Dairy cow longevity – early and late predictors

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Roadmap of today’s “journey”

• Background
• Early and late events with implications on cow longevity
• Monitoring of these events
Early lactation
Late lactation
Transition period
Dry period, mammary involution, BCS, risk of infection
Birth
1st calving
1st Breeding period
Weaning
Colostrum period
Birth
Conception
Pre-conception
Calving
Peak lactation
Early lactation
After John Roche, DairyNZ
Why should a dairy cow live long?

- Early culling may indicate health / welfare problems.
- The carbon footprint per kg produce is reduced.
- The costs for a replacement heifer will be recovered.

Source: Patrik Nordgren, Växa Sverige
Why should a dairy cow live long?

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Phenotypic (- - -) and genetic (—) means of herd-life by birth year in Israel (Weller & Ezra, 2015)
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Average breeding value for survival for Swedish cows per year of birth and breed (Eriksson J-Å, personal communication)

Age (in months) of culled Swedish cows per year and breed (Swedish Dairy Assoc., 1999-2010)
Early predictors
Calf morbidity

- Warnick (1997):
  - No association (tendency for dullness); owner recorded diseases
- Hultgren (2009):
  - No association; technician / vet / owner recording of diseases
- Bach (2011):
  - Diarrhoea, navel infection – no association
  - Bovine respiratory disease (BRD) – reduced chance to complete 1st lactation
- Stanton (2012):
  - BRD before 120d – reduced chance to complete 1st lactation
- Schaffer (2016):
  - BRD before 120d – reduced chance to complete 1st lactation
Growth

• Le Cozler (2010)
  – Lower growth rates 300-430d & 660–780d – decreased longevity
• Bach (2011)
  – Higher growth rates 12-65d – increased chance to complete 1st lactation
• NB high rates before puberty not always beneficial for milk production
Failure of passive transfer (FPT)

• Faber (2005):
  – 2 vs. 4L colostrum within 1h of birth; the rest of feeding was equal
  – 75 and 87% survival through 2nd lactation, respectively
  – Epigenetic programming?
• [Raboisson (2016):
  – FPT increased risk for BRD]
Monitoring early predictors
Characteristics of a monitor

- Objective
- High accuracy and precision
- Cheap / cost-effective
- Easy / feasible to use
- Non-invasive
Monitoring morbidity (BRD)

- Observations by farmer, technician
- Automatic calf feeder
  - Svensson (2007) – unrewarded visits associated with disease
  - Borderas (2009) – milk intake / frequency / duration associated with disease, but affected by feed allowance
- Social and feeding behaviour [Weary, 2009; Rushen, 2012]
  - Cramer (2016) – behaviour scoring and association with BRD
  - de Passillé (2010) – activity meters; health?
  - Smith (2015) - triple-axis accelerometer and health (steers)
  - Position location (only cows?); health?
  - Sound analysis; health?
Monitoring growth

- Electronic scales (automatic?)
- Girth tape
- Withers / rump height

- Objective
- Accurate/precise
- Cost-effective
- Easy
- Non-invasive
Monitoring FPT

• Refractometer (Brix) on serum samples (at 48h age)
  – Deelen (2014) – Brix % and IgG highly correlated (0.93); Sensitivity / Specificity for FPT 89% / 89%
  – Hernandez (2016) – r=0.79; Se / Sp = 100% / 89%

• Epigenetic programming; Telomere length?
Late predictors
General longevity

- Age at first calving (AFC) – mixed results
- Milk production – mixed results
- Foot lesions
- Lameness
- Reproduction (not pregnant)
- Diseases:
  - Metabolic disorders
  - Mastitis
  - Reproductive disorders (metritis)
Specifically – on-farm mortality, early cull

- On-farm mortality can be an “iceberg indicator” for involuntary culling
- Alvåsen (2014):
  - Traumatic events and (several) diseases
  - Dystocia, stillbirth
  - Early lactation
  - Low or missing milk yield at first test-milking (~disease / disturbance)

⇒ A transition cow problem
⇒ Metabolic load, negative energy balance
⇒ Metabolic adaptation (van Knegsel, 2014)
Monitoring late predictors
Monitoring general predictors

- Dairy herd improvement / farmer records – AFC, milk production, reproduction, diseases
- Routine claw trimming information – foot lesions
- (triple-axis) Accelerometer – lameness, diseases
- Force sensors – lameness
- Rumen bolus (pH, temperature) – diseases
- Position location – lameness, diseases

[Caja, 2016]
Monitoring transition problems

- Stangaferro (2016) – rumination and activity monitoring associated with metabolic, mastitis, metritis risks [and culling…]
- Roberts (2012) – metabolic parameters nonesterified fatty acids (NEFA), β-hydroxybutyric acid (BHBA), calcium associated with early-lactation culling risk
- Milk-fat composition as biomarkers of metabolic state
- Crookenden (2016) – circulating exosomes as biomarkers of metabolic state
- Hallén Sandgren (2016) – automatic body condition scoring; intra-class correlation 0.86-0.94; health?; fertility!
At the end of the day (journey)...

Longevity is in the head of the farmer!

Bergeå (2016):

- Farmers seemed well aware of biological factors related to cow longevity
- Farmers had not worked explicitly with longevity
- The “heifer push”

Monitoring and acting on predictors:

- may not necessarily improve longevity
- will still improve animal welfare
- provides room for voluntary culling
Concluding remarks

• Not a completely exhaustive review!
• There are early predictors!
• There are ways to monitor these predictors
• Careful considerations are necessary in choosing if / how to monitor – for longevity!

• There are several later predictors
• There are ways to monitor these predictors
• Careful considerations necessary
• Combinations of monitoring “devices” – Caja (2016): “the third sense approach”
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