Heritability and genetic correlations for health and survival in Norwegian Red calves

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Introduction

- Calf survival and health
  - indicator of animal welfare
  - important economically
  - No calf, no cow

- Increased recordings on calfhood diseases in recent years in Norway
  - increased direct recording by veterinarians

Aim

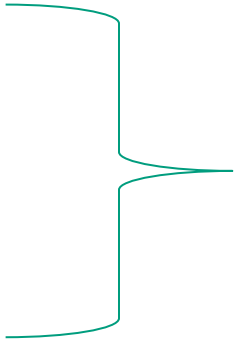
- Estimate heritabilities and genetic correlations for calf survival and the three most common calfhood diseases in Norwegian Red

Traits

4 binary traits:

- Survival to 6 months of age

- Respiratory disorders
- Gastritis/enteritis
- Arthritis/joint disorders



Veterinary treatments

Data

- 606,447 Norwegian Red calves
- Males and females born from 2004 to 2013
- Records until 180 days old, death or sold from the herd

- Binary traits
  - Diseases: 1 = treated, 0 = not treated
  - Survival: 1 = alive, 0 = dead before 180 d
    - Calves sold from herd: survival = missing

Mean Frequency

	Number of records	Frequency (%)
Respiratory disease	606 447	3.32
Gastritis/enteritis	606 447	2.31
Arthritis/joint disorder	606 447	1.32
Survival	497 109	95.57

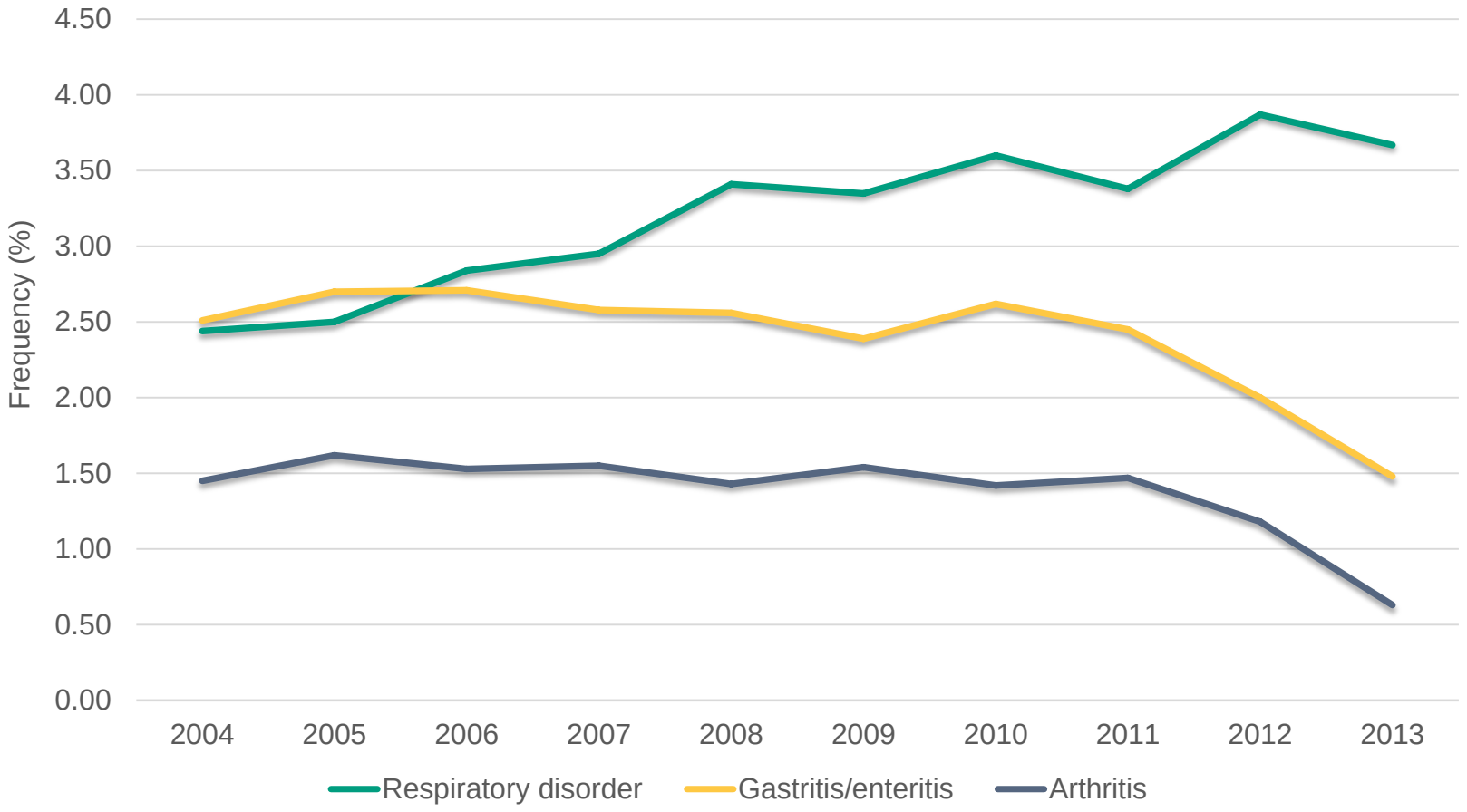
Disease frequency among those that died:

11.57 % respiratory disease

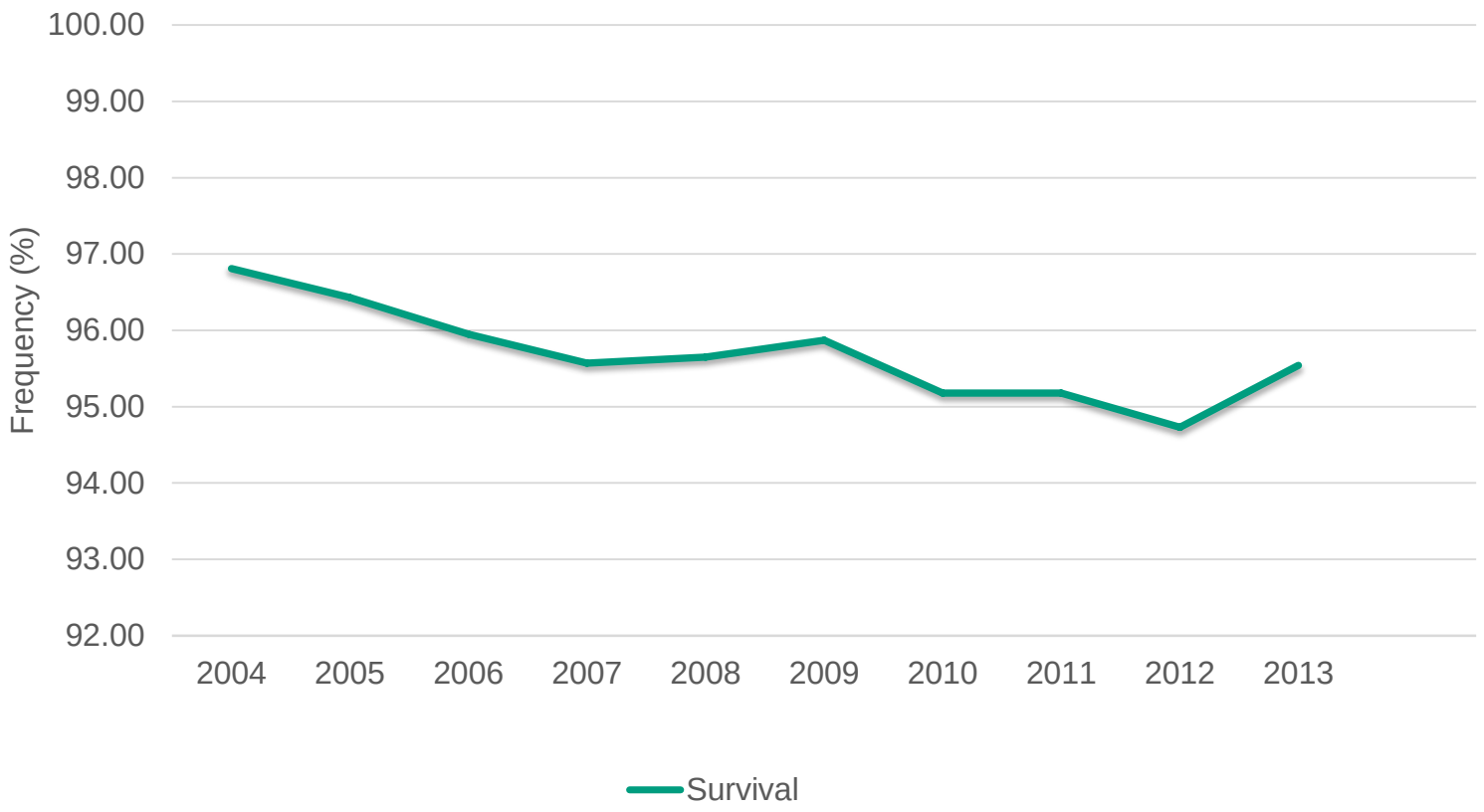
7.94 % gastritis/enteritis

4.82 % arthritis/joint disorder

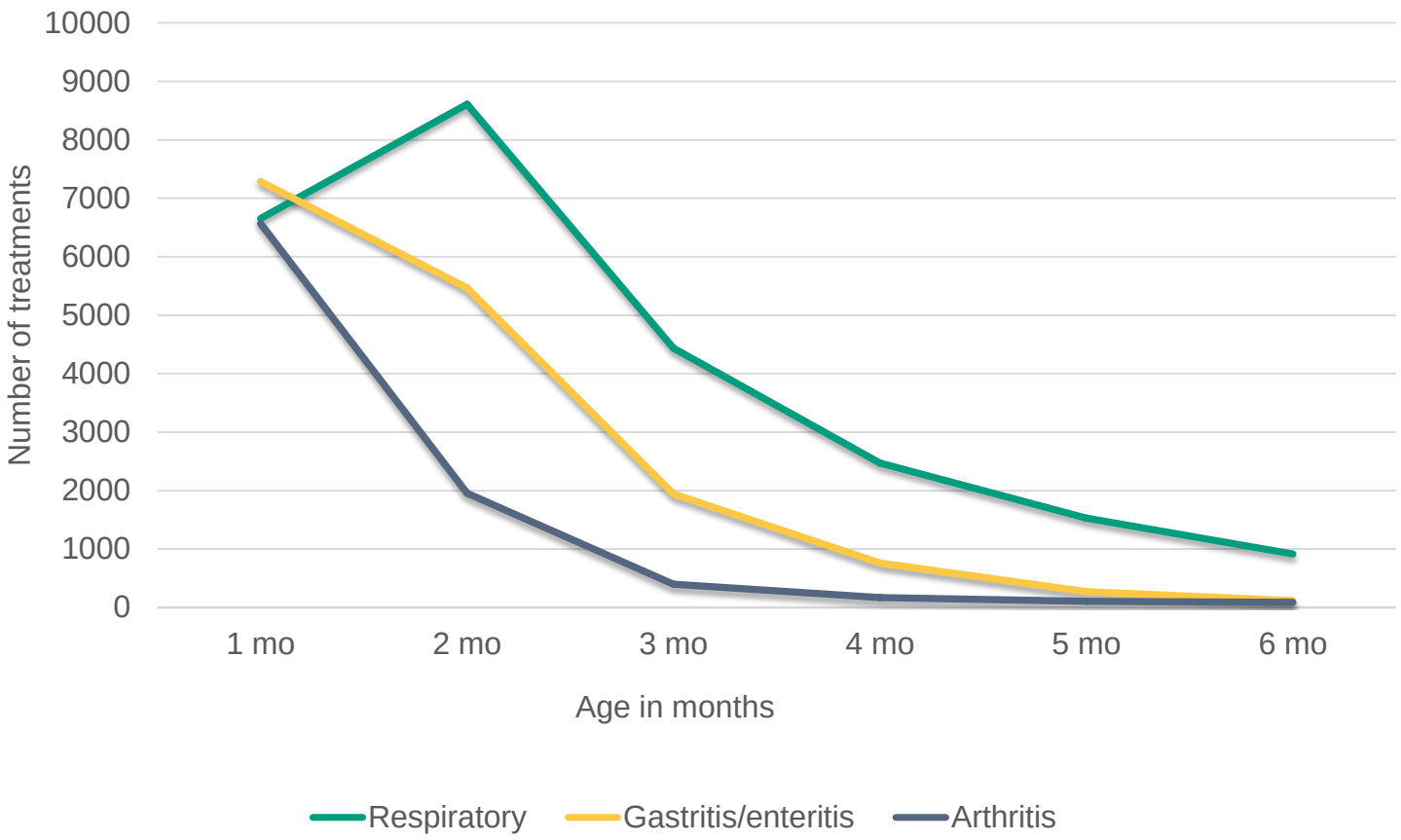
Disease frequency by birthyear



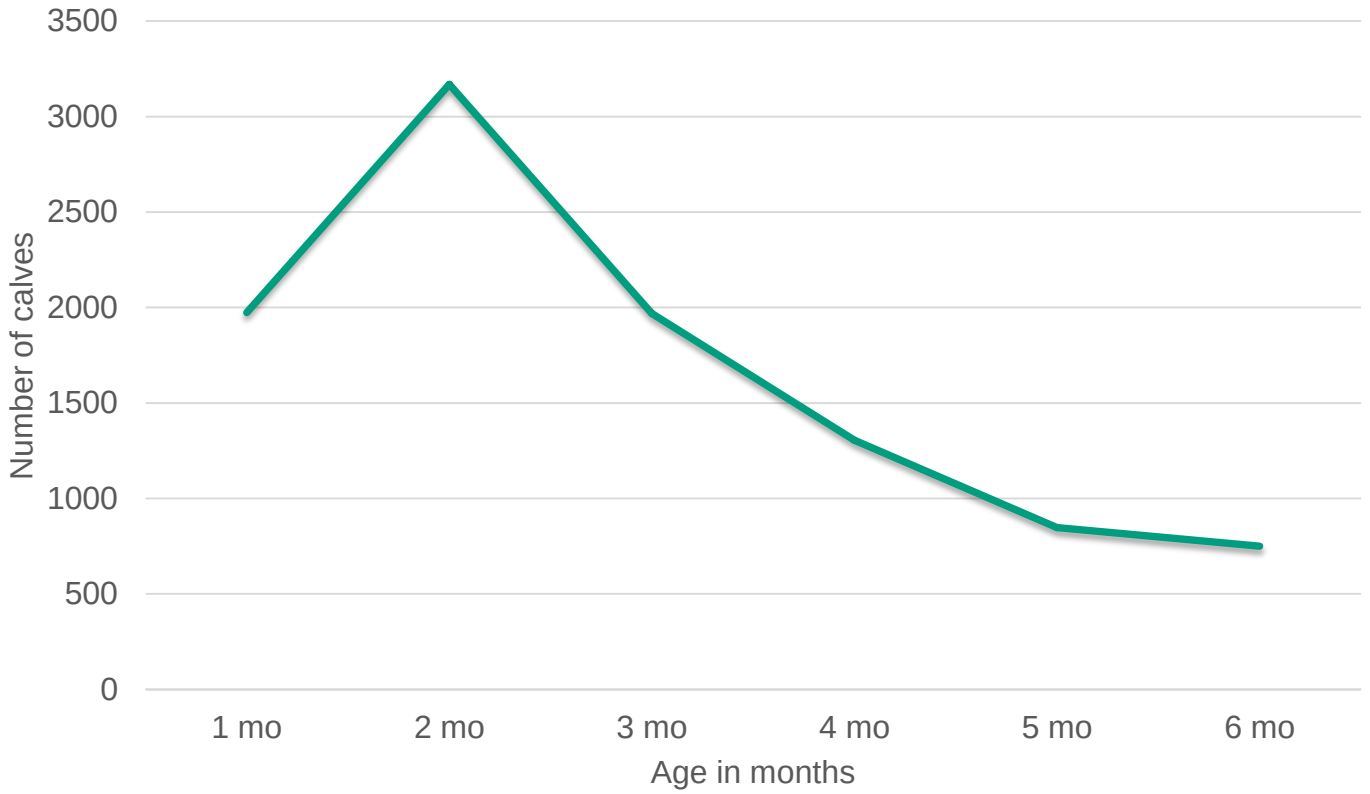
Calf survival by birthyear



Age at time of treatment



Age at time of death



Model

- Multivariate threshold sire model
  - Gibbs sampling, RJMC in DMU (Madsen and Jensen, 2010)

- Fixed effects (no classes):
  - Sex (2)
  - Singleton/twin (2)
  - Calving difficulties (3)
  - size of calf (3)
  - group size (11)
  - month-year of birth (120)

- Random effects:
  - Herd-year
  - Sire

Random effects

- 1,320 Norwegian Red AI-sires
  - Minimum 50 calves/sire (mean=460)
  - 12,942 animals in pedigree file
    - Sires and dams traced as far back as possible

- 23,997 herd-year
  - Minimum 1 health recording on calves 180 d or younger
    - Including dehorning

Variance components and heritability - posterior mean (SD)

	σ^2_{sire}	σ^2_{hy}	h^2
Respiratory disease	0.022 (0.002)	0.40 (0.01)	0.09 (0.01)
Gastritis/ enteritis	0.012 (0.002)	0.46 (0.01)	0.05 (0.01)
Arthritis	0.019 (0.003)	0.23 (0.01)	0.07 (0.01)
Survival	0.011 (0.001)	0.18 (0.01)	0.04 (0.01)

$$h^2 = 4* \sigma^2_{sire} / \sigma^2_{sire} + \sigma^2_{hy} + 1$$

Genetic correlations

- posterior mean (SD)

	Respiratory disease	Gastritis/ enteritis	Arthritis/ Joint disorder
Gastritis/ enteritis	0.30 (0.09)		
Arthritis/ joint disorder	0.23 (0.08)	0.31 (0.10)	
Survival	-0.67 (0.07)	-0.64 (0.07)	-0.59 (0.07)

Herd correlations

- posterior mean (SD)

	Respiratory disease	Gastritis/ enteritis
Arthritis/ Joint disorder	-0,25 (0.02)	-0.17 (0.02)
Survival	-0.22 (0.02)	

Remaning herd correlations was close to zero

Summary

- Heritabilities 0.04 – 0.09, similar to other health traits
- Genetic correlations are favourable, moderate to strong
- Information early, from both sexes - advantage
  - Large progeny groups, high accuracy of sire EBV
- New traits to be included in the total merit index for Norwegian Red

Thank you