

Genetic parameters of conception rate and days open in US Holsteins

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Factors in conception rate

- Voluntary waiting period (VWP)
 - milk production level
- Details of inseminations
 - number of inseminations
 - days in milk = days to service
 - season of insemination
 - service sire
 - AI or natural / type of heat detection
 - estrus synchronization

Fertility traits

- Days open as linear trait
 - simple and flexible
 - heterogeneity and censoring problems
- Time to conception by survival model
 - sire model only (single trait)
 - assumption may not hold in practice
(risk of pregnancy not every day)

Both methods ignore details of inseminations

Objectives

- Analyze individual insemination records
- Compare with days open

Data

- Service records from 2001-2003 in New York state
- Days open between 50 d and 250 d
- Conception rate determined by pregnancy test and/or next calving date
- 75,227 service records (44,425 first service records) in first parity
- 81,728 animals

Model 1

- Threshold-linear model (bivariate):
 - Conception Rate at first service (binary) and Days Open (continuous):

$$y = \text{herd-year} + \text{age-class} + \text{service-month} + \text{AI-status} + \text{DFS(CR only)} + \text{TD-milk} + \text{animal} + e$$

where DFS = days to first service after calving

Model 2

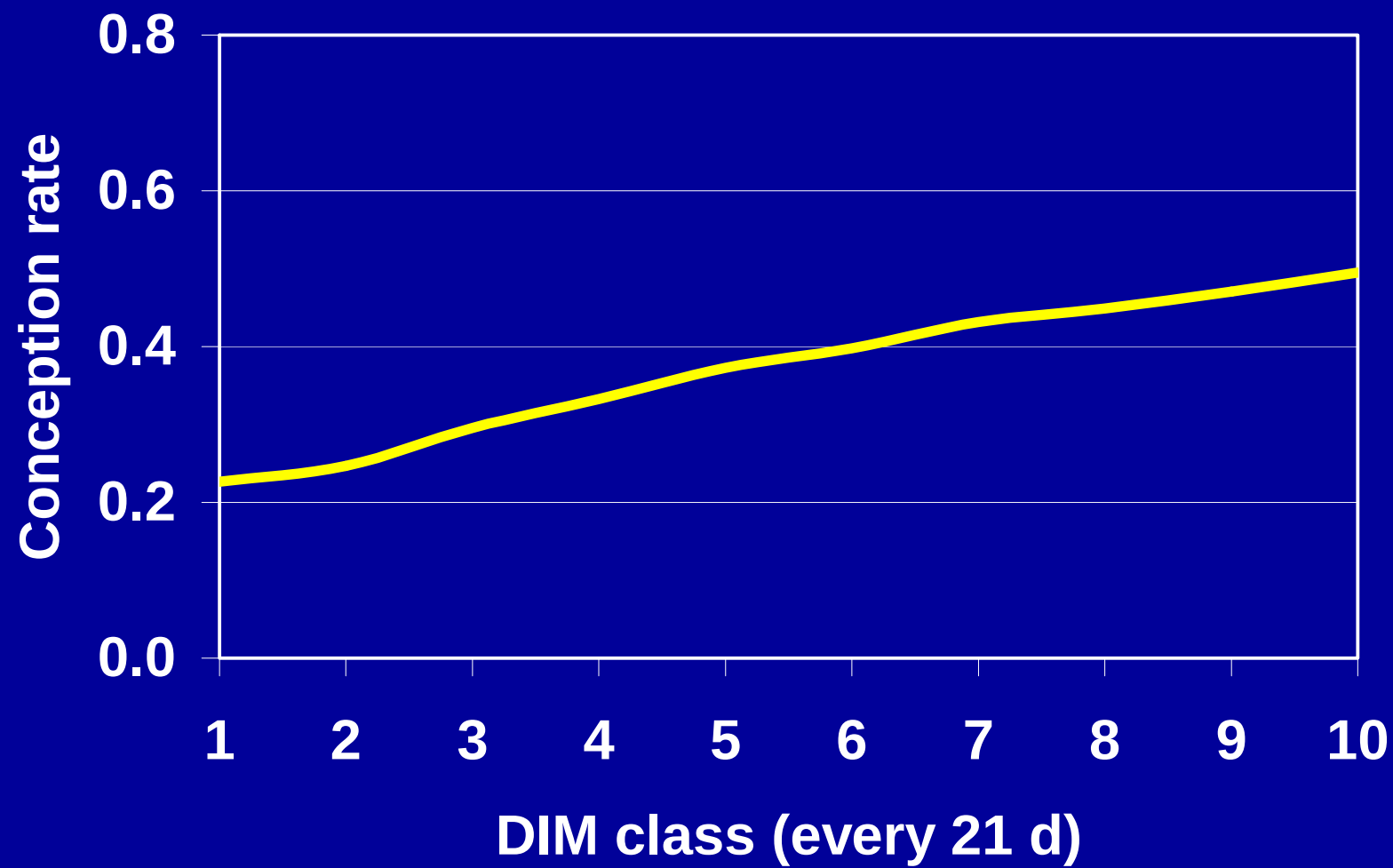
- Threshold model with random regressions:
 - Conception Rate (binary):

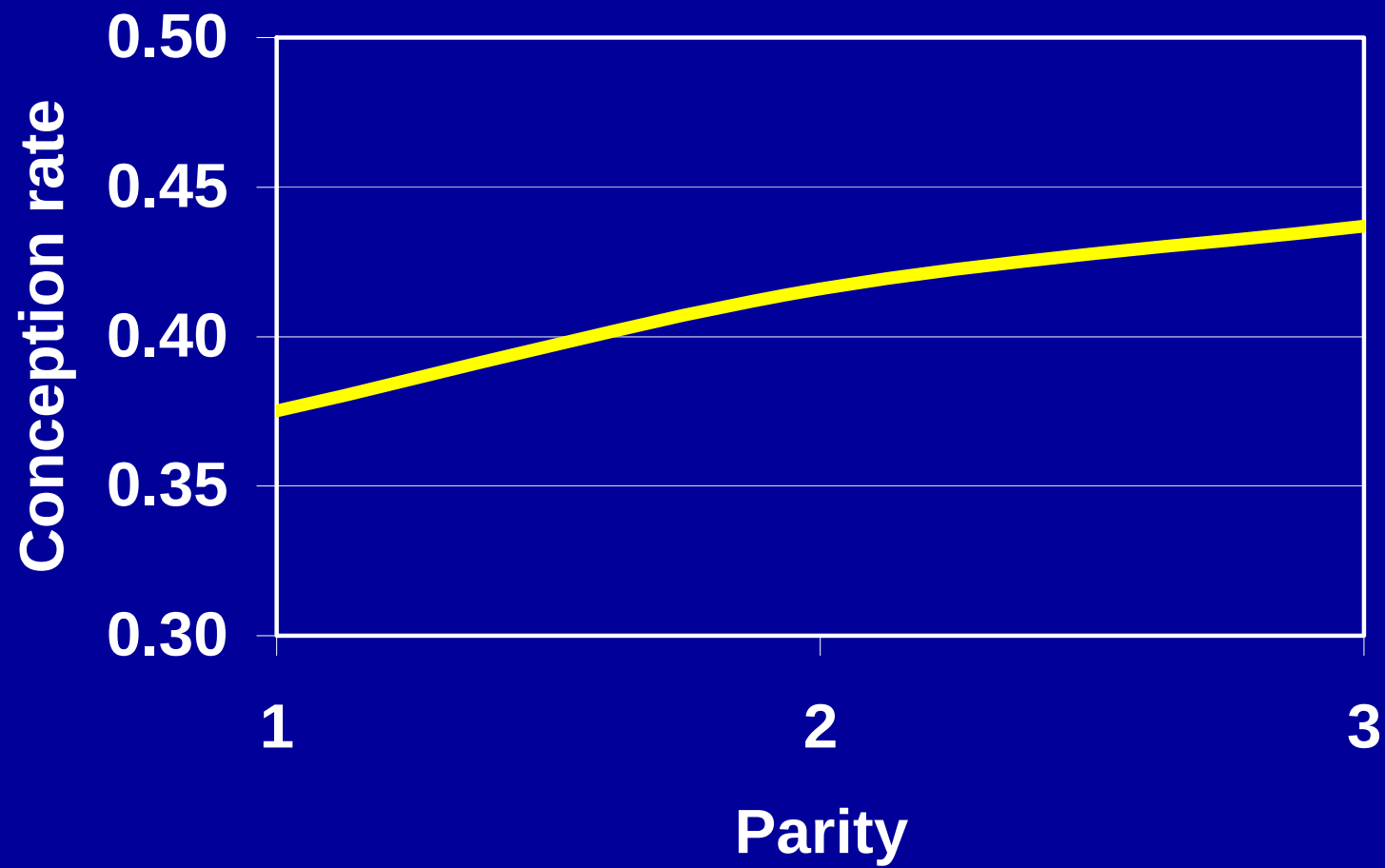
$$y = \text{herd-year} + \text{age-class} + \text{service-month} + \text{AI-status} + \text{TD-milk} + f(\text{DS}) + f(\text{DS})\text{animal} + f(\text{DS})\text{PE} + e$$

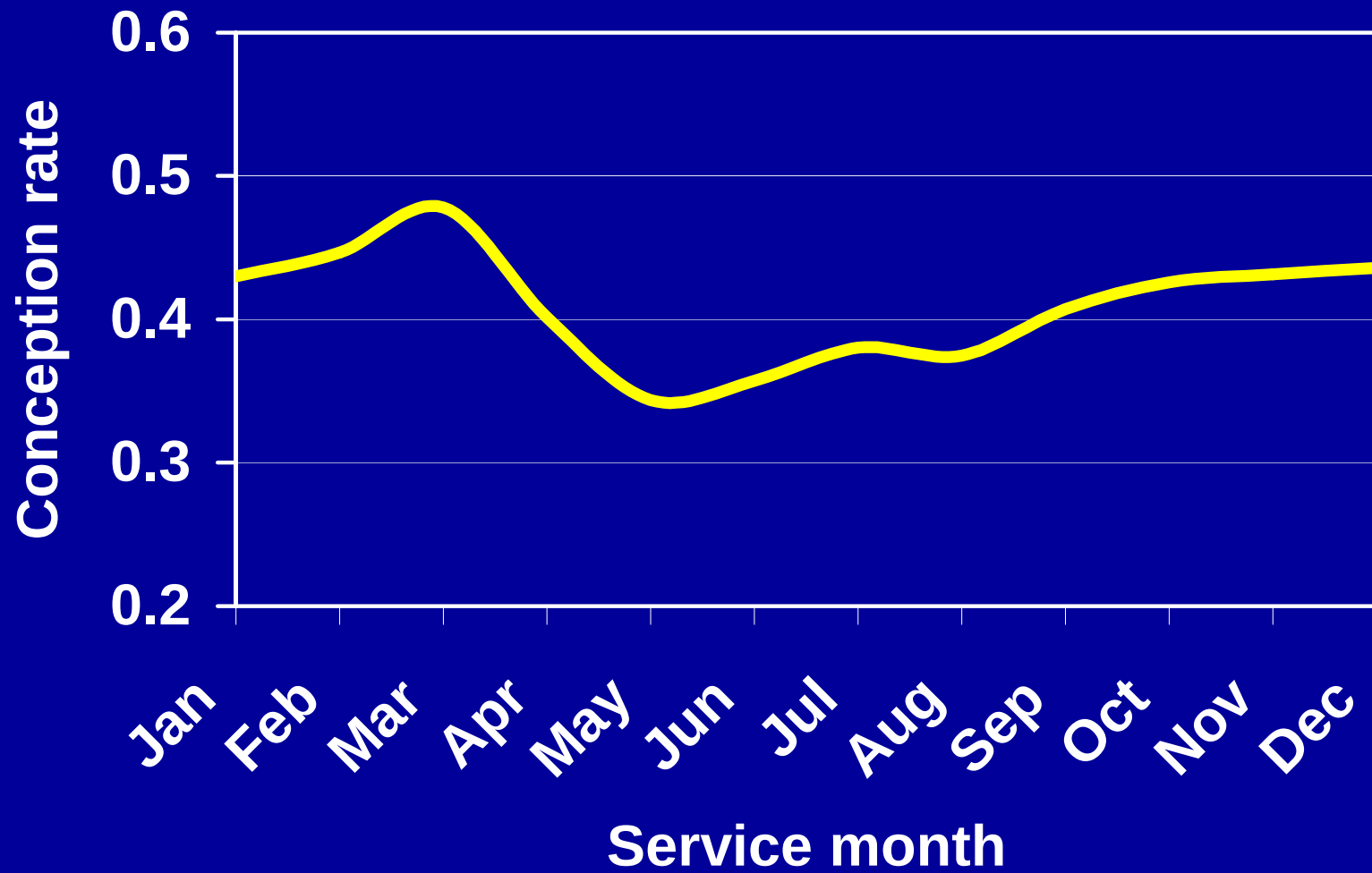
where DS = days to each service after calving = DIM

Service type (A=AI or N=natural)

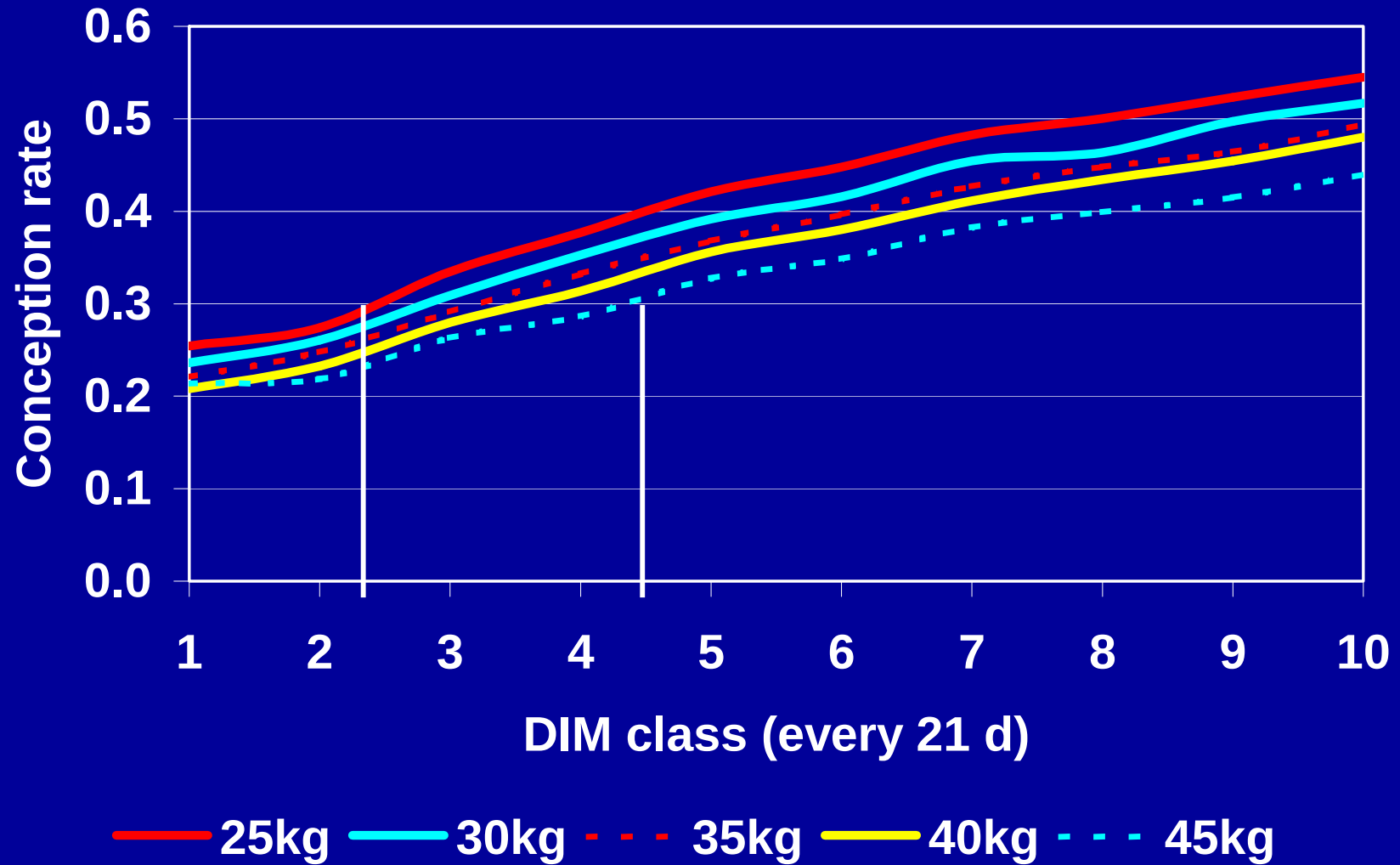
Service type	%
A,...,A	76.2
N,...,N	11.1
A,...,AN	6.6
N,...,NA	1.4
Other	4.7





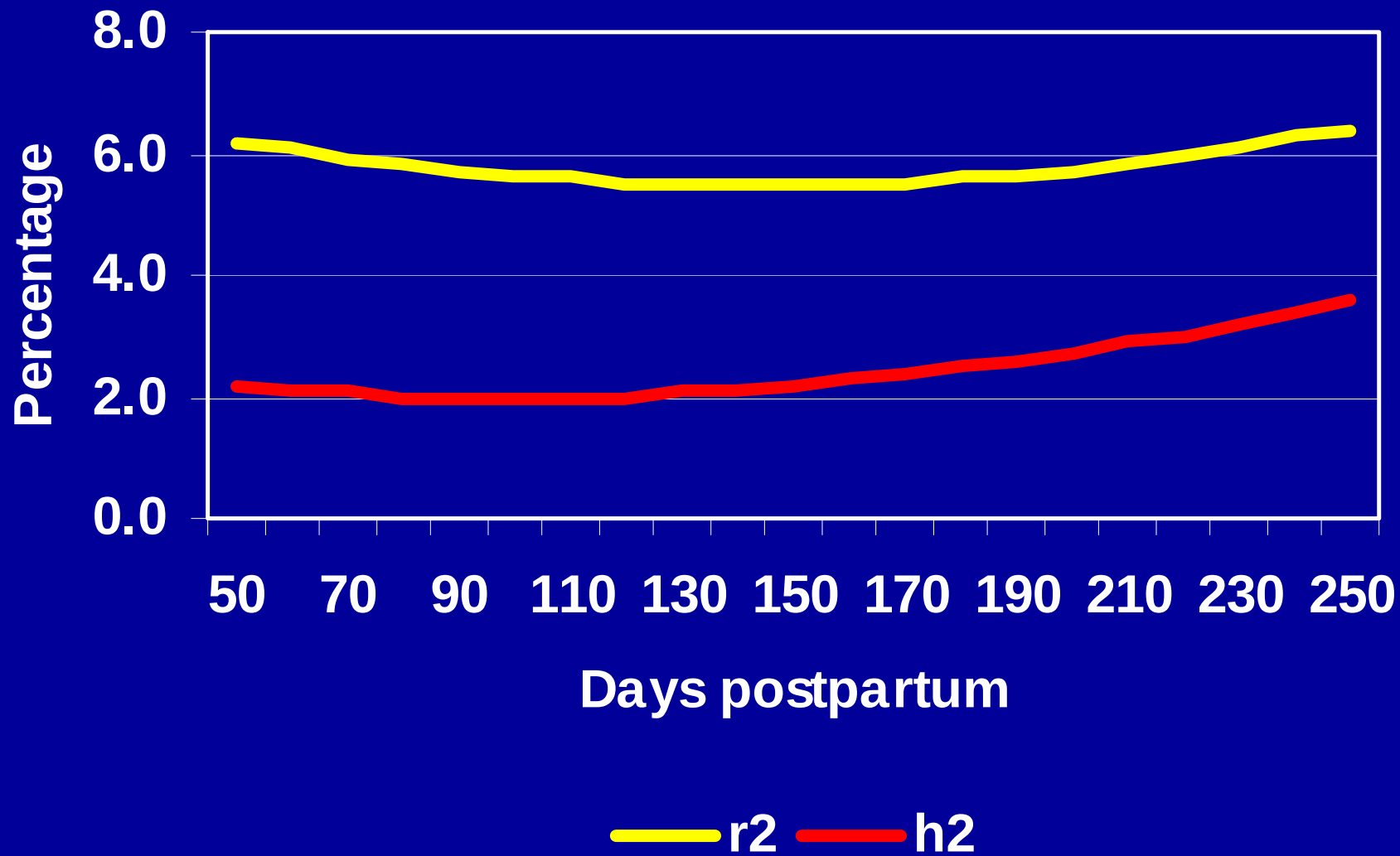


Milk level



Bivariate (threshold-linear) analysis

Parameter	Conception rate at first service	Days open	Genetic correlation
h^2 , %	3.0	3.0	−0.98



Threshold model with random regressions

Parameter	Conception rate
h^2 , %	2.4 (2.0-3.6)
r^2 , %	5.8 (5.5-6.4)

Summary

- CR varies by season, milk level, and parity.
- Heritability for first service CR equal for DO.
- Genetic correlation between CR and DO high.
- Heritability for CR with random regressions slightly lower than for DO.
- Heritability slightly increased with days postpartum.

What's next?

- More data from 1999-2004 available.
- Include censoring records.
- Set a different VWP for each cow or herd.
- Ignore natural service data?
- Other states.
- G x E (seasonal or regional variation).