



# Survival Curves and Reproductive Risk Factors for Culling in Dairy Herds



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## Objectives

1. Quantify dairy cow survival by parity and stage of lactation.
2. Quantify risk per day by pregnancy status and DHI termination code.
3. Quantify risk factors for pregnancy and culling.
4. Use SAS for survival analysis with random effects.

## Material and Methods

- Data: 2.2 million DHI lactation records from 707 herds with  $\geq 200$  cows in each of the years 2001 to 2006. Herds were located primarily in the eastern US.
- Likelihood of synchronized breeding program was based on distribution of 1<sup>st</sup> services per day of the week: **unlikely, possibly, probably, most likely** (Miller et al., 2007).
- Survival curves and risks per day: Proc Lifetest with actuarial method.
- Hazard ratios: Proc Glimmix with complementary log-log function, log(time) as covariate, and herd as random effect. This estimates a Weibull survival model with a random effect (after Allison, 1995).

## Results

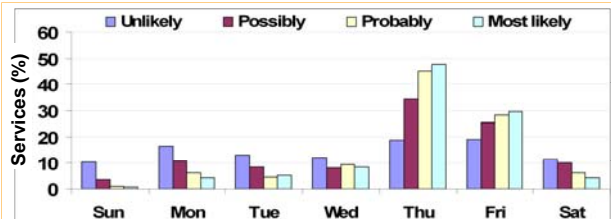


Figure 1. Percentage of services per day of the week for each likelihood of synchronized breeding program.

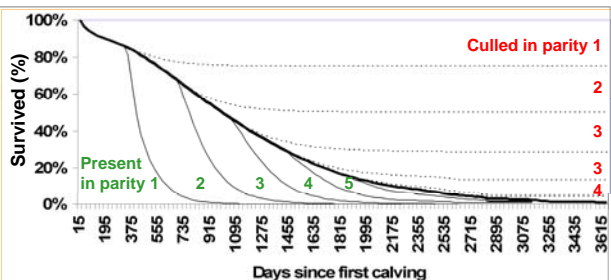


Figure 2. Survival curves since first calving categorized by whether the cow is present or culled in parities 1 to 9.

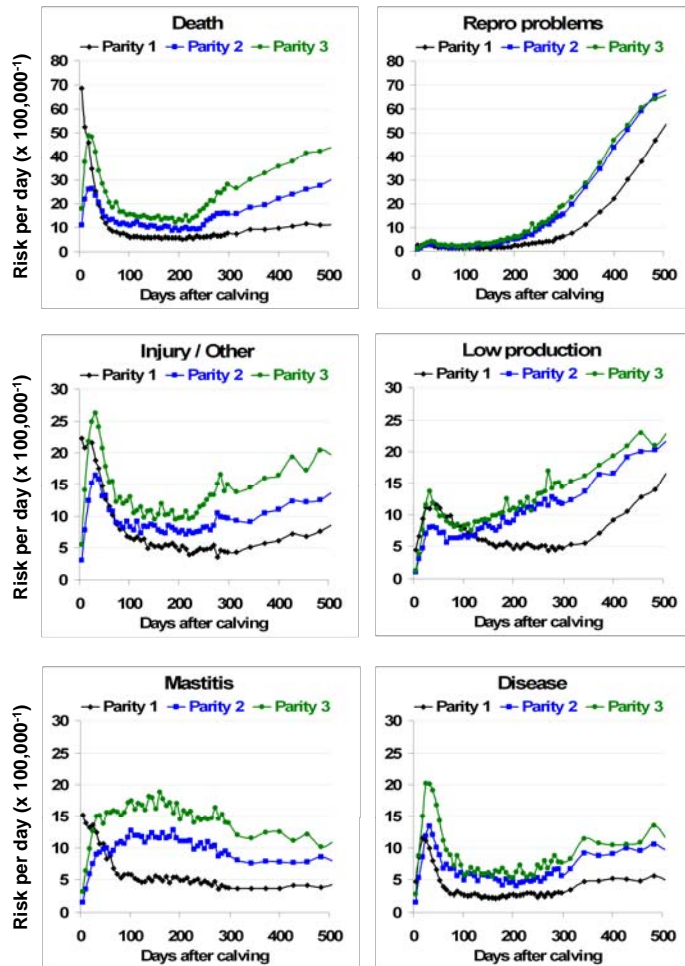


Figure 3. Risk of culling per day ( $\times 100,000^{-1}$ ) by days after calving and parity for 6 termination codes (death, reproduction problems, injury / other, low production, mastitis, disease).

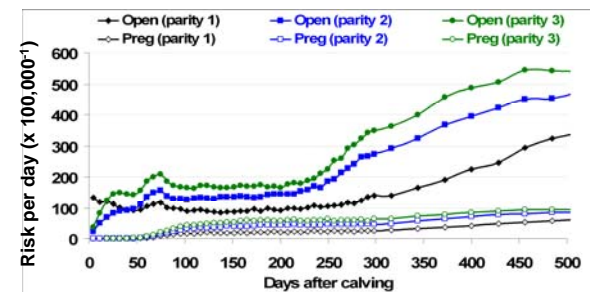


Figure 4. Risk of culling per day ( $\times 100,000^{-1}$ ) by days after calving by parity for open and pregnant cows.

Table 1. Hazard ratios ("relative risk") for pregnancy and culling for various risk factors

Risk factor	Pregnancy			Culling		
	Lower 95%	Hazard ratio	Upper 95%	Lower 95%	Hazard ratio	Upper 95%
<b>Day 70 milk yield*</b>						
< -5 kg	0.92	0.92	0.93	2.93	2.97	3.01
-5 to +5 kg	1.02	1.03	1.03	1.27	1.29	1.31
> +5 kg	-	1.00	-	-	1.00	-
<b>Synch. breeding program</b>						
Unlikely	0.92	0.93	0.94	1.00	1.03	1.06
Possibly	0.94	0.96	0.97	0.96	0.99	1.02
Probably	0.95	0.96	0.96	0.98	1.01	1.03
Most likely	-	1.00	-	-	1.00	-
<b>Herd pregnancy rate</b>						
< 12%	0.70	0.70	0.71	1.27	1.30	1.32
12 to 16%	0.88	0.89	0.89	1.11	1.12	1.14
> 16%	-	1.00	-	-	1.00	-
<b>Season</b>						
Winter	0.99	0.99	1.00	0.91	0.92	0.93
Spring	0.76	0.76	0.76	0.78	0.79	0.80
Summer	0.63	0.63	0.63	0.88	0.89	0.91
Fall	-	1.00	-	-	1.00	-

\* Herd mate deviation

## Summary

Dairy cow survival curves were quantified by parity. Culling risks were quantified by termination code and by parity and pregnancy status. Hazard ratios for risk factors for pregnancy and culling were quantified.