

# Genetic parameters for fertility-related disorders in Norwegian Red

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## Fertility-related disorders

- Veterinary treatments recorded in the Norwegian Dairy Herd Recording System since 1978.
- Only category of diseases that increased in Norway last year.
- Most common in Norway:
  - retained placenta, cystic ovaries, silent heat and metritis.
- So far not included in the routine genetic evaluations

## Aim

- Estimate heritabilities for the 4 most common fertility-related disorders in 5 lactations
  - Why 5 lactations?
    - Frequency increases in later lactations
    - Utilize all available information for genomic selection
- Evaluate if the fertility related disorders can be considered to be the same trait across lactations, based on genetic correlations.

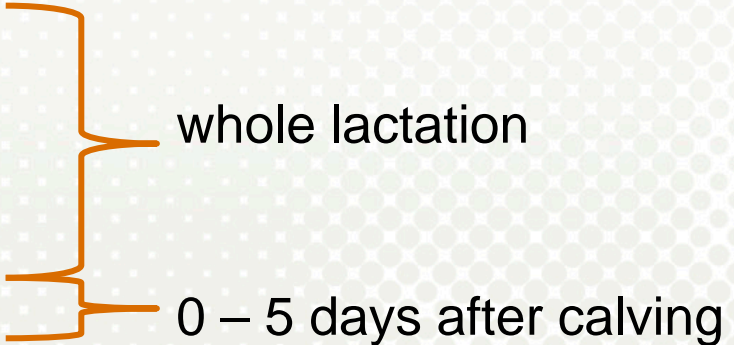
## Material

- Calving information and health records from lactation 1 to 5
- 1,247 Norwegian Red AI-sires
- Calving from January 2001 through December 2011.
- Lactations defined from day of calving to
  - 15 days before next calving
  - Culling
  - 400 days after calving

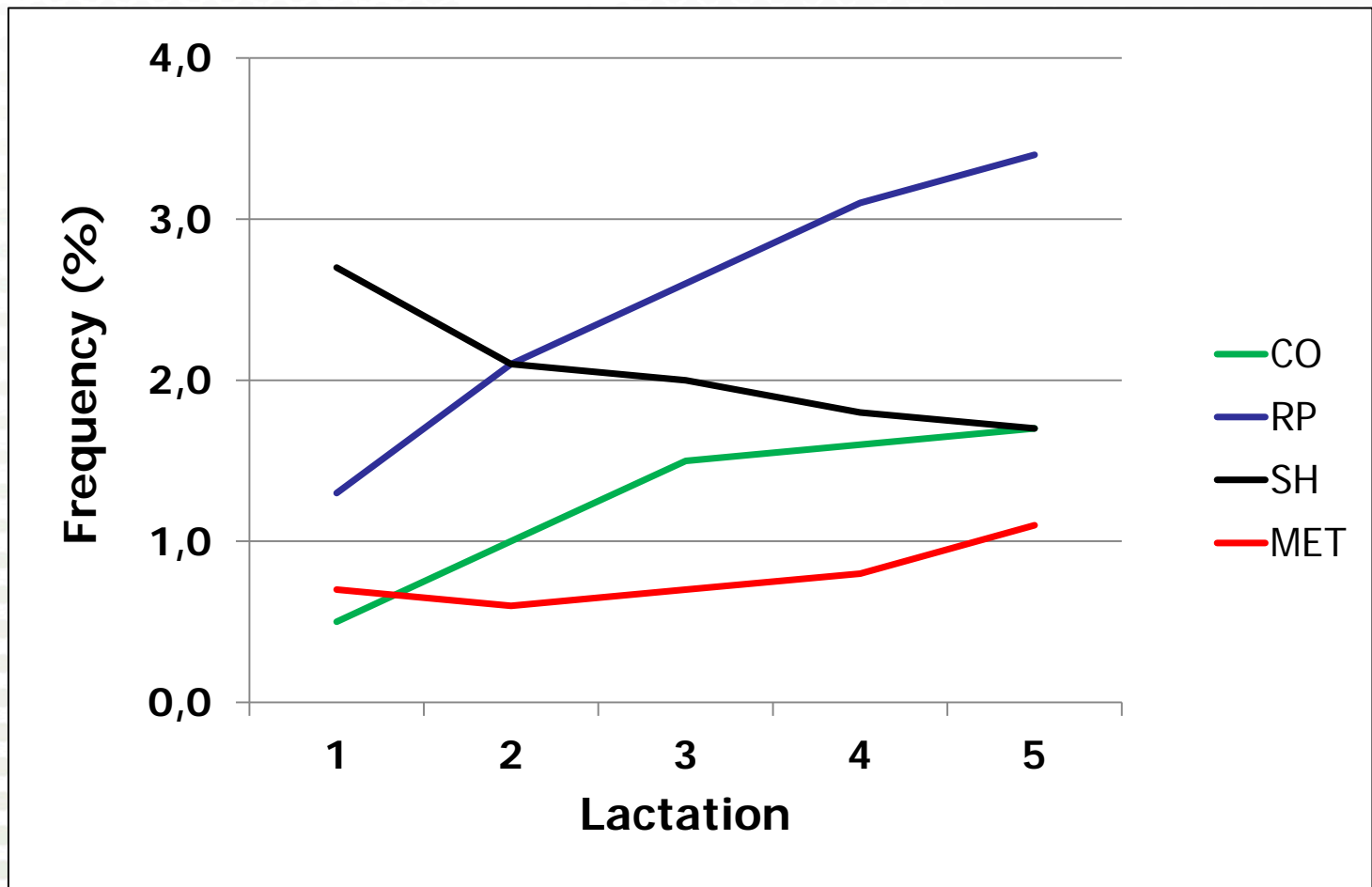
## Data

Lactation	Age at calving (months)	No of cows
1	20-36	780,114
2	32-48	489,903
3	44-60	280,085
4	56-72	138,938
5	68-84	58,461

## Traits

- 20 binary (0/1) traits
    - 4 fertility related disorders x 5 lactations
    - Cystic ovaries (**CO**)
    - Metritis (**MET**)
    - Silent heat (**SH**)
    - Retained placenta (**RP**)
- 
- whole lactation
- 0 – 5 days after calving

# Traits



## Method

- Multivariate threshold sire model
- Each disorder analyzed separately
- The 5 lactations analyzed as correlated traits
  
- Model:  $\lambda = X\beta + Zh + Zs$
  
- RJMC-procedure in DMU
  - 300,000 iterations after 50,000 burn-in



## Models

Systematic effects	CO	MET	SH	RP
Year-season	✓	✓	✓	✓
Calving interval previous calving	✓		✓	✓
Age at calving	✓			
Calving difficulties		✓		✓
Twinning		✓		✓

## Results: Heritabilities of liability

Posterior means (SD)

	Lactation				
	1	2	3	4	5
<b>CO</b>					
h <sup>2</sup>	0.10	0.14	0.13	0.12	0.14
SD	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)
<b>MET</b>					
h <sup>2</sup>	0.04	0.03	0.04	0.04	0.08
SD	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)
<b>RP</b>					
h <sup>2</sup>	0.07	0.08	0.09	0.10	0.10
SD	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
<b>SH</b>					
h <sup>2</sup>	0.05	0.03	0.04	0.04	0.07
SD	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)

## Results: Genetic correlations – Cystic ovaries

- Posterior means (SD) of genetic correlations for cystic ovaries ( $CO_i$ ), in five lactations ( $i=1-5$ ).

	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>	<b>CO5</b>
<b>CO1</b>					
<b>CO2</b>	0.91 (0.03)				
<b>CO3</b>	0.84 (0.06)	0.95 (0.03)			
<b>CO4</b>	0.86 (0.07)	0.93 (0.04)	0.92 (0.04)		
<b>CO5</b>	0.74 (0.11)	0.85 (0.07)	0.85 (0.07)	0.90 (0.07)	

## Results: Genetic correlations - Metritis

- Posterior means (SD) of genetic correlations for metritis ( $MET_i$ ), in five lactations ( $i=1-5$ ).

	<b>MET1</b>	<b>MET2</b>	<b>MET3</b>	<b>MET4</b>	<b>MET5</b>
<b>MET1</b>					
<b>MET2</b>	0.56 (0.15)				
<b>MET3</b>	0.64 (0.14)	0.77 (0.11)			
<b>MET4</b>	0.51 (0.21)	0.67 (0.16)	0.53 (0.21)		
<b>MET5</b>	0.67 (0.15)	0.44 (0.23)	0.40 (0.23)	0.38 (0.29)	

## Results: Genetic correlations – Retained placenta

- Posterior means (SD) of genetic correlations for retained placenta ( $RP_i$ ), in five lactations ( $i=1-5$ ).

	<b>RP1</b>	<b>RP2</b>	<b>RP3</b>	<b>RP4</b>	<b>RP5</b>
<b>RP1</b>					
<b>RP2</b>	0.68 (0.06)				
<b>RP3</b>	0.61 (0.07)	0.94 (0.03)			
<b>RP4</b>	0.61 (0.08)	0.86 (0.05)	0.93 (0.04)		
<b>RP5</b>	0.59 (0.11)	0.86 (0.06)	0.88 (0.05)	0.86 (0.07)	

## Results: Genetic correlations – Silent heat

- Posterior means (SD) of genetic correlations for silent heat ( $SH_i$ ), in five lactations ( $i=1-5$ ).

	SH1	SH2	SH3	SH4	SH5
SH1					
SH2	0.79 (0.04)				
SH3	0.60 (0.12)	0.83 (0.09)			
SH4	0.37 (0.14)	0.65 (0.12)	0.77 (0.12)		
SH5	0.44 (0,16)	0.77 (0.12)	0.59 (0.21)	0.44 (0.25)	

## Preliminary result: Genetic correlations

- Genetic correlation (SE) for the 4 fertility related disorders in the first lactation
  - estimated from a multivariate **linear** sire model

	<b>CO1</b>	<b>MET1</b>	<b>RP1</b>	<b>SH1</b>
<b>CO1</b>				
<b>MET1</b>	0.12 (0.11)			
<b>RP1</b>	-0.19 (0.10)	0.56 (0.08)		
<b>SH1</b>	0.17 (0.12)	0.02 (0.11)	-0.01 (0.09)	

## Summary

- Heritabilities ranged from 0.03 to 0.14
  - increased in later lactations
- CO - genetically the same trait across lactations
- MET and SH - genetically different traits across lactation
- RP in 1<sup>st</sup> lactations is genetically a different trait than RP in 2<sup>nd</sup> to 5<sup>th</sup> lactation
- The genetic correlations between CO, MET, RP and SH in 1<sup>st</sup> lactation was in general low.

Thank you for your attention