Revision of the Fertility and Health Genetic Evaluations for Irish Holstein-Friesian Dairy Cattle

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Current situation

- Irish total merit index, EBI, includes fertility and health

- Fertility
  - *Calving interval*
- Health
  - *Udder health – SCC itself and as a predictor of mastitis*
  - *Lameness – locomotion as a predictor*

Deficiencies

- Calving interval is lowly heritable requires a long time to measure
  - Use milk yield as a predictor but difficult to identify high yielding fertile dams

- Genetic correlation between SCC and mastitis assumed to be 0.70
- Genetic correlation between locomotion and lameness assumed to be -0.40

Objective

- To evaluate the usefulness of now routinely recorded service and pregnancy diagnosis data as early biological predictors of fertility
- To estimate genetic parameters for mastitis and lameness

Data - Fertility

- Years: 2002 to 2009
- >2 million AI services, >200,000 natural matings, >350,000 pregnancy diagnoses
- Parity 1 to 5

Fertility Traits

- Interval traits:
  - Age at first service (AFS), age at first calving (AFC), calving to first service interval (CFS), calving interval (CIV)
- Binary traits
  - Calving in first 42 days of calving season (CALV42), submission in first 21 days of breeding season (SR21), pregnancy to first service (PRFS), pregnant in first 42 days of breeding season (PR42), 56-day non-return (NR56)
- Count traits
  - Number of services

Data - Health

- Years: 2003 to 2009
- Mastitis recorded by farmers
- Lameness recorded by farmers and hoof trimmers
- >60,000 mastitis events from ~40,000 lactations
- 18,000 lameness events from 16,000 lactations
- Compressed to a per lactation basis

Fertility analysis – within parity

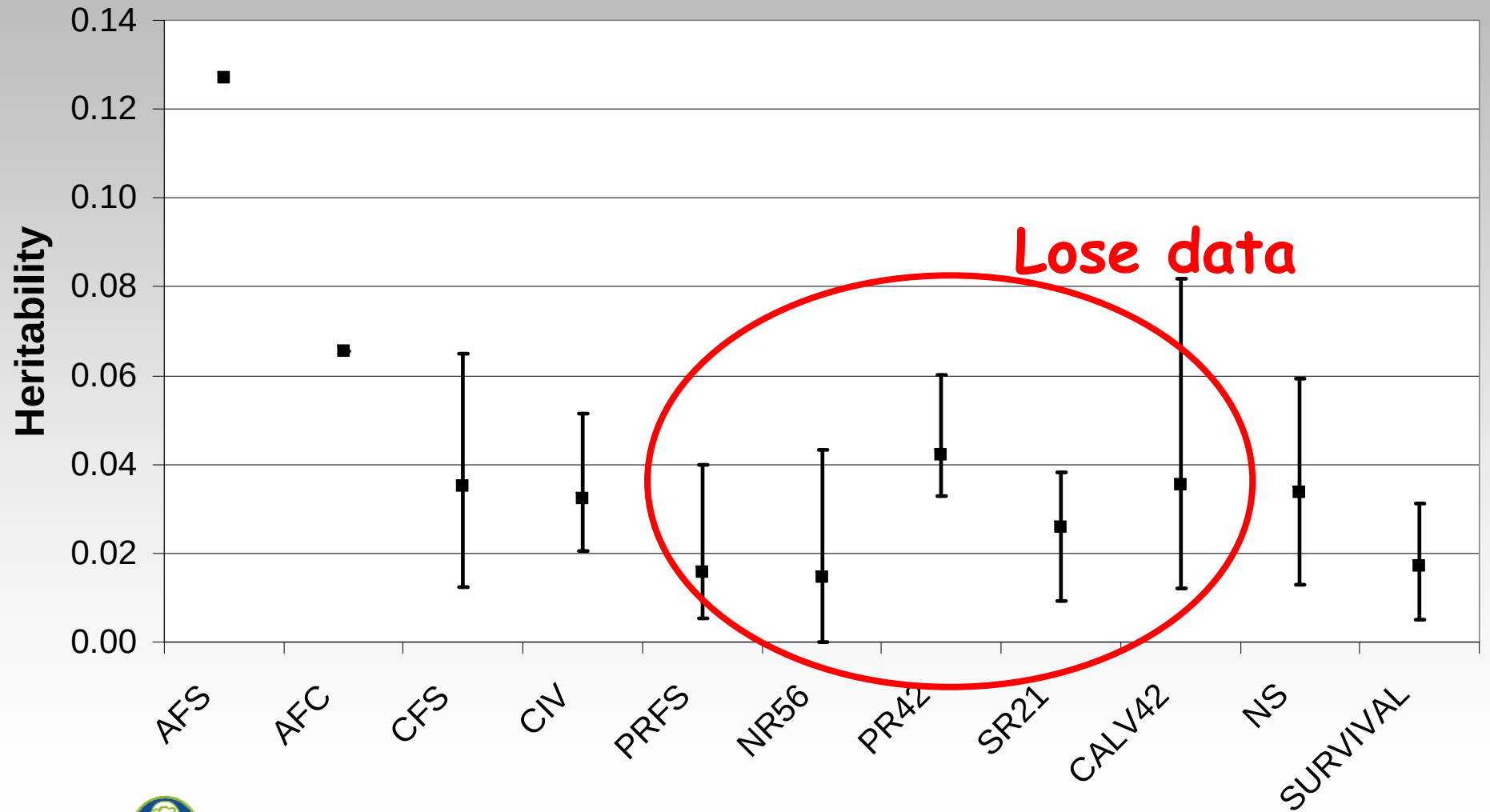
- Animal model
- Fixed effects
  - Contemporary group
  - Holstein breed proportion
  - Heterosis and recombination
  - Age at calving
  - PRFS and NR56
    - Whether or not a double insemination
    - Service sire
    - Technician
    - Year of service by month of service

Health analysis – across parity

- Animal repeatability model
- Fixed effects
  - Contemporary group
  - Holstein breed proportion
  - Heterosis and recombination
  - Number of herd events

Results

Heritability - variation



Genetic correlations

- Milk is moderately genetically correlated with calving interval

		Milk yield				
		1	2	3	4	5
Calving interval	1	0.33	0.65	0.37	0.58	0.70
	2	0.02	0.52	0.45	0.34	0.57
	3	0.23	0.31	0.42	0.61	0.54
	4	0.23	0.40	0.42	0.35	0.36
	5	0.15	0.39	0.28	0.29	0.45

Genetic correlations

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Calving interval	1	**0.33**	0.65	0.37	0.58	0.70
	2	0.02	**0.52**	0.45	0.34	0.57
	3	0.23	0.31	**0.42**	0.61	0.54
	4	0.23	0.40	0.42	**0.35**	0.36
	5	0.15	0.39	0.28	0.29	**0.45**

Genetic correlations

- Calving to first service is genetically correlated with calving interval
  - Better biological predictor

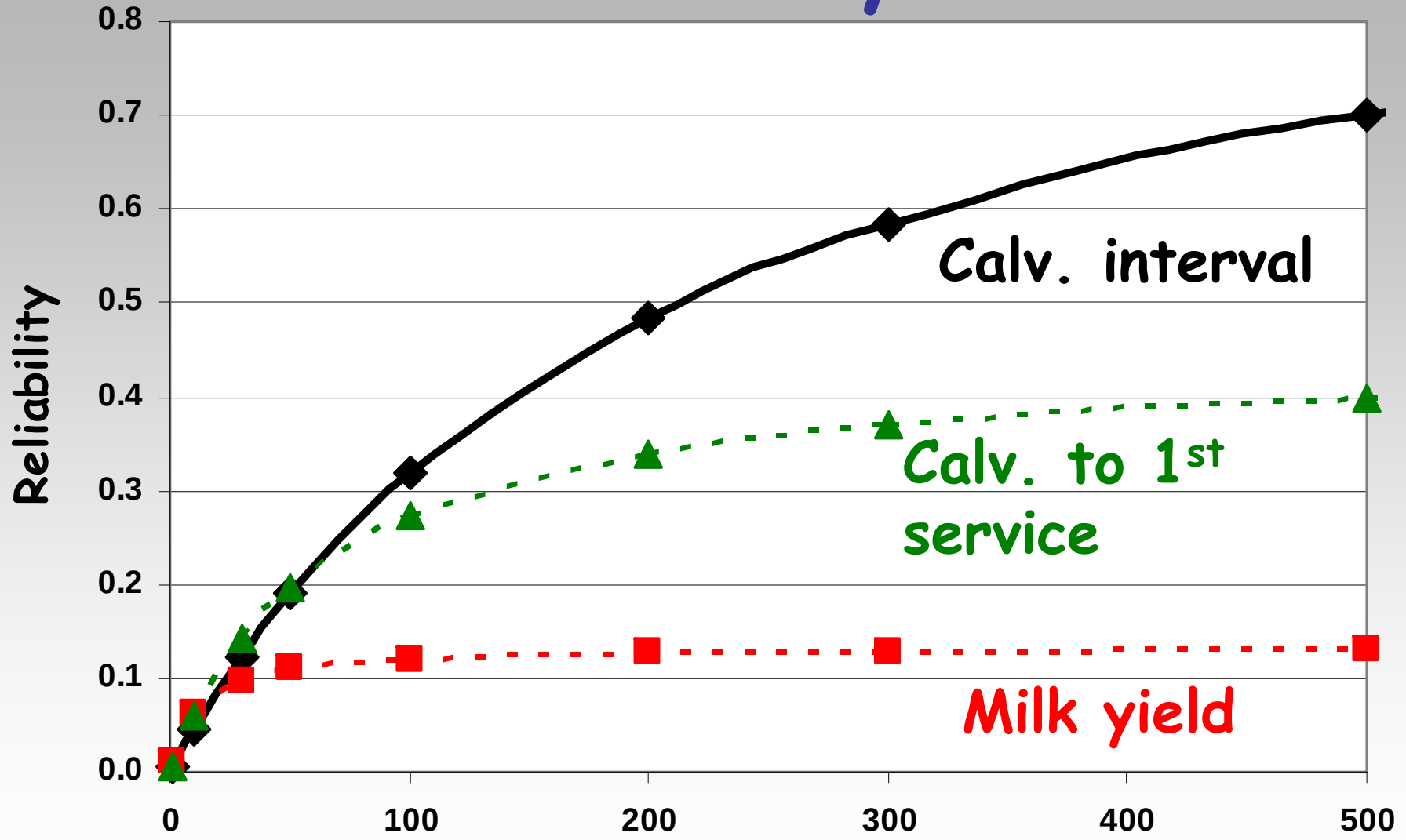
		Calving to first service				
		1	2	3	4	5
Calving interval	1	0.77	0.05	0.65	-0.01	0.06
	2	0.04	0.76	0.23	-0.09	0.23
	3	0.52	0.31	0.54	0.01	0.30
	4	0.50	0.23	0.40	0.32	0.27
	5	0.84	-0.05	0.23	-0.15	0.31

Genetic correlations

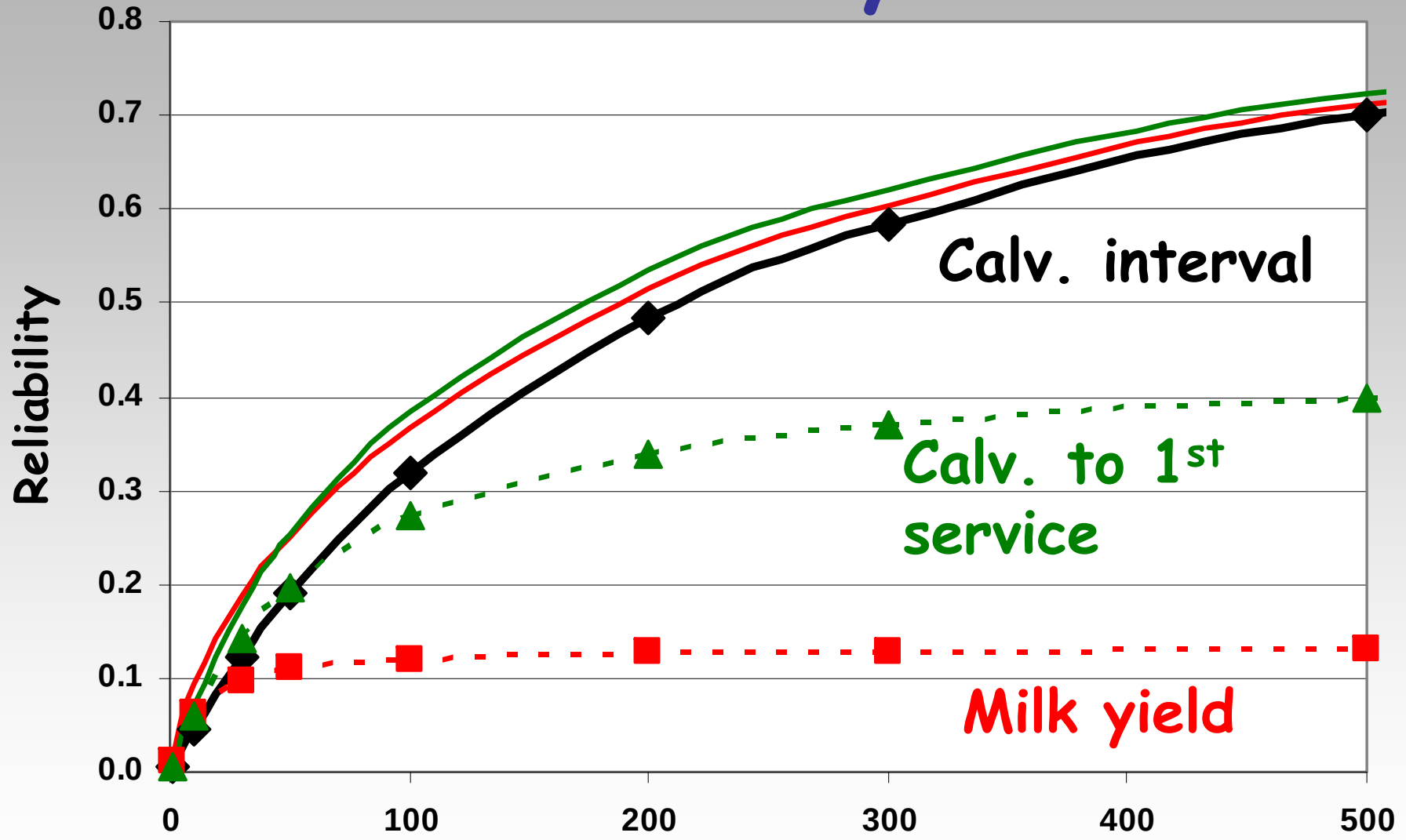
- Calving to first service is genetically correlated with calving interval
  - Better biological predictor

		Calving to first service				
		1	2	3	4	5
Calving interval	1	**0.77**	0.05	0.65	-0.01	0.06
	2	0.04	**0.76**	0.23	-0.09	0.23
	3	0.52	0.31	**0.54**	0.01	0.30
	4	0.50	0.23	0.40	**0.32**	0.27
	5	0.84	-0.05	0.23	-0.15	**0.31**

Reliability



Reliability



Mastitis

- Incidence – 10%
- Heritability – 0.05
- Repeatability - 0.10

- Genetic correlation of ~0.80 between SCC and mastitis
- Correlated with udder attachment, height, and support & teat length

Lameness

- Incidence – 10%
- Heritability – 0.04
- Repeatability - 0.07

- Genetic correlation of -0.35 between locomotion and lameness
- No correlation with other feet & legs traits

Conclusions

1. Useful genetic variation in fertility traits defined from insemination data
2. Calving to first service interval is a good predictor of calving interval and arguably a better biological predictor than milk yield
3. Good quality health data and useful genetic variation comparable to international estimates
4. Revised fertility and health evaluations for 2010

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