in the data
- Conclusions:
- Intermediate (conventional) dry period length is optimal
- Pregnancy at earlier DIM is favourable

Cumulative milk (kg) to 90 DIM

PDDRY \ PDOPN	50	80	110	140	170	200	230	260	290	320
20	3424	3398	3373	3347	3321	3295	3269	3243	3217	3192
30	3682	3656	3630	3604	3579	3553	3527	3501	3475	3449
40	3889	3863	3837	3811	3786	3760	3734	3708	3682	3656
50	4045	4019	3993	3968	3942	3916	3890	3864	3838	3812
60	4150	4125	4099	4073	4047	4021	3995	3969	3944	3918
70	4205	4179	4153	4127	4101	4076	4050	4024	3998	3972
80	4209	4183	4157	4131	4105	4079	4053	4028	4002	3976
90	4161	4136	4110	4084	4058	4032	4006	3980	3955	3929
100	4063	4038	4012	3986	3960	3934	3908	3882	3857	3831
110	3915	3889	3863	3837	3811	3785	3759	3734	3708	3682
120	3715	3689	3663	3637	3612	3586	3560	3534	3508	3482

Take-homes

- Culling is an economic decision. Sell a cow when her net present value is < an available replacement animal
- Options for longevity follow control of
    - Transition period health
    - Mastitis
    - Lameness
    - Pregnancy rate
- The transition period is to be managed, not to be avoided

  (unless lactation curves change meaningfully)

Take-homes

- Poor health will reduce productive lifespan, but longevity is a poor measure of health or welfare.
  - Because it depends on:
    - Heifer supply and prices
    - Market cow price
    - Milk price
- So far, economic models still suggest that calving every 12-13 months is economically optimal.
  - Albeit many of these models do not account for transition risk
  - The value of calves is presently a bigger driver than lactation curves
- Good nutrition, cow comfort, and attentive management provide the conditions for health, high production, good reproduction, and optimal culling