What's long enough or too long? Are extended lactations and cow longevity desirable goals?

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

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.

HOARD'S DAIRYMAN

HOARD'S DAIRYMAN INTEL - THURSDAY Jan. 23 2025 08:02 AM

Cow longevity begins with management

BY **JENNA BYRNE, ASSOCIATE EDITOR**

What is the goal?

- "Breaking" cows is bad because
  - Welfare
  - Social license
  - It prevents realizing economic potential
- Quality vs quantity of life
- Environmental impact/GHG footprint
    - Per cow
    - Per acre
    - Per calorie
    - Per kg of protein or essential AA

- *“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 ≥90 lb tank average?

- Do you have ≥90 lb tank average and consistently < 20% annual culling?

- Do you have ≥ 90 lb 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 ≥ 90 lb 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

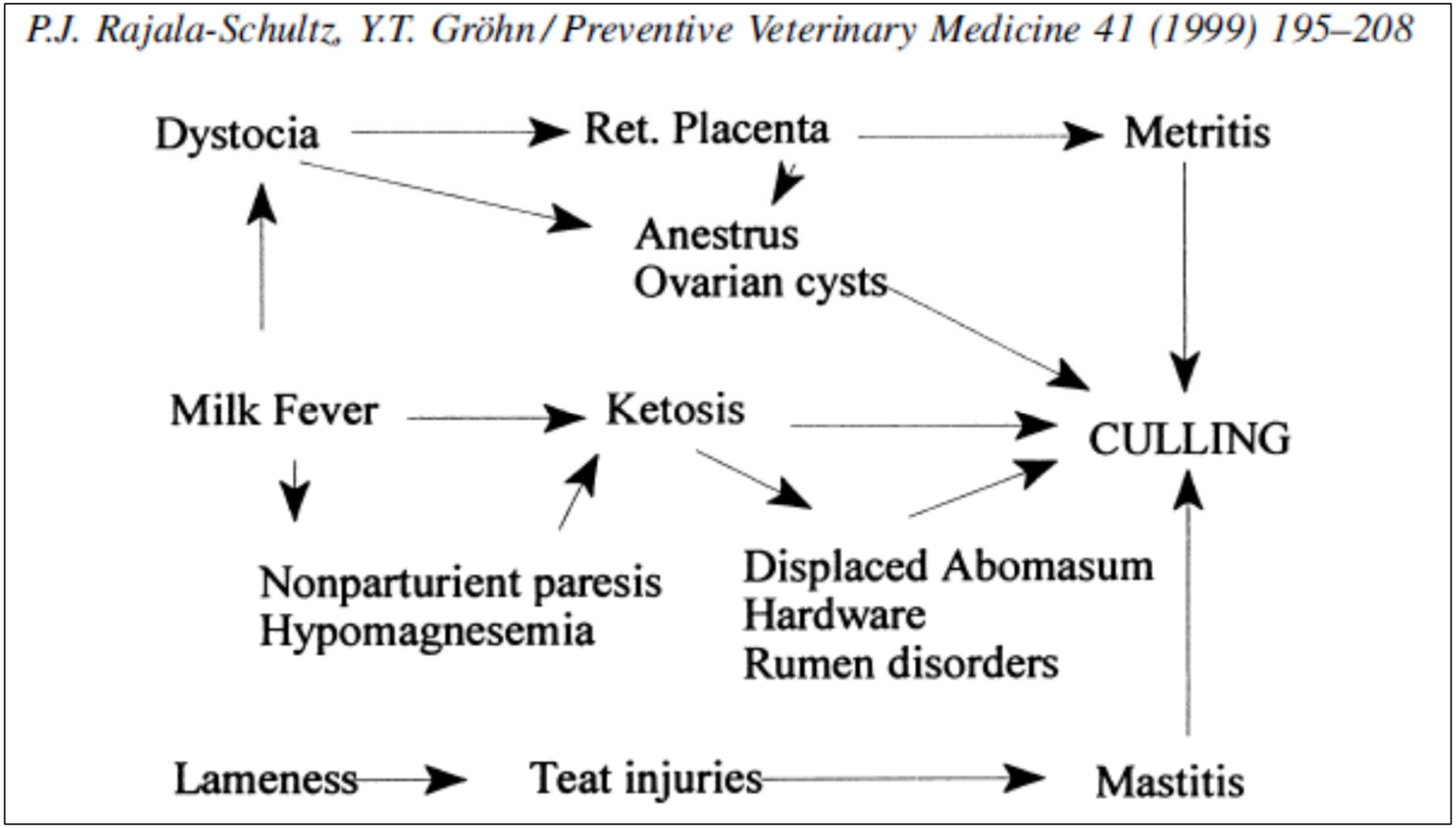
Do you have any below-average cows in your herd?

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

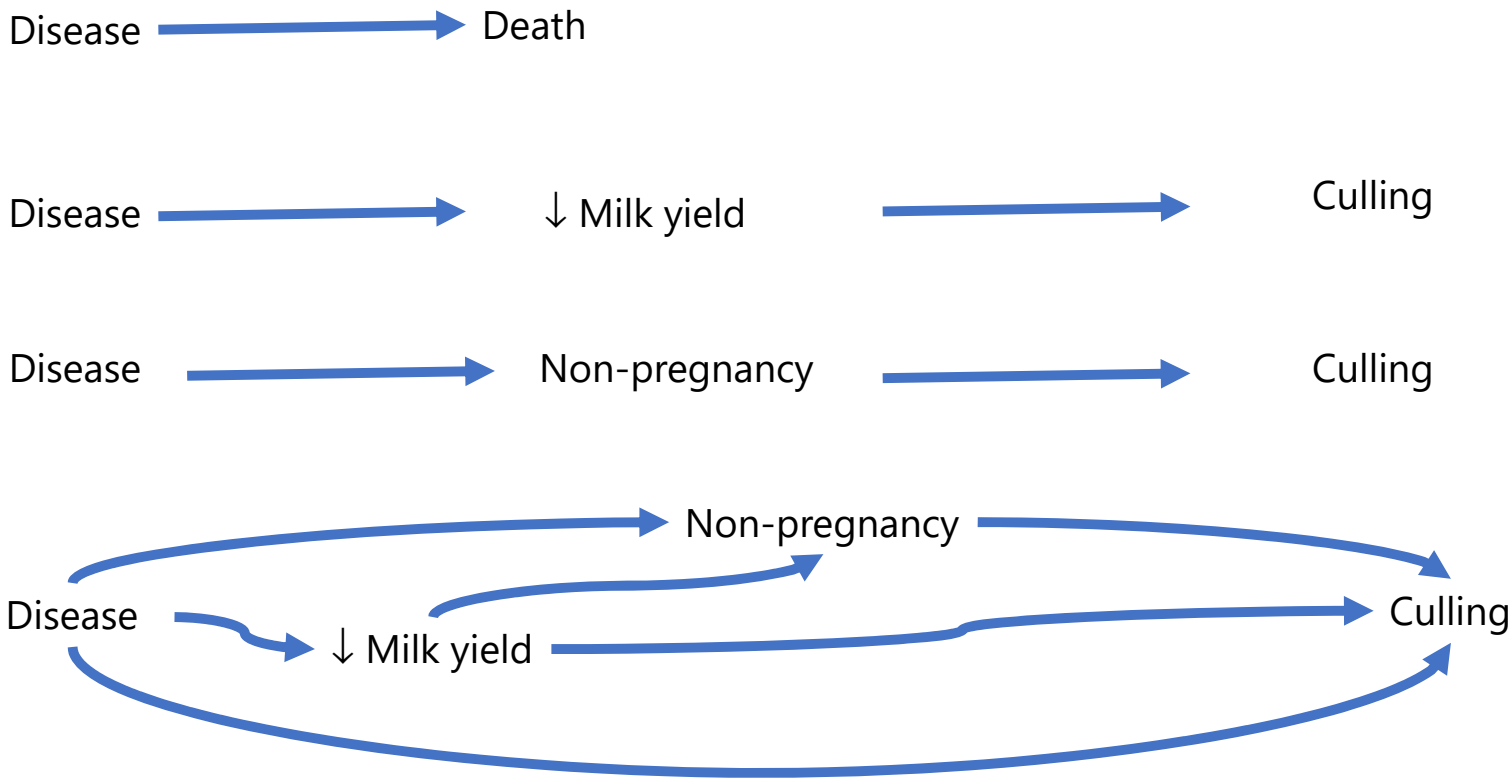
2025 plot twist

- $800 to > $1000 beef-on-dairy calves
- → substantial reduction in supply of dairy replacements
  - → retention of cows
  - → increasing average age of lactating cows

Classical associations



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

Brief report

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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[2]Canadian Brain Injury and Violence Research Team, Toronto, Ontario, Canada
[3]Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Ontario, Canada

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

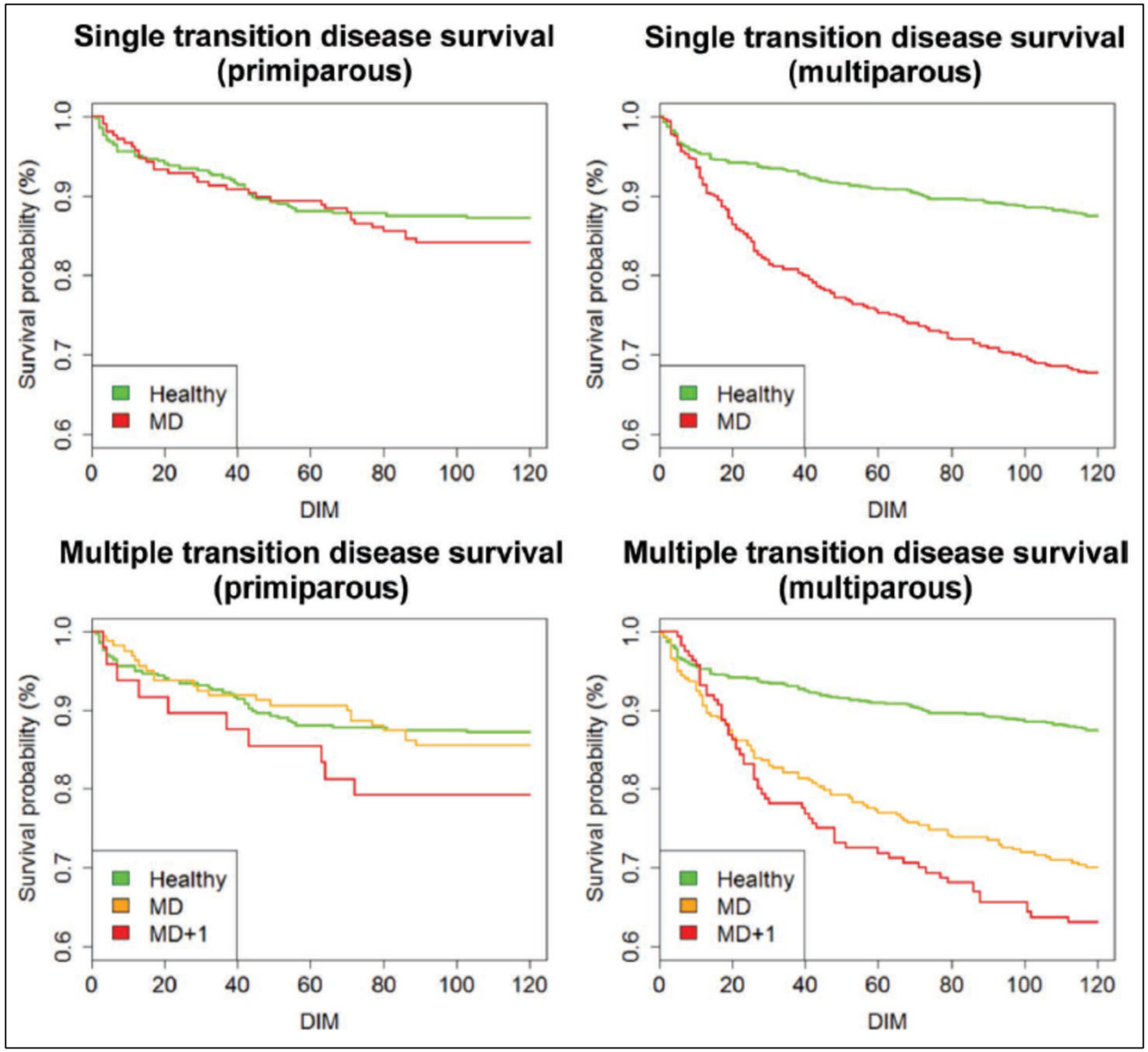
Consequences, in terms of estimated effect of health disorders, of methodological choices (e.g. whether or not including in the models descriptors for milk yield and/or reproductive performance) are [important]. Metabolic and reproductive disorders may act indirectly through a subsequent decrease in milk yield and reproductive performance.

The impact of health disorders on longevity is on average weak, compared to the impact of low milk yield potential and poor reproductive performance. Herd characteristics (availability of heifers, quota, farmer's attitude towards risk and uncertainty...) modify the risk for a cow to be culled for a given health disorder.

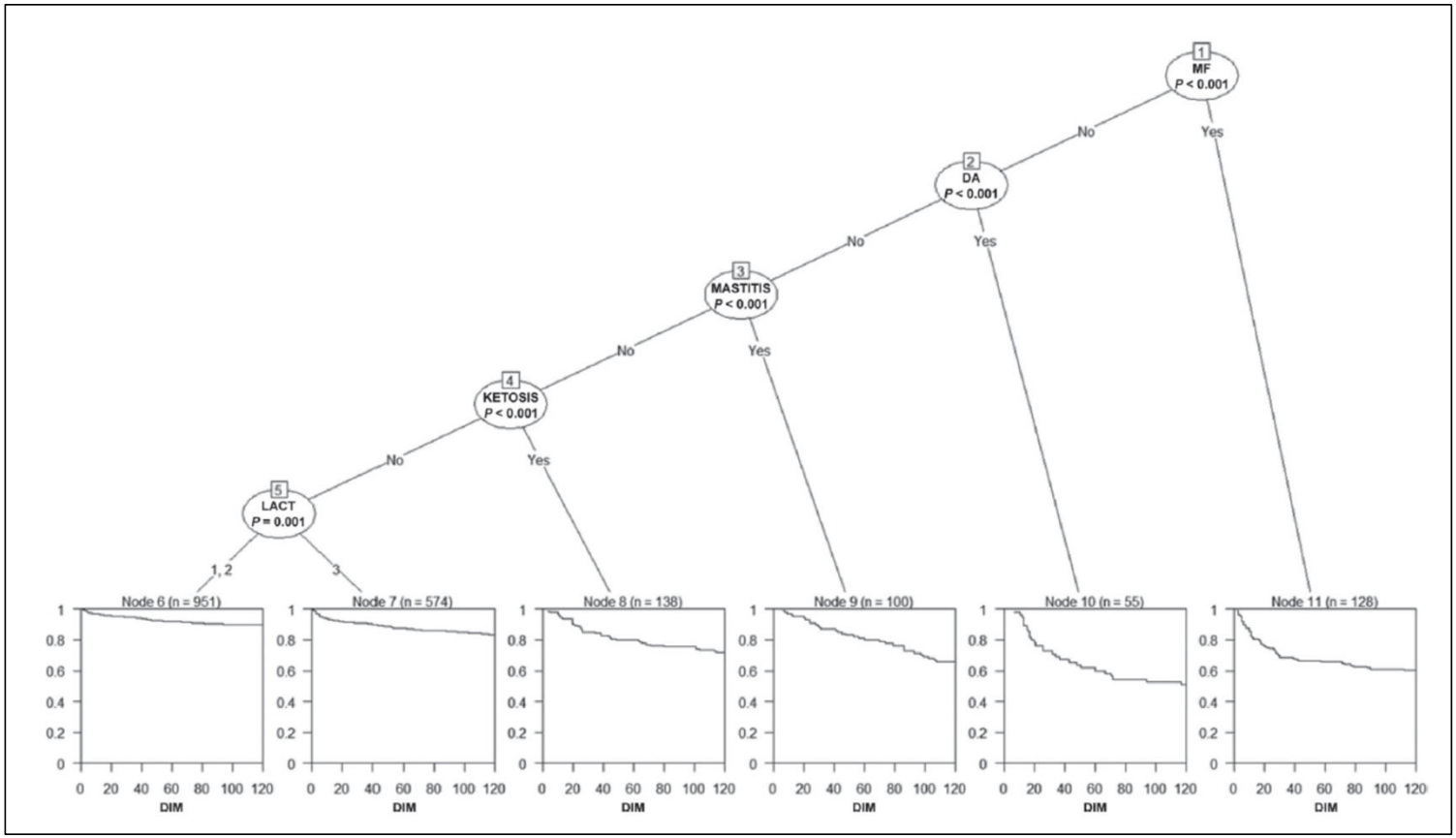
Beaudeau et al AnnZootech 2000

- 1-year cohort of data from 1946 cows in a transition facility in Germany
- Metabolic disease = MF, RP, METR, KET, TWIN or MAST
- Disease effects on culling vary by parity
- Either primiparous cows are more resilient to a single disease, or producers (rightly?) weigh that event less heavily
- Comprehensive disease data
- No milk data

Prado et al JDS 2018



- Same study
- Machine learning algorithm
- Conditional inference tree
- Implies that clinical disease events were more influential than age in culling



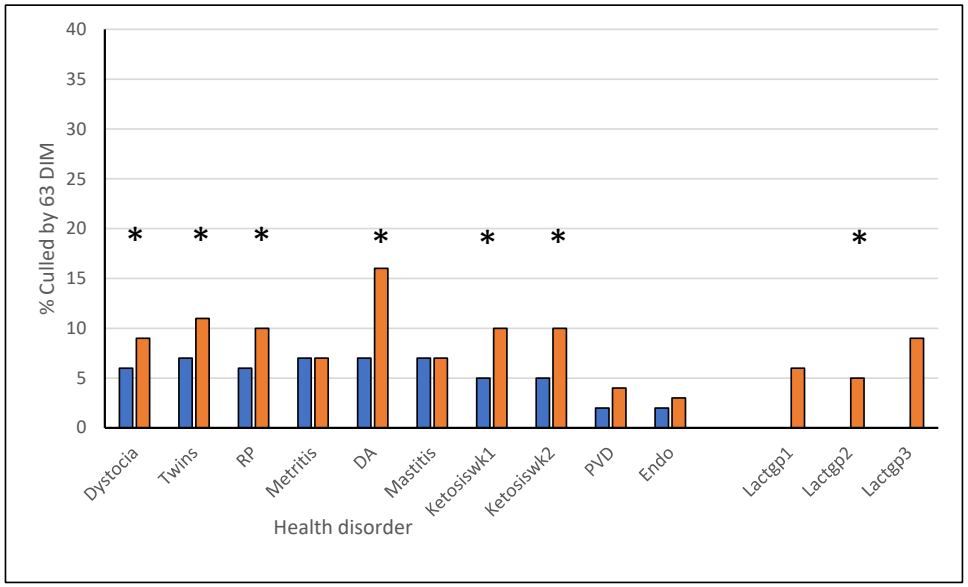
Prado et al JDS 2018

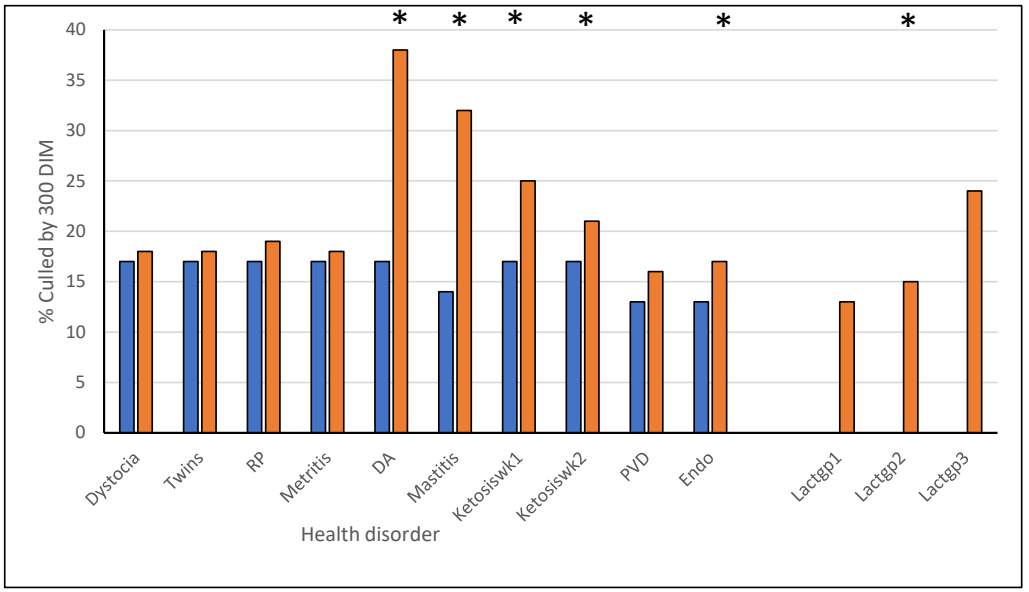
Simple associations of health with culling

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

…controlling for other variables

Multivariable model Culled by 63 DIM

Variable	OR	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

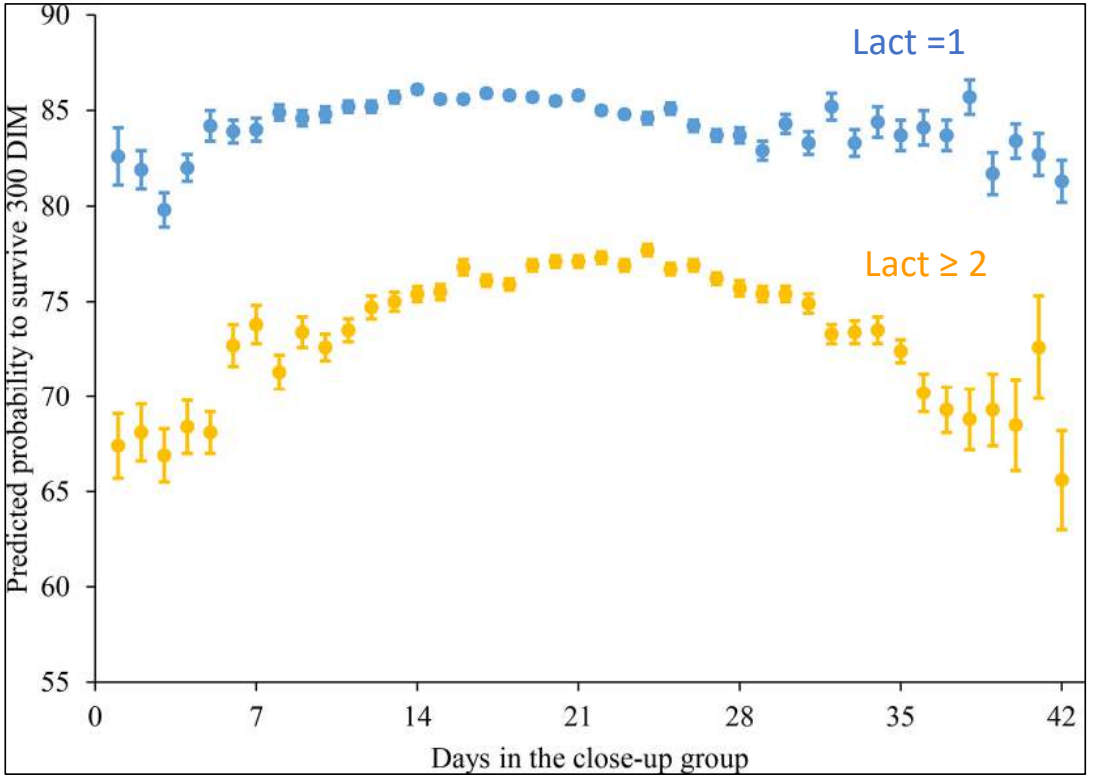
Multivariable model Culled by 300 DIM

Variable	OR	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

Inferences depend on the data analyzed

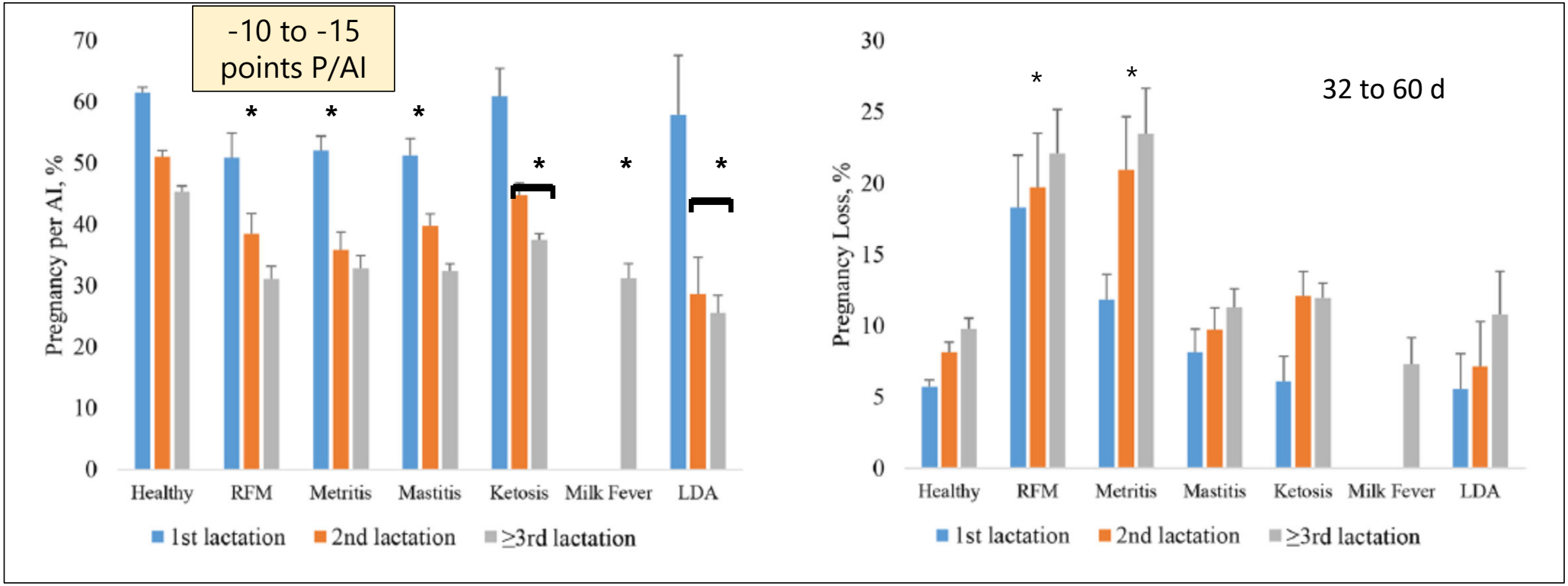
- 28,813 lactations from 14,155 cows on 2 farms in Germany and Slovakia, 2015 - 2020
- Diseases not in the final model of culling risk to 300 DIM
- DINCU associated with
  - Milk yield
  - MF
  - RP
  - Ketosis
  - DA
  - Mastitis
  - Pregnancy at 1st AI
- = "suitcase variable"



Venjakob et al JDS 2023

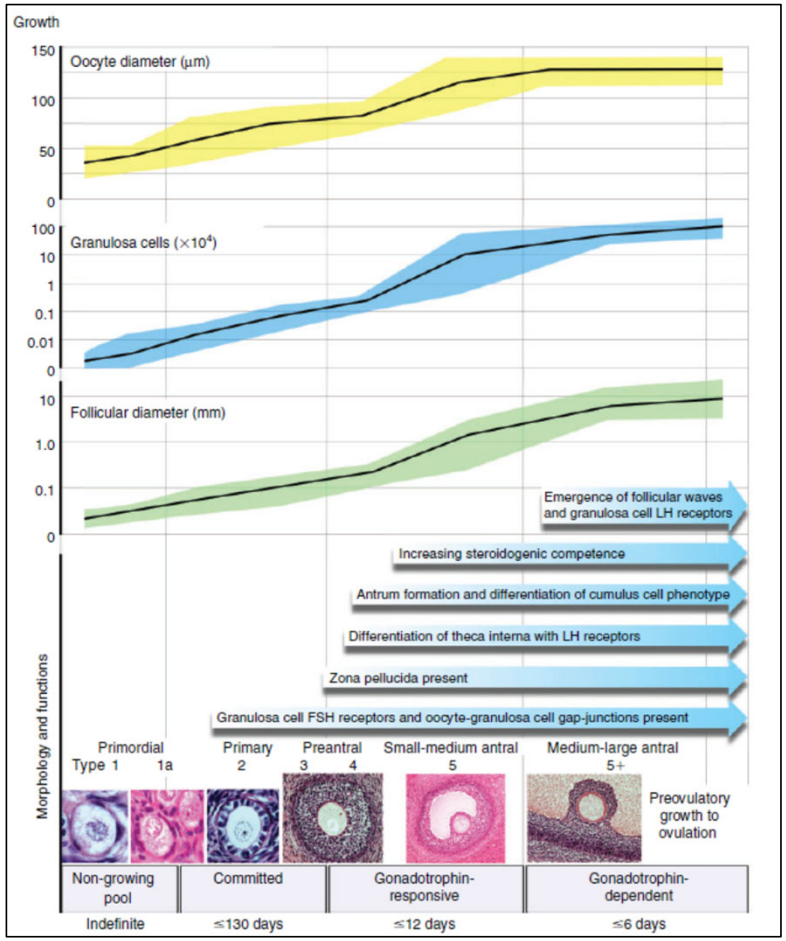
Transition health affects fertility even with Double Ovsynch

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



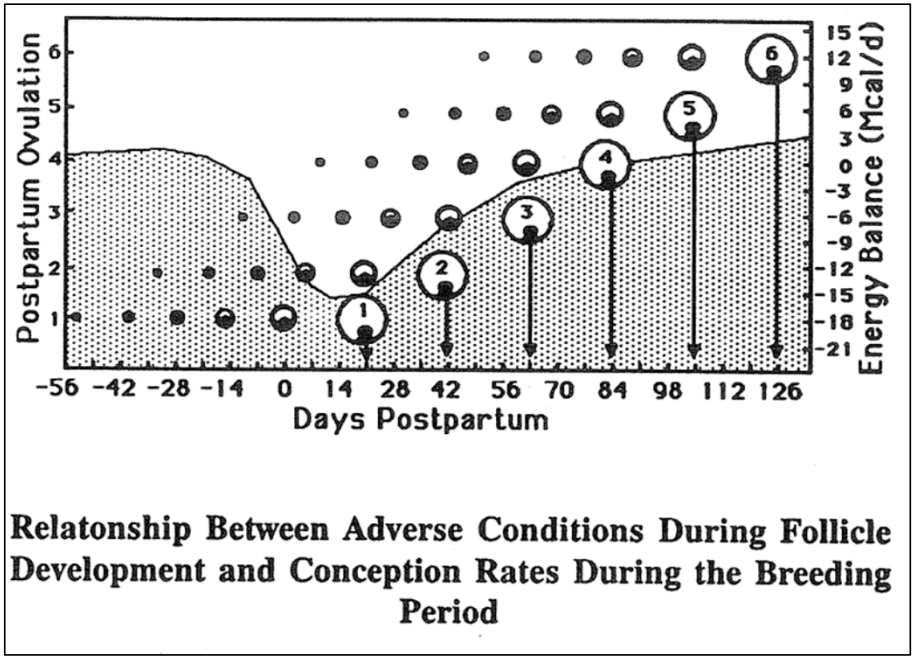
Frenkel et al JDSC 2024

Follicular development occurs over 2 to > 4 months



Ewe model - Scaramuzzi et al RFD 2011

Britt hypothesis (1992)

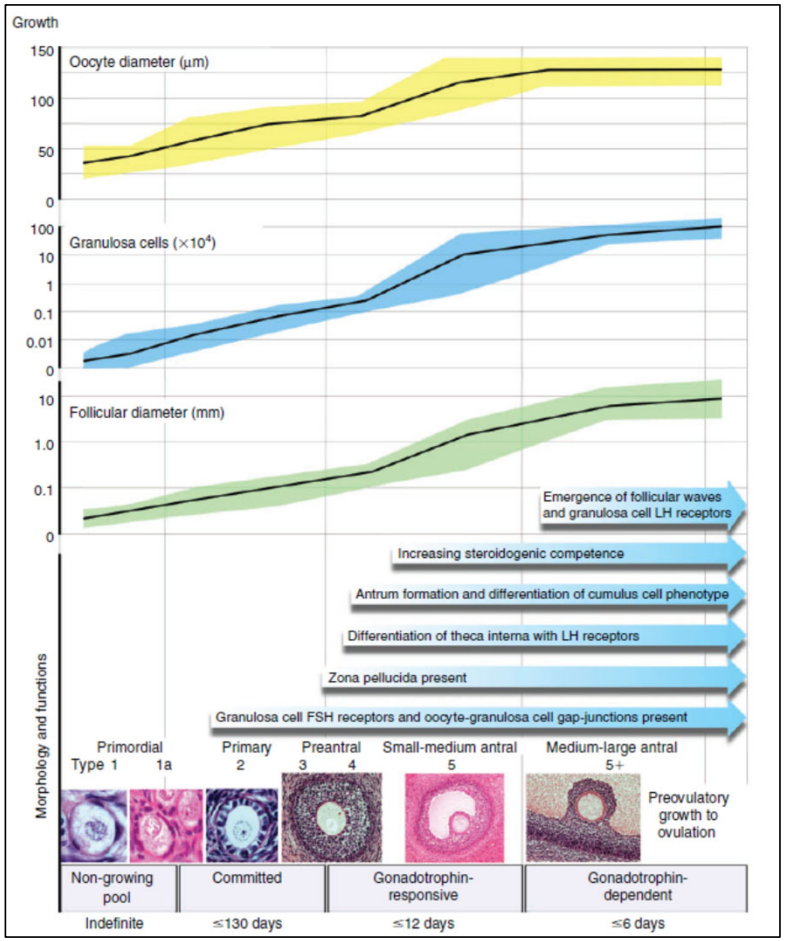


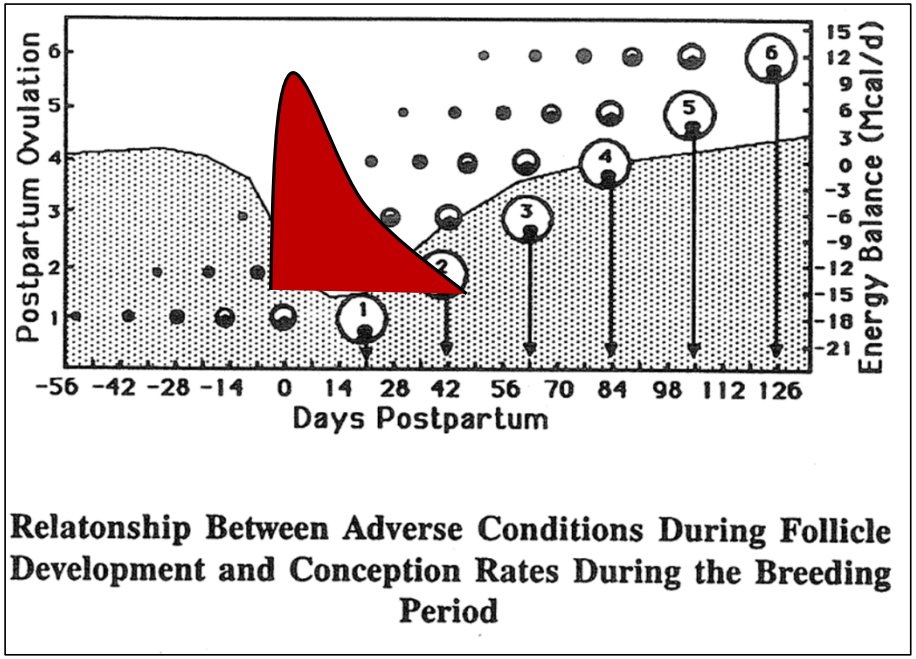
Relatonship Between Adverse Conditions During Follicle Development and Conception Rates During the Breeding Period

Follicular development occurs over 2 to > 4 months

Britt hypothesis (1992)

LeBlanc hypothesis (2024)





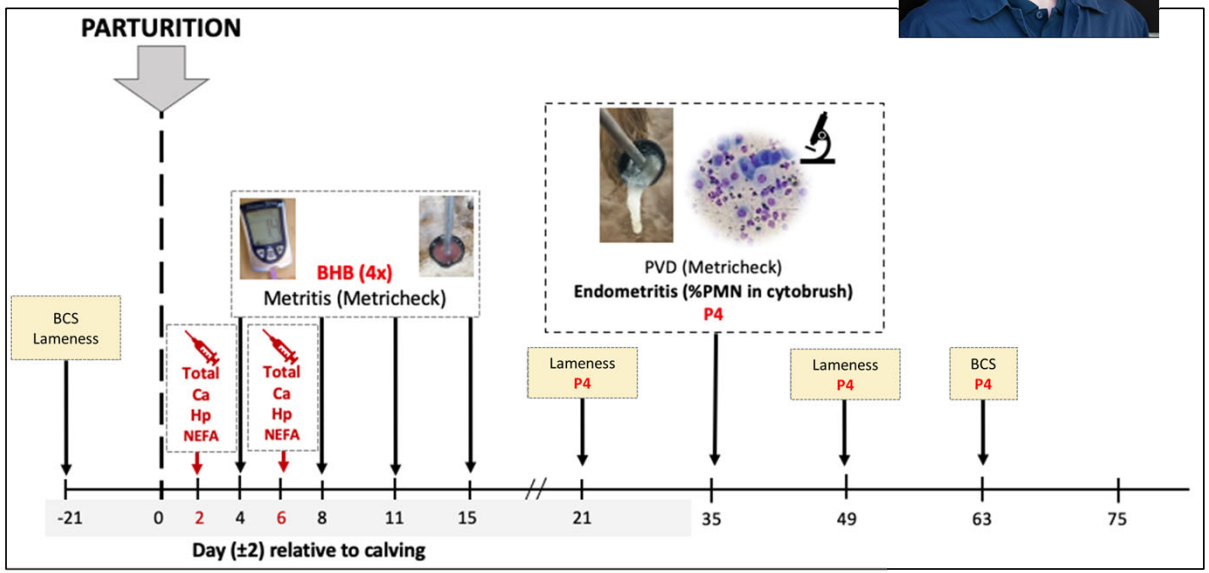
Relatonship Between Adverse Conditions During Follicle Development and Conception Rates During the Breeding Period

Inflammation

Ewe model - Scaramuzzi et al RFD 2011

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

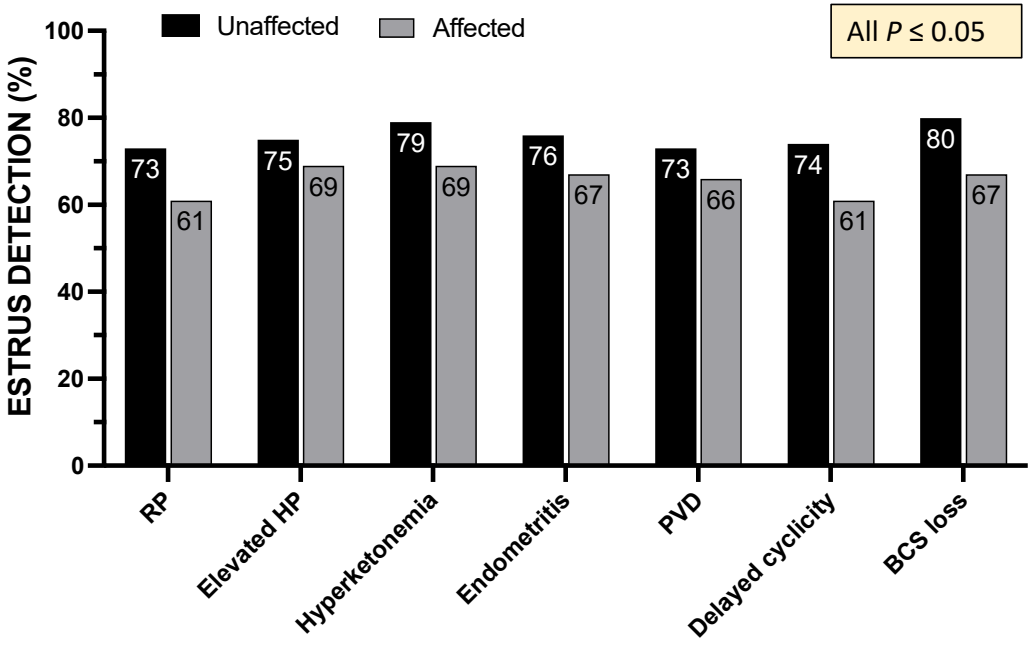


Prevalence of risk factors			
Retained placenta (RP)	**10%**	Lameness (49 d)	**14%**
Haptoglobin at d6 (≥ 0.5 g/L)	**48%**	Acyclic by 49 d	**15%**
Hyperketonemia (≥ 0.7 m*M*)	**50-55%**	BCS Loss (≥ 0.50 point by 63 d)	**53%**
Endometritis (≥ 2.4% PMN)	**44%**	One clinical disease	**29%**
Purulent vaginal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

Bruinjé et al JDS 2024

Transition health associations with estrus and pregnancy at 1st AI

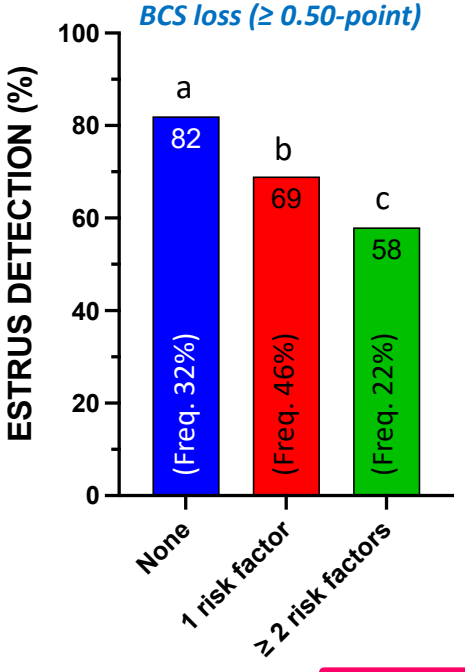
70% of cows detected in estrus by 75 DIM

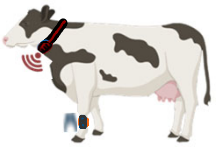


- *Elevated haptoglobin (HP): ≥ 0.5 g/L at 6 (± 2) DIM*
- *Hyperketonemia: ≥2 samples of BHB ≥0.9mM (4 DIM) or ≥0.7mM (8, 11, or 15 DIM)*
- *Endometritis: ≥ 2.4% PMN at 35 (± 3) DIM*
- *Delayed cyclicity: Acyclic by 49 (± 3) DIM*
- *BCS loss: ≥ 0.50-point loss from 3 wk prepartum to 9 wk postpartum vs.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

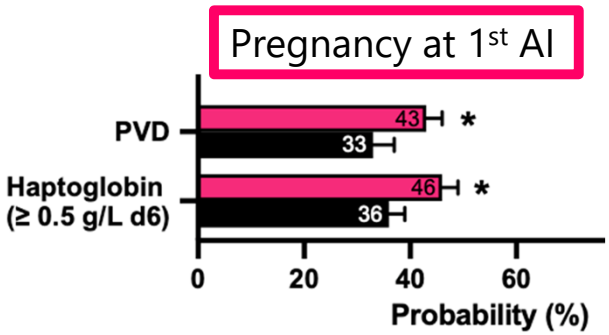
ONLY RISK FACTORS DIAGNOSED ON FARM

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

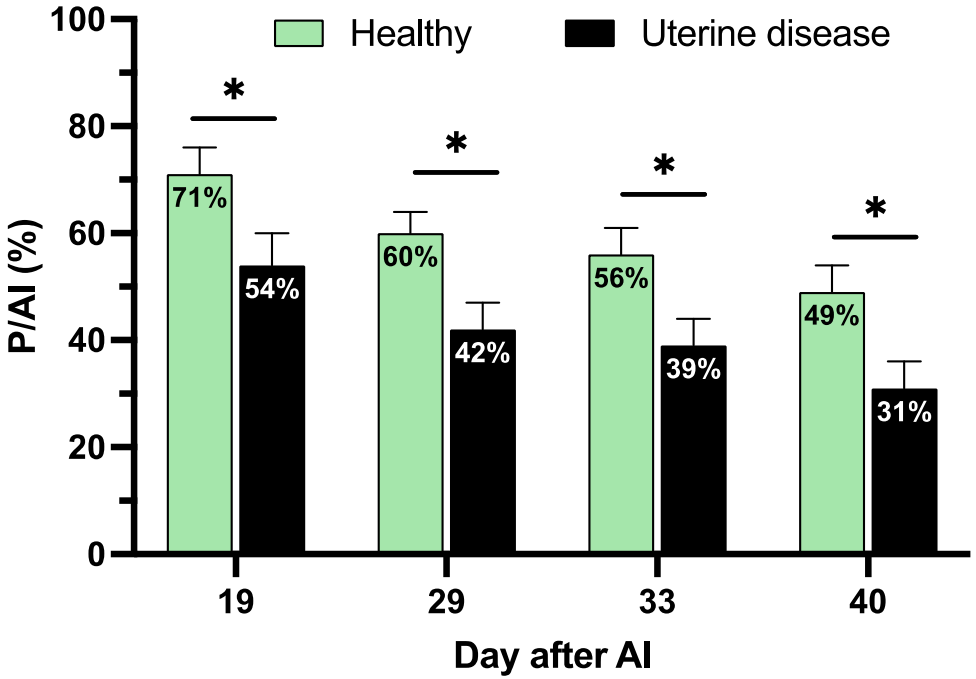


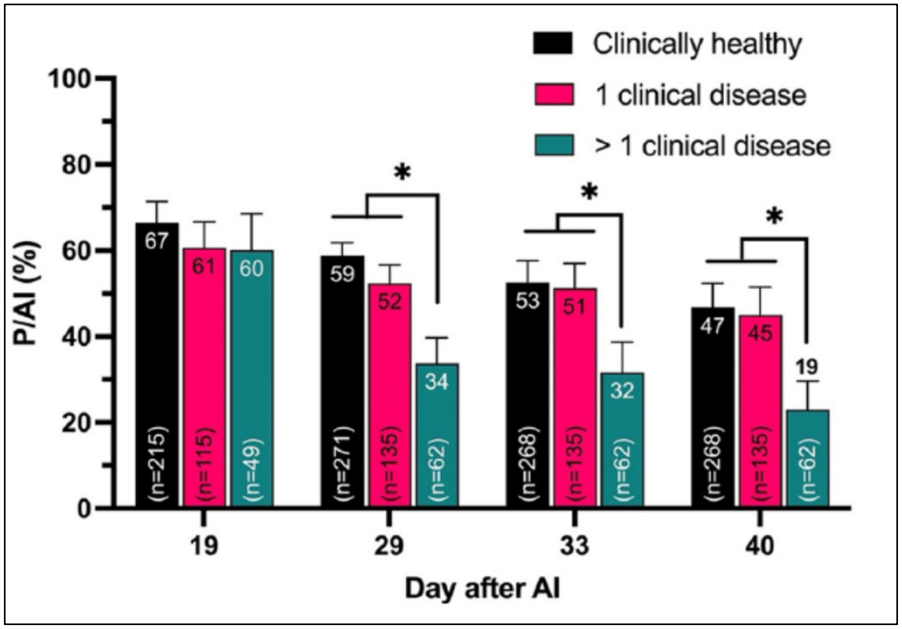


n = 1,210

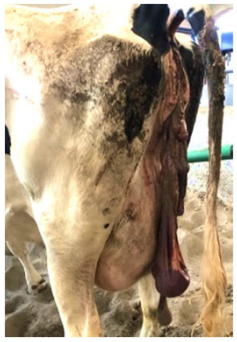


Postpartum Health & Pregnancy Loss





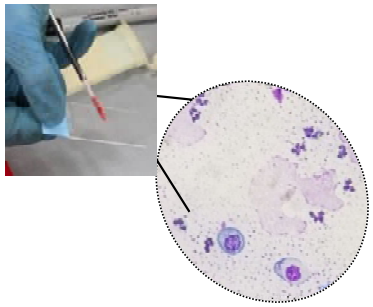
1. RP



2. Metritis

3. PVD

4. Endometritis (cytology)



Bruinjé et al JDS 2024

Fixable problems

- Metritis
- Early-stage lameness
- Some first cases of mastitis
- Purulent vaginal discharge (PVD)

Currently ± unfixable problems

- Chronic mastitis
  - Mycoplasma, Prototheca, Klebsiella (?) mastitis
- Chronic lameness
- Johne's disease
- Leukosis
- Endometritis

Conclusions

- There are not enough large, validated, comprehensive datasets to fully disentangle the effects of health disorders on milk yield and culling
  - Harder than it sounds. Reliable, standardized, complete health data are limiting.
- Milk price, heifer supply and price, and beef price confound these relationships
- Prevention of disease is a primary goal
- Lameness and mastitis are likely main contributors to erosion of profitable lifespan at the herd level
  - Importance = % cows affected * impact per case

When do you want cows to be pregnant?

Ways to lose money on reproduction – Simplistic view

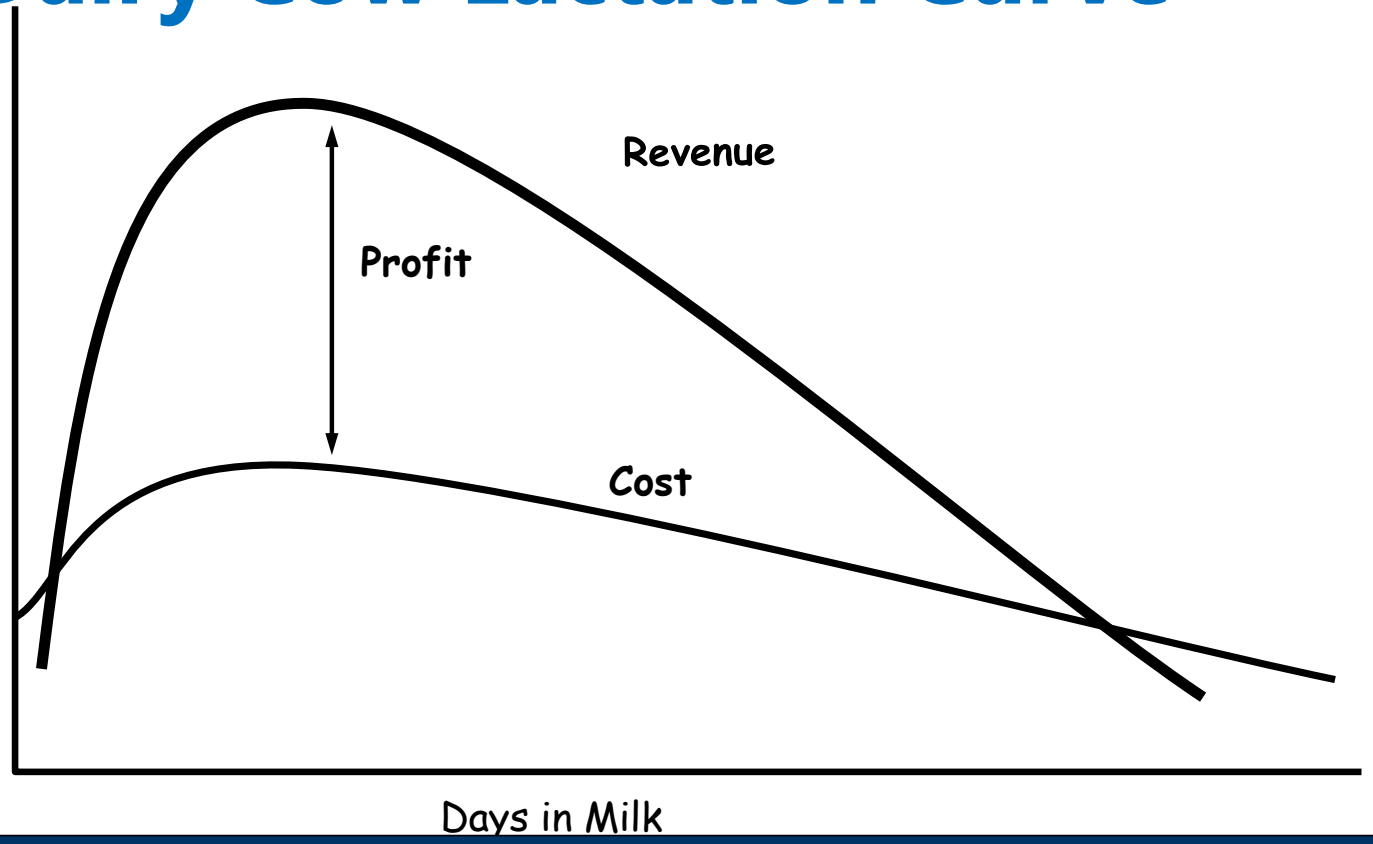
- **Opportunity cost of days open past ~100-120 DIM**
  - Forgone profit from not having cows spend more of their lifetime in the most profitable part of the lactation curve
  - Approximately $1-4 cow/day >100 DIM
- **Culling of otherwise profitable cows due to inability to get them pregnant**
  - =[(Cost 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 hectare
  - Per tonne of N or P
  - Per tonne of GHG

- Not per cow
- Not per insemination

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