

# Impact of Inbreeding on Dairy Cow Survival



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# Impact of Inbreeding on Dairy Cow Survival

## Hypothesis:

Inbreeding impacts negatively dairy cow survivability and lifespan

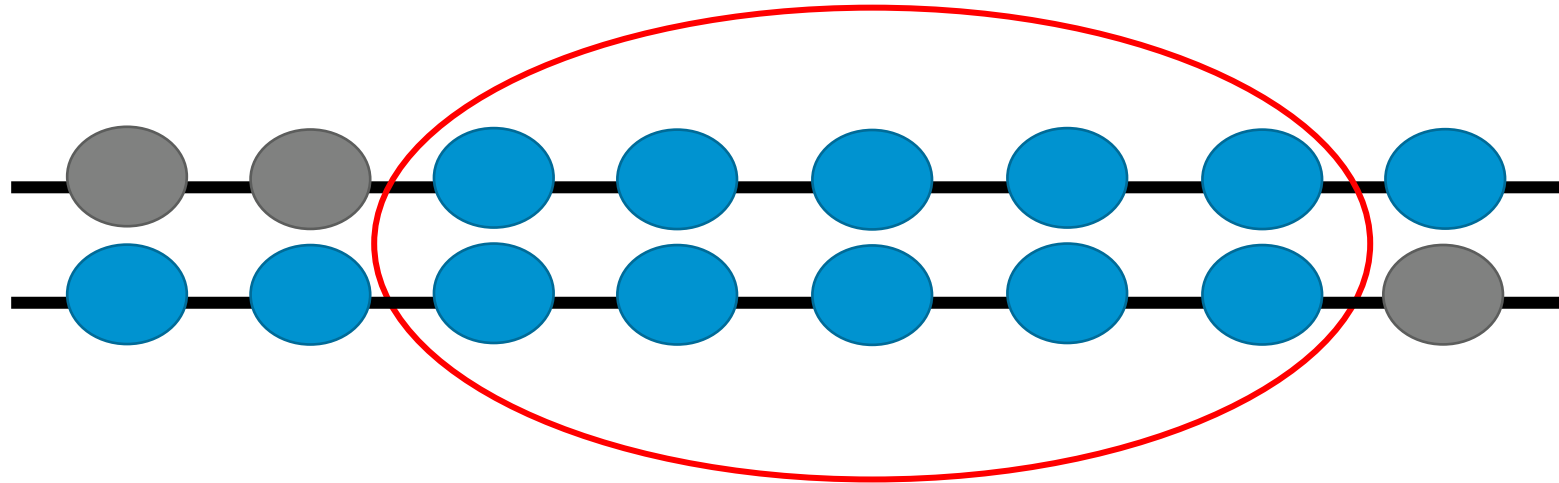
## Why lifespan?

Industry aims for long-living, healthy, and profitable cows



# Genomic inbreeding - $F_{roh}$

Runs of Homozygosity (ROH)



Long ROH chain = Recent inbreeding



Short ROH chain = Ancient inbreeding

# Statistical models

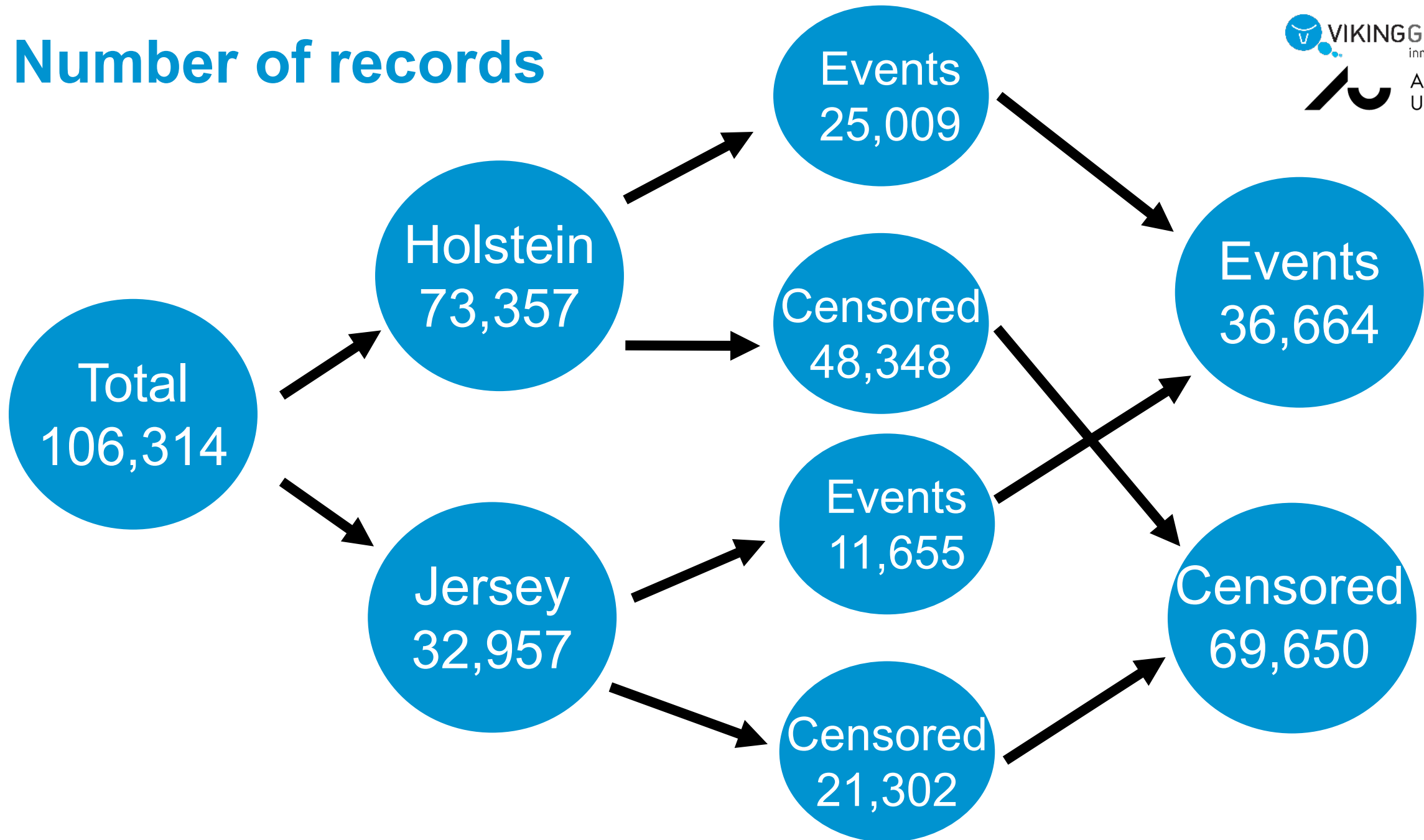
## Kaplan-Meier estimator

- Survival probability in a given time
- Compares groups between each others

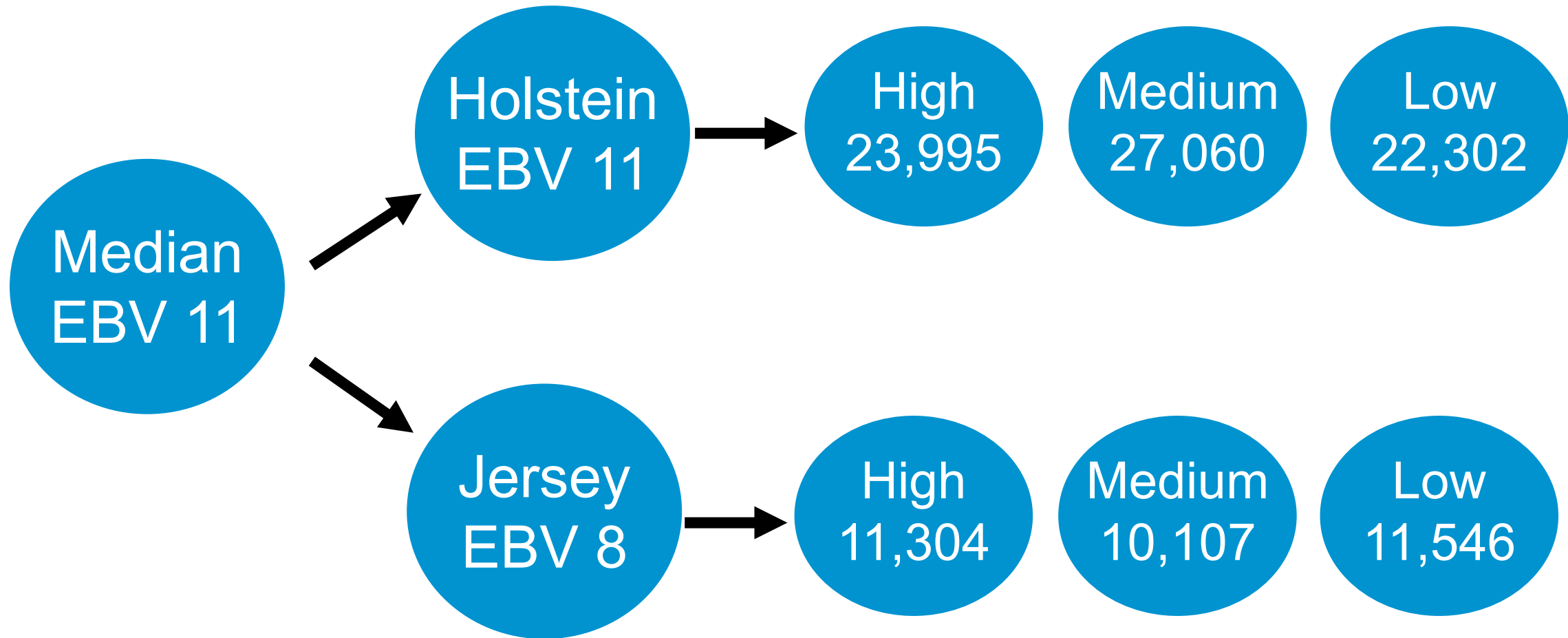
## Cox proportional hazard model

- Hazard rate to estimate probability or risk of failure (culling)
- Estimating how much risks increase based on different covariates

# Number of records

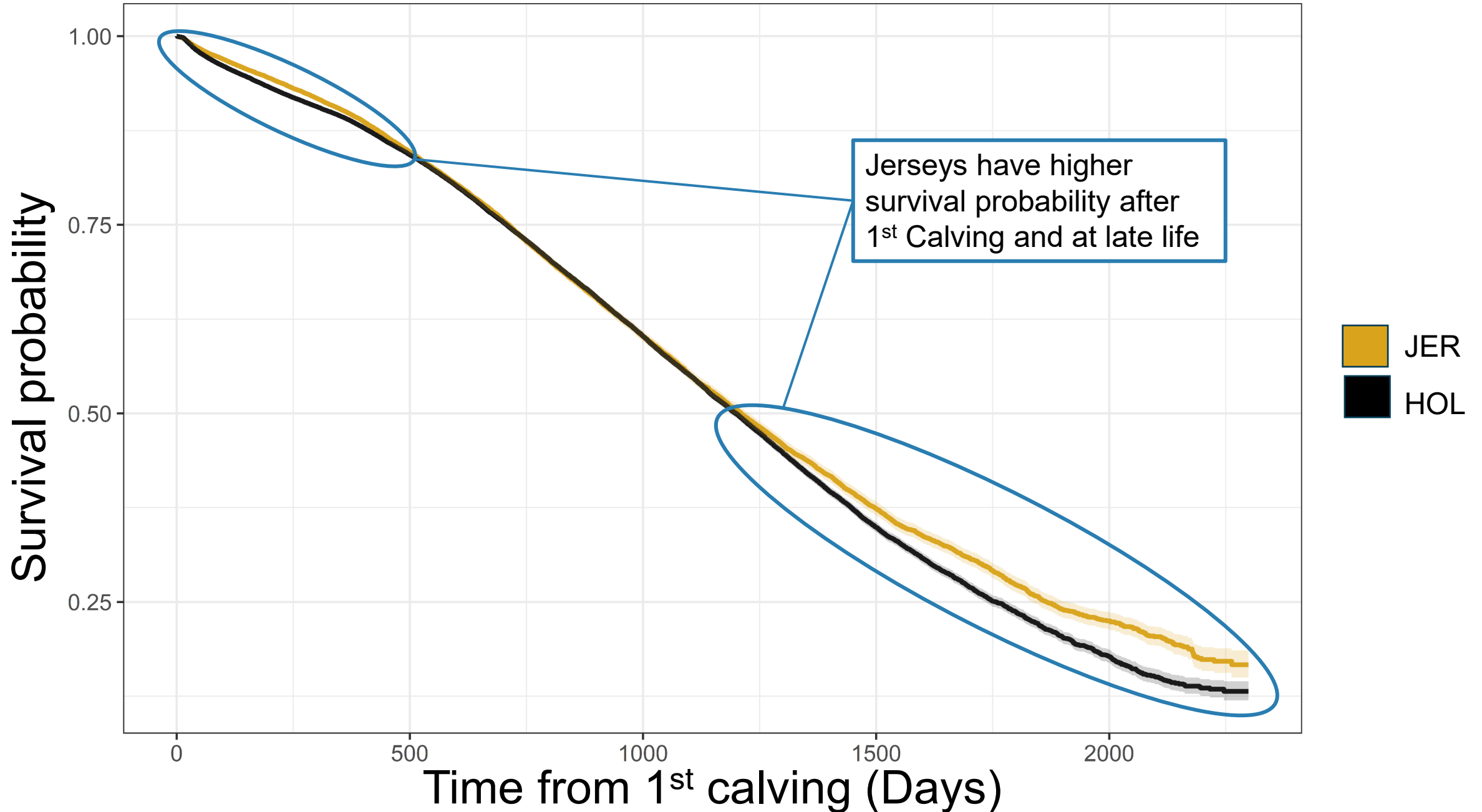


# EBV Groups

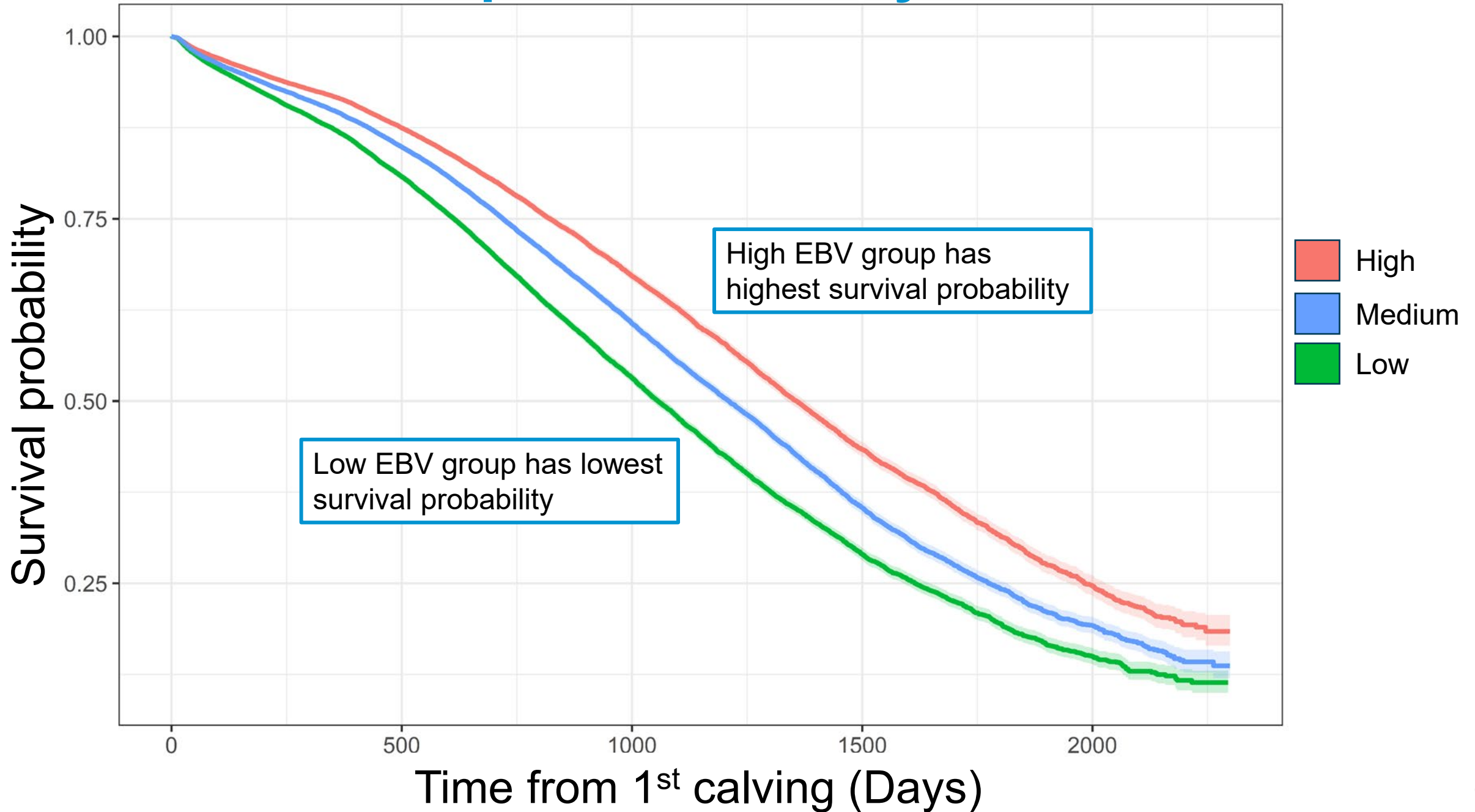




# Kepler-Meier analysis

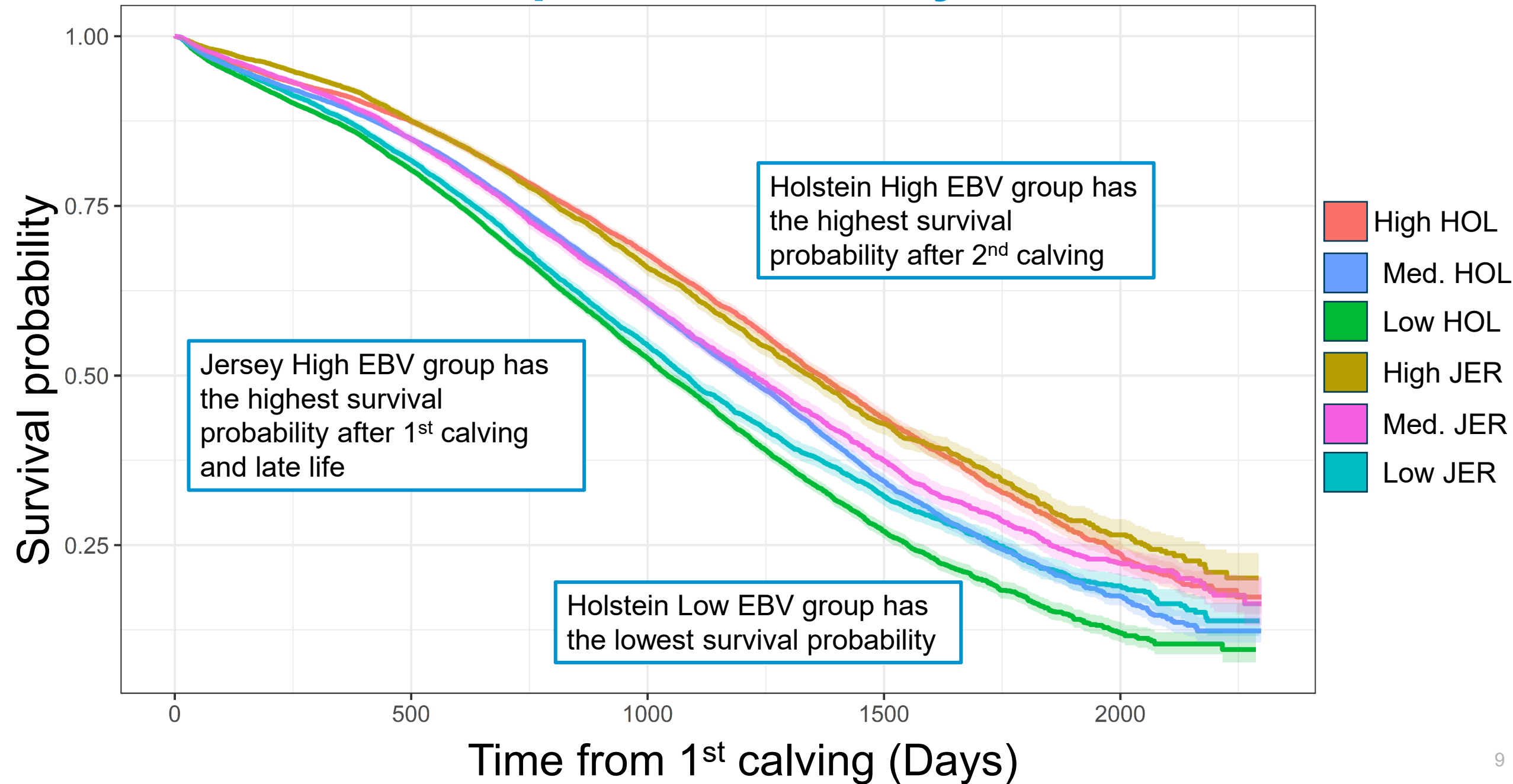


# Kepler-Meier analysis





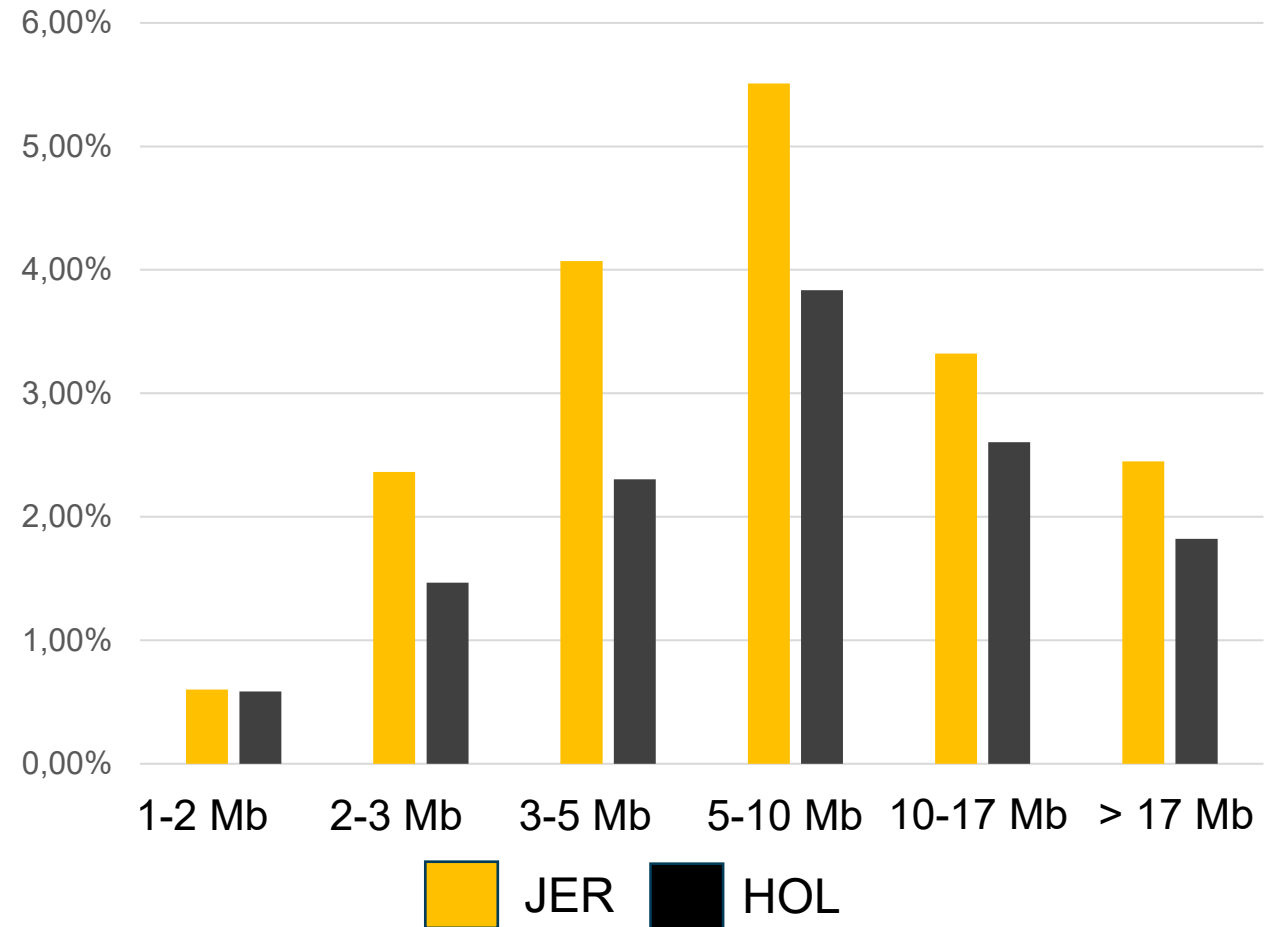
# Kepler-Meier analysis



# Distribution of genomic inbreeding

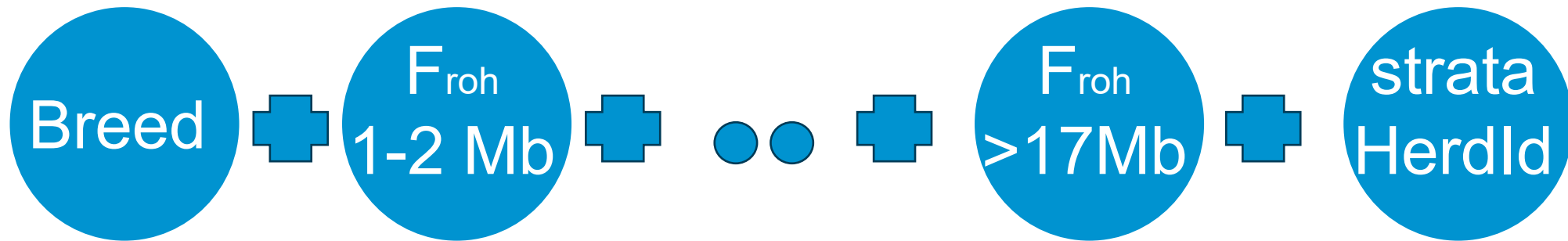
**Jersey**  
Mean  $F_{roh}$   
18.3%

**Holstein**  
Mean  $F_{roh}$   
12.6%

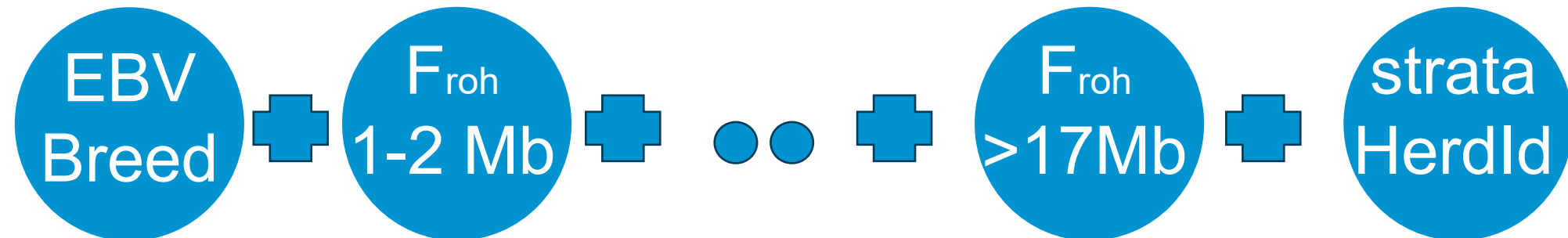


# Cox proportional hazard models

Model 1 – Breed and genomic inbreeding



Model 2 – EBV Breed Group and genomic inbreeding



# Model 1 – Breed and genomic inbreeding

Jerseys have less risk than Holstein

Ancient inbreeding decreases risk

Recent inbreeding increases the risk

| Parameter    | Hazard Ratio |
|--------------|--------------|
| Holstein     | -            |
| Jersey       | 0.78**       |
| Froh 1-2Mb   | 0.93**       |
| Froh 2-3Mb   | 0.98         |
| Froh 3-5Mb   | 0.98*        |
| Froh 5-10Mb  | 1.00         |
| Froh 10-17Mb | 1.02***      |
| Froh > 17Mb  | 1.02***      |

\* p < 0.05 , \*\* p < 0.01, \*\*\* p < 0.001

## Model 2 – EBV Breed Group and genomic inbreeding

High EBV Jersey has the least risk

Low EBV Holstein has the highest risk

Ancient inbreeding decreases risk, but insignificant

Recent inbreeding increases the risk

| Parameter     | Hazard Ratio |
|---------------|--------------|
| High Holstein | -            |
| Med. Holstein | 1.25***      |
| Low Holstein  | 1.61***      |
| High Jersey   | 0.75***      |
| Med. Jersey   | 0.90         |
| Low Jersey    | 1.11         |
| Froh 1-2Mb    | 0.95         |
| Froh 2-3Mb    | 1.00         |
| Froh 3-5Mb    | 0.99         |
| Froh 5-10Mb   | 1.01*        |
| Froh 10-17Mb  | 1.03***      |
| Froh > 17Mb   | 1.03***      |

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001



# Conclusion

- Danish Jerseys have less risk of culling than Danish Holstein
- Recent inbreeding increases the risk for culling
- Ancient inbreeding is most likely connected to the preferred traits and decreases risk of culling

