Phenotypic study on longevity in Italian Heavy Draught mares

Mantovani R.[1], Contiero B.[1], Sartori A.[1], Stoppa C.[2] and Pigozzi G.[2]

[1] *Department of Animal Science, University of Padova, Italy*

[2] *Italian Heavy Draught Horse Breeders Association, Verona, Italy*

roberto.mantovani@unipd.it

Background

- Increasing attention to longevity in farm animals -> economic impact on profit
- Longevity investigated in sport horses (Wallin et al., Livest. Prod. Sci. 2000, 2001 & 2003)
- Longevity require a long time to be measured
- Indirect measures have been studied as possible indicators of longevity
- Appropriate statistical methods to evaluate properly longevity (i.e. survival analysis) now available

Aim of the study

To investigate the phenotypic relationship between production traits, inbreeding, morphology, etc., on length of productive life of Italian Heavy Draught Horse (IHDH) mares

Italian Heavy Draught Horse

- Breed developed in Italy since 1861 from military program
- Re-construction after the world war II mainly with French Breton stallions
- Conversion of the dynamic attitude to the meat production during the '70s
- At present selection for dual purpose (meat and heavy draught)
- Small population size (i.e. about 3000 registered mares) and small studs widespread in the national territory

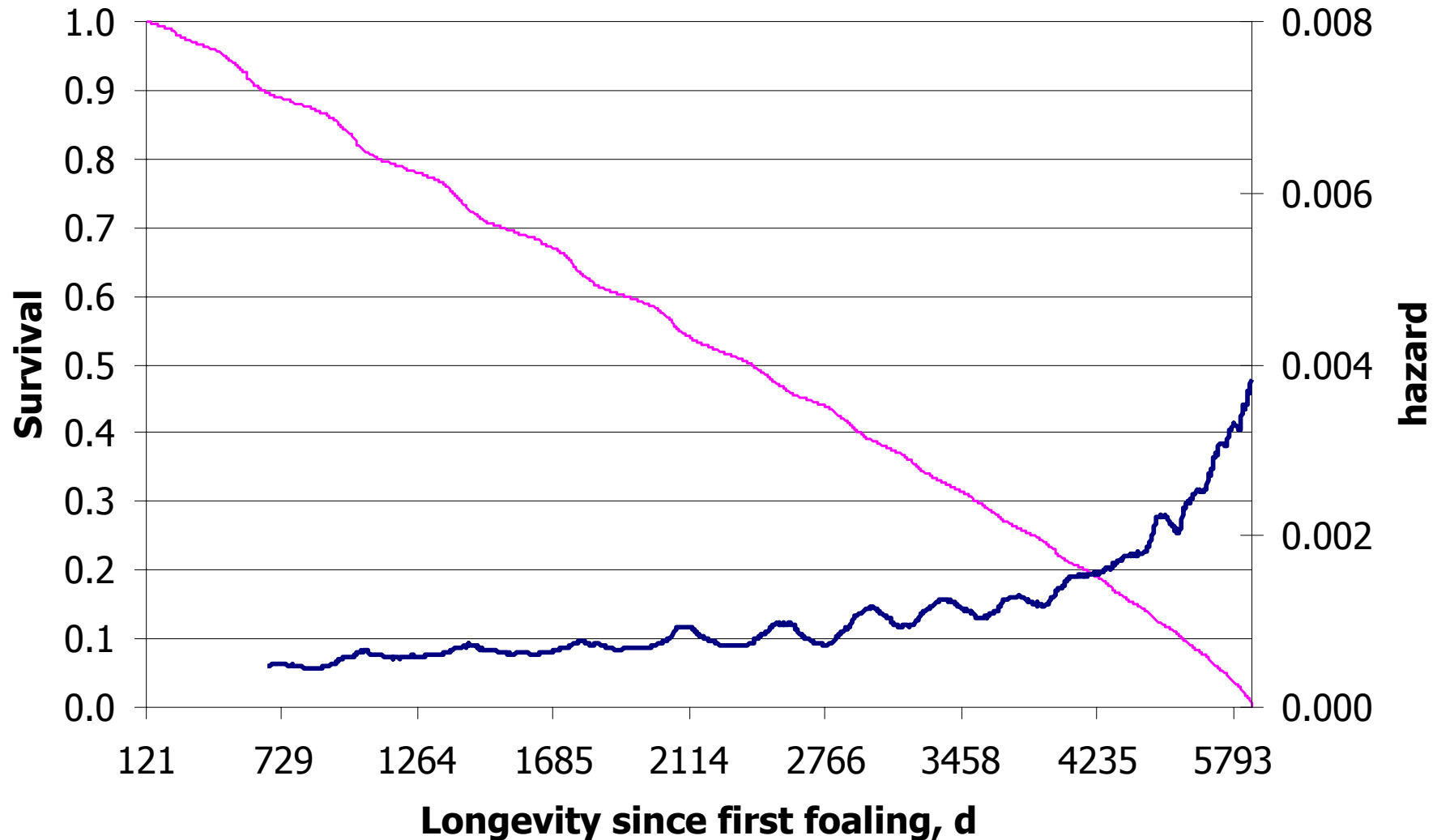Mantovani et al., 2004 – EAAP pub. 116 for more details

Data-set

- Data on 4597 mares born between Jan 1, 1967 and Dec 31, 2002 with at least the first parity recorded
- All parities up to the 17th analyzed
- Longevity=length of productive life (LPL):

  LPL=culling date-first foaling date
- Right censored records (n=1494, 32.5%) were included in the data set. For these records censoring point was Dec 31, 2005
- Average censoring time 2060 d (min 184 d and max 7153 d)
- The data set included also 154 left truncated records (3.35%) and the truncation point was Jan 1, 1987
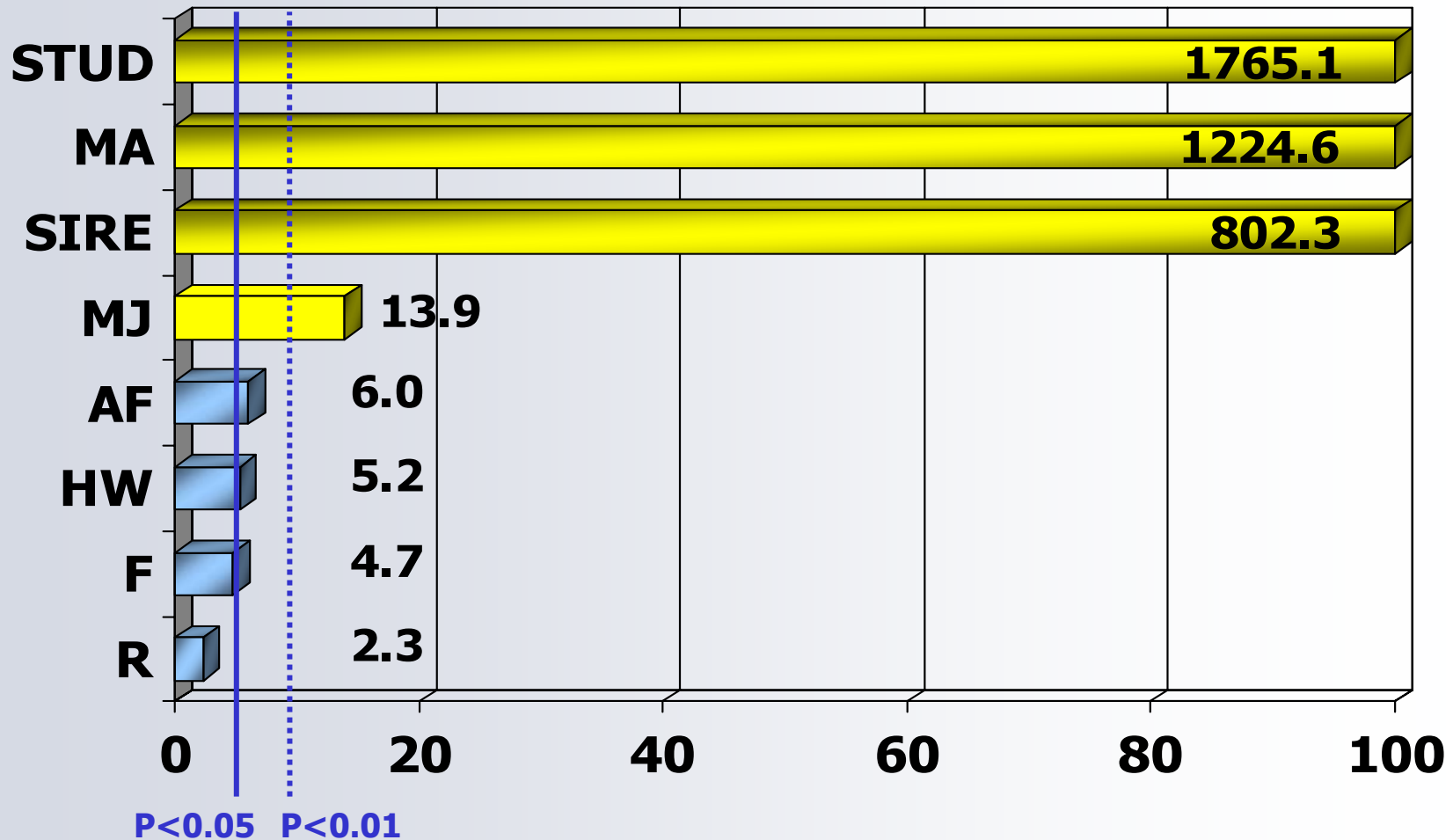
Survival analysis – Survival Kit V3.1

- Proportional COX hazard model used with time independent fixed effects:
    - **AF**: Age at first foaling (early: 36.6±2.1; late: 50.2±4.4 mo. of age)
    - **F**: Individual inbreeding (1: F<0.0625; 2: 0.0625<F<0.125; 3: F>0.125)
    - **OR**: Origin of mare's sire (1: IHDH; 2: French Breton)
    - **MJ**: Morphological Judgment at 3 yrs. of age (1: fair or poor, 2: good and 3: very good or excellent)
    - **HW**: Height at withers at 3 yrs. (low≤150; desirable 150-162; high>162 cm)
    - **R**: Ratio between HW and chest girt (1:<1.22; 2:≥1.22)
- Mare's birth year (34 levels) was used as stratification variable
- Maternal ability (**MA**; i.e. no. of foals born per year of life) was used as time depend covariate (i.e., changing every year)
- Stud used as random effect assuming a log-gamma distribution (Studs with 1 or 2 mares were grouped on the basis of their territory proximity and management)
- A genetic model with the sire random (assuming a normal distribution) was also taken into account. Sires with ≤2 daughters were grouped on the basis their birth year and 24 genetic groups were obtained
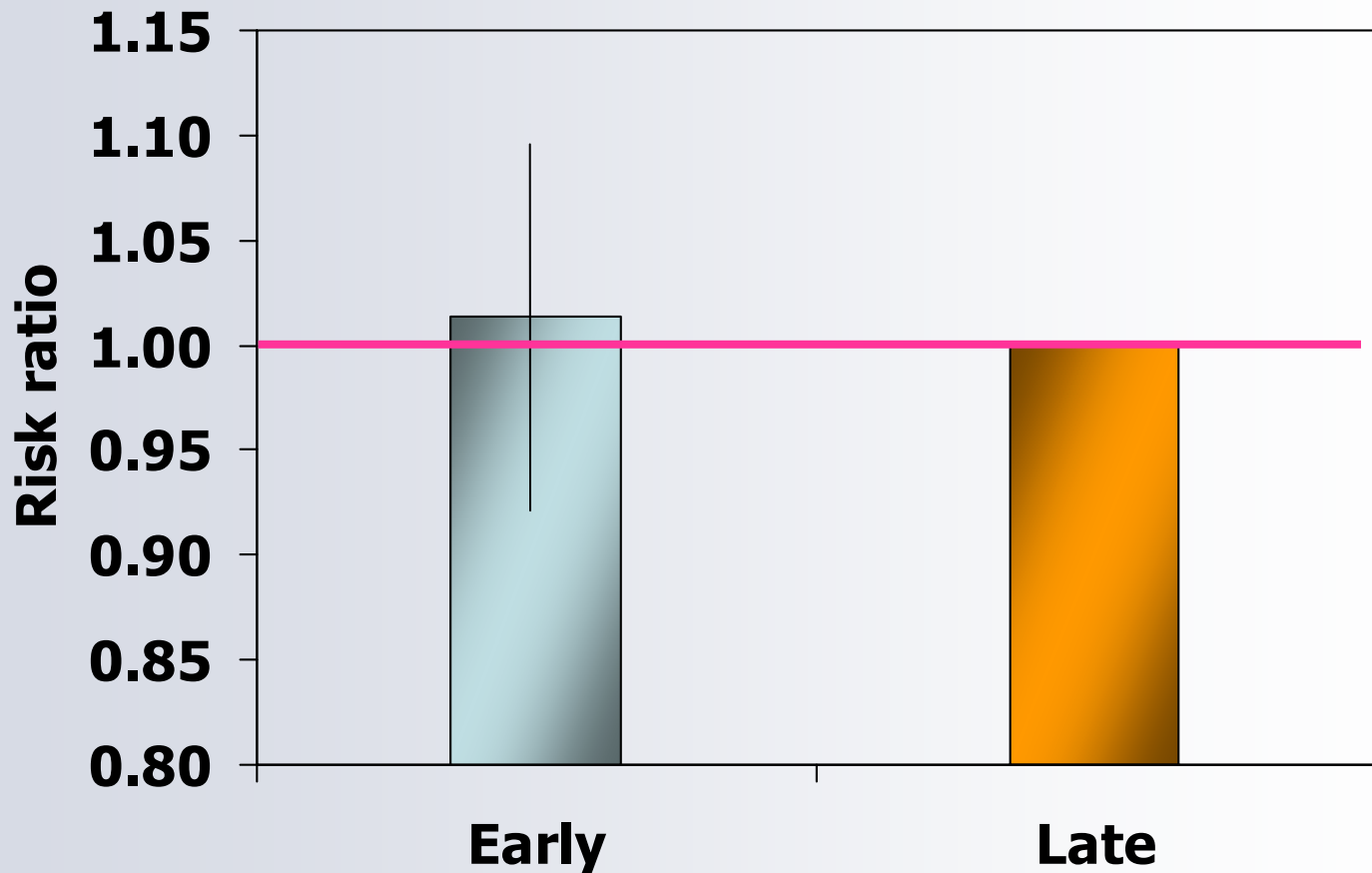
Baseline Survival and hazard function

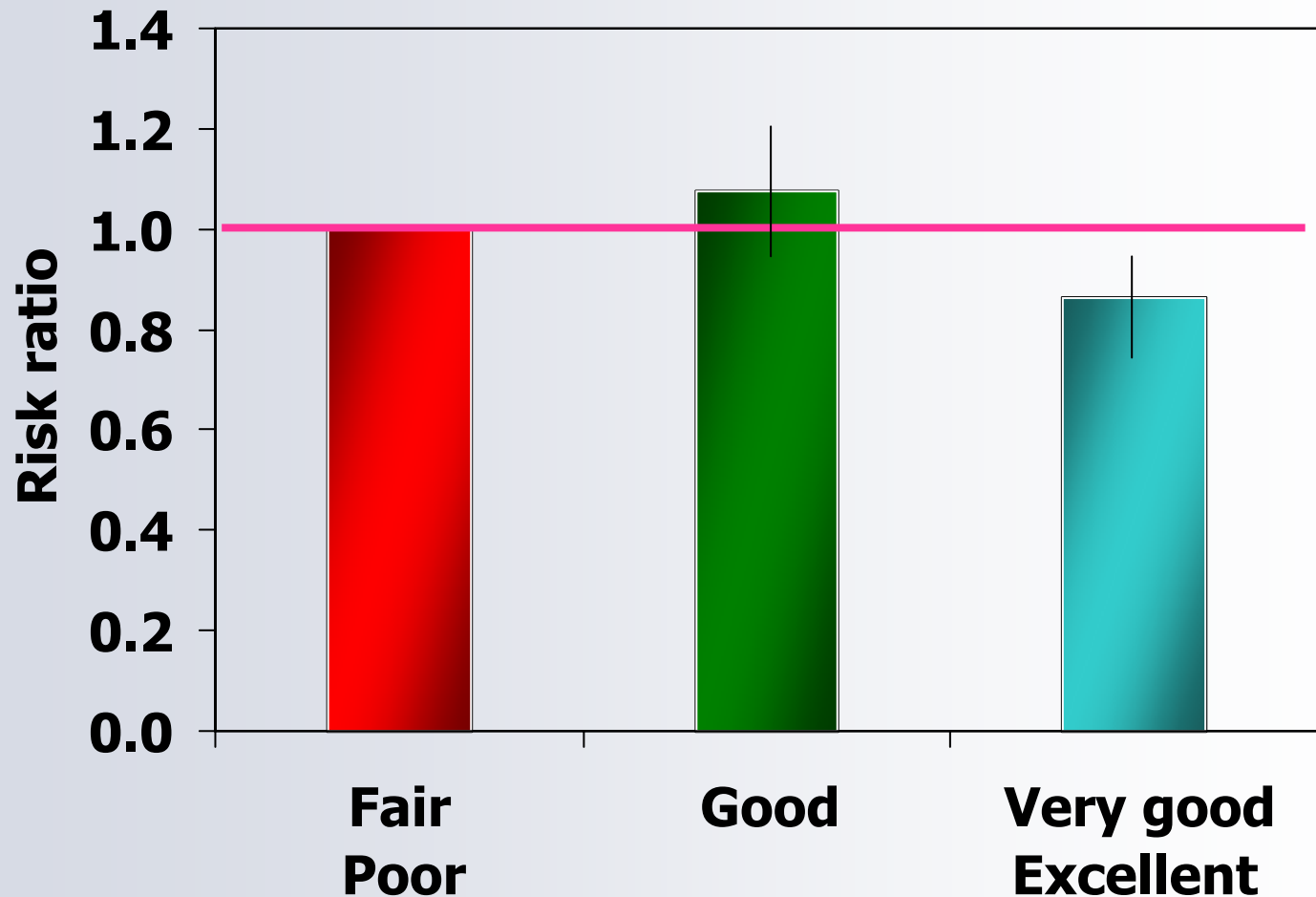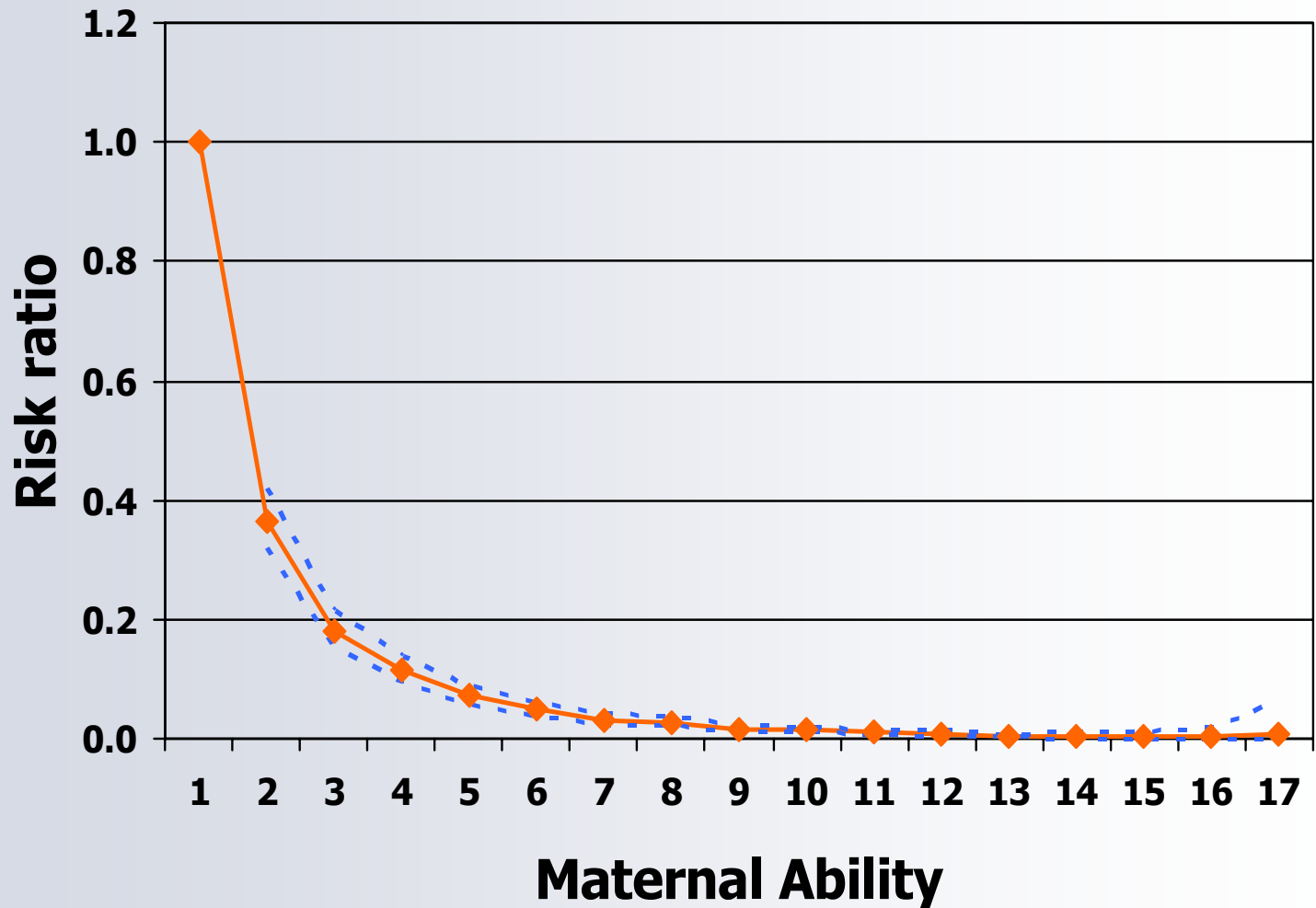# Contribution of each factor to the likelihood for LPL

Factor	Value
STUD	1765.1
MA	1224.6
SIRE	802.3
MJ	13.9
AF	6.0
HW	5.2
F	4.7
R	2.3

0   20   40   60   80   100

P<0.05   P<0.01

Risk ratio and s.e. for age at first foaling

Risk ratio and s.e. for morphological judgement at 3 yrs.

Risk ratio and s.e. for Maternal Ability of mares

Genetic parameter estimates

SIRE VARIANCE (σ_s^2) =   0.0194

  - Lower bound   0.0191

  - Upper bound   0.0200

h^2 (effective) = σ_s^2 / (σ_s^2+1) =   0.0763

Conclusions

- Results from the study indicate a median productive life of 6.6 yrs, i.e. a survival of 10.4 yrs for IHDH mares

- Morphology is the most important phenotypic factor affecting survival

- Maternal Ability greatly influenced LPL, particularly from 1st to 2nd foaling

- The obtained h^2 indicated a promising use of survival analysis for genetic evaluation of longevity