

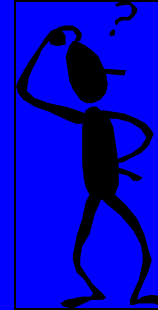
Event-Time Analysis of Reproductive Traits in Dairy Heifers

B. Vargas, M. Baaijen, T. van der Lende, and J.A.M van Arendonk





WHY?

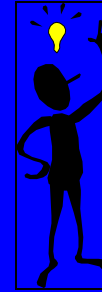


1. Allows the use of reproductive data from cows which have only partial information on a specific trait
2. The outcome variable corresponds to the measure of time elapsed from some starting point until an awaited event occurs
3. The results obtained from this analysis are given in the form of time specific probabilities
4. Time dependent covariates can also be added to the analysis.

OBJECTIVES

- 1. Assess the effect of heifer-weight category on age at first calving.**
- 2. Assess the effect of heifer-weight and heifer-milk yield category on days open after first calving.**

COX MODEL



$$\lambda(t; \mathbf{x}) = \lambda_0(t) e^{(\mathbf{x}' \beta)}$$

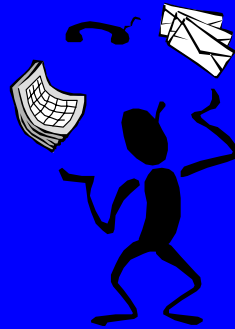
$\lambda(t; \mathbf{x})$ = Hazard of event for a cow at time t with covariates \mathbf{x}

$\lambda_0(t)$ = Baseline hazard function describing the hazard of event for a hypothetical situation when all covariant values are set to zero.

$e^{(\mathbf{x}' \beta)}$ = Term specific to individuals with covariates \mathbf{x} .

X

- HY_i** = fixed effect of herd-year *i* in which the sample was taken (1 to 222)
- YS_j** = fixed effect of year-season *j* in which the sample was taken (1 to 15)
- BREED_k** = fixed effect of breed type *k* (*k*= 1 to 3)
- H_WE_l** = fixed effect of herd-weight category *l* (*l*=1 to 3)
- C_WE_m** = fixed effect of heifer-weight category *m* (*m*= 1 to 4)
- H_MY_n** = fixed effect of herd-milk yield category *n* (*n*= 1 to 2)
- C_MY_o** = fixed effect of heifer-milk yield category *o* (*o*= 1 to 4)



Descriptive statistics of variables under analysis

	<u>Age at First Calving</u>	<u>Days Open</u>
Records	4631	1992
Right censored records (%)	1087 (23.5)	183 (9.2)
Minimum censoring time (d)	781	19
Maximum censoring time (d)	1150	610
Average Censoring time (d)	846.1	183.5
No. uncensored records	3544	1809
Minimum failure time (d)	541	22
Maximum failure time (d)	1751	338
Average failure time (d)	843.7	109.8

The mean and standard deviation of body weight in different categories.

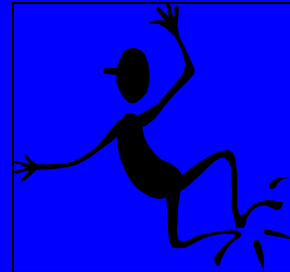
<u>Factor</u>	<u>Class</u>	<u>n</u>	<u>X</u>	<u>SD</u>
Breed	General	4631	252.6	51.8
	Holstein	2526	271.5	50.3
	Jersey	1269	211.3	34.3
	Others	836	258.3	41.8
Herd weight	H_WE1	1602	277.9	44.7
	H_WE2	2241	248.6	49.9
	H_WE3	788	212.7	41.4
Heifer weight	C_WE1	570	307.0	44.8
	C_WE2	1838	261.8	46.1
	C_WE3	1637	238.3	44.1
	C_WE4	586	211.1	41.9

The mean and standard deviation of milk yield in different categories

<u>Factor</u>	<u>Class</u>	<u>n</u>	<u>X</u>	<u>SD</u>
	General	1992	1897.8	540.9
Breed	Holstein	1114	2127.8	542.6
	Jersey	592	1586.8	362.9
	Others	286	1646.0	387.0
Herd milk yield	H_MY1	1016	2151.5	521.6
	H_MY2	976	1633.7	421.2
Heifer milk yield	C_MY1	288	2482.0	493.3
	C_MY2	727	1983.7	474.7
	C_MY3	696	1728.6	435.3
	C_MY4	281	1496.1	416.1

Results

Chi-squares values



<u>Factor</u>	<u>Age at First Calving</u>			<u>Days Open</u>		
	<u>df</u>	<u>χ^2</u>	<u>P > 0</u>	<u>df</u>	<u>χ^2</u>	<u>P > 0</u>
Herd-Year	221	1187.0	0.01	167	278.5	0.01
Year-Season	14	57.04	0.01	12	4.25	0.98
Breed	2	3.88	0.14	2	14.20	0.01
Herd_Weight	2	454.4	0.01	2	16.77	0.01
Herd_Milk Yield	-	-	-	1	0.49	0.48
Heifer_Weight	3	79.14	0.01	3	3.65	0.30
Cow_Milk Yield	-	-	-	3	9.54	0.02

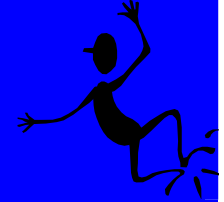
Results



Hazard Ratios (HR) for Age at First Calving

<u>Factors</u>	<u>Class</u>	β	<u>std</u>	<u>HR</u>	<u>n</u>
Breed	Holstein	0.00	-	1.00	1976
	Jersey	0.16	0.08	1.18	952
	Other	0.10	0.16	1.10	616
Herd-weight	H_WE1	0.17	0.17	1.18	1208
	H_WE2	0.00	-	1.00	1806
	H_WE3	-0.09	0.17	0.91	530
Heifer-weight	C_WE1	0.22	0.06	1.25	399
	C_WE2	0.00	-	1.00	1471
	C_WE3	-0.19	0.04	0.83	1324
	C_WE4	-0.35	0.06	0.70	350

Results

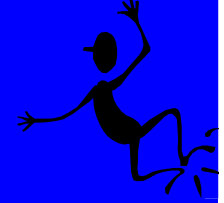


Hazard Ratios for Days Open

<u>Factor</u>	<u>Classes</u>	<u>β</u>	<u>std</u>	<u>HR</u>
Breed	Holstein	0.00	-	1.00
	Jersey	0.42	0.11	1.52
	Others	0.35	0.22	1.42
Herd-weight	H_WE1	-0.03	0.21	0.98
	H_WE2	0.00	-	1.00
	H_WE3	-0.39	0.27	0.68
Heifer-weight	C_WE1	0.10	0.08	1.11
	C_WE2	0.00	-	1.00
	C_WE3	0.09	0.06	1.10
	C_WE4	0.11	0.08	1.12

Results

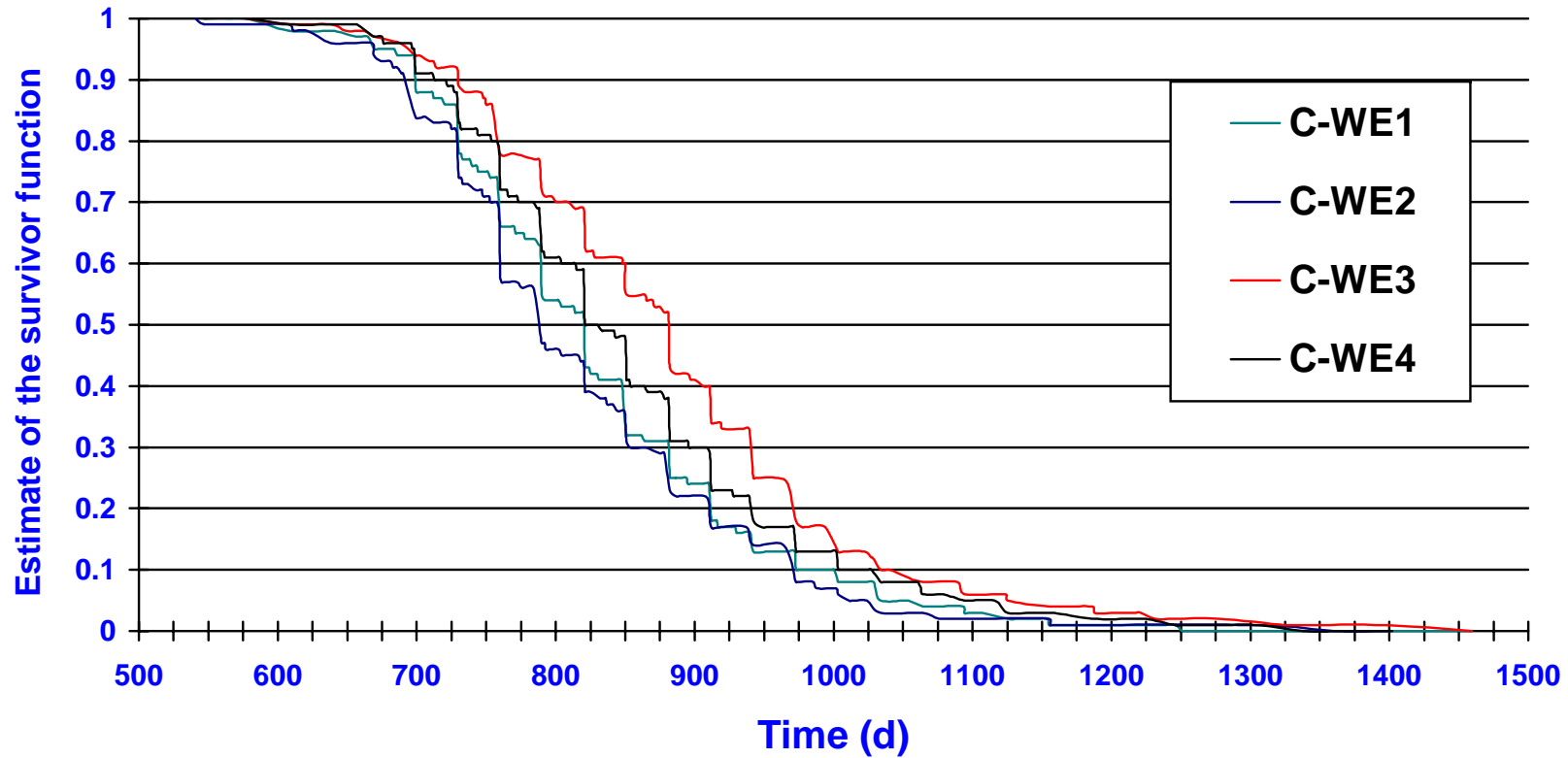
(cont.) Hazard Ratios for Days Open



<u>Factor</u>	<u>Classes</u>	<u>β</u>	<u>std</u>	<u>HR</u>
Herd-milk yield	H_MY1	0.00	-	1.00
	H_MY2	0.15	0.39	1.15
Heifer-milk yield	C_MY1	-0.08	0.08	0.92
	C_MY2	0.00	-	1.00
	C_MY3	-0.05	0.06	0.95
	C_MY4	-0.25	0.08	0.78

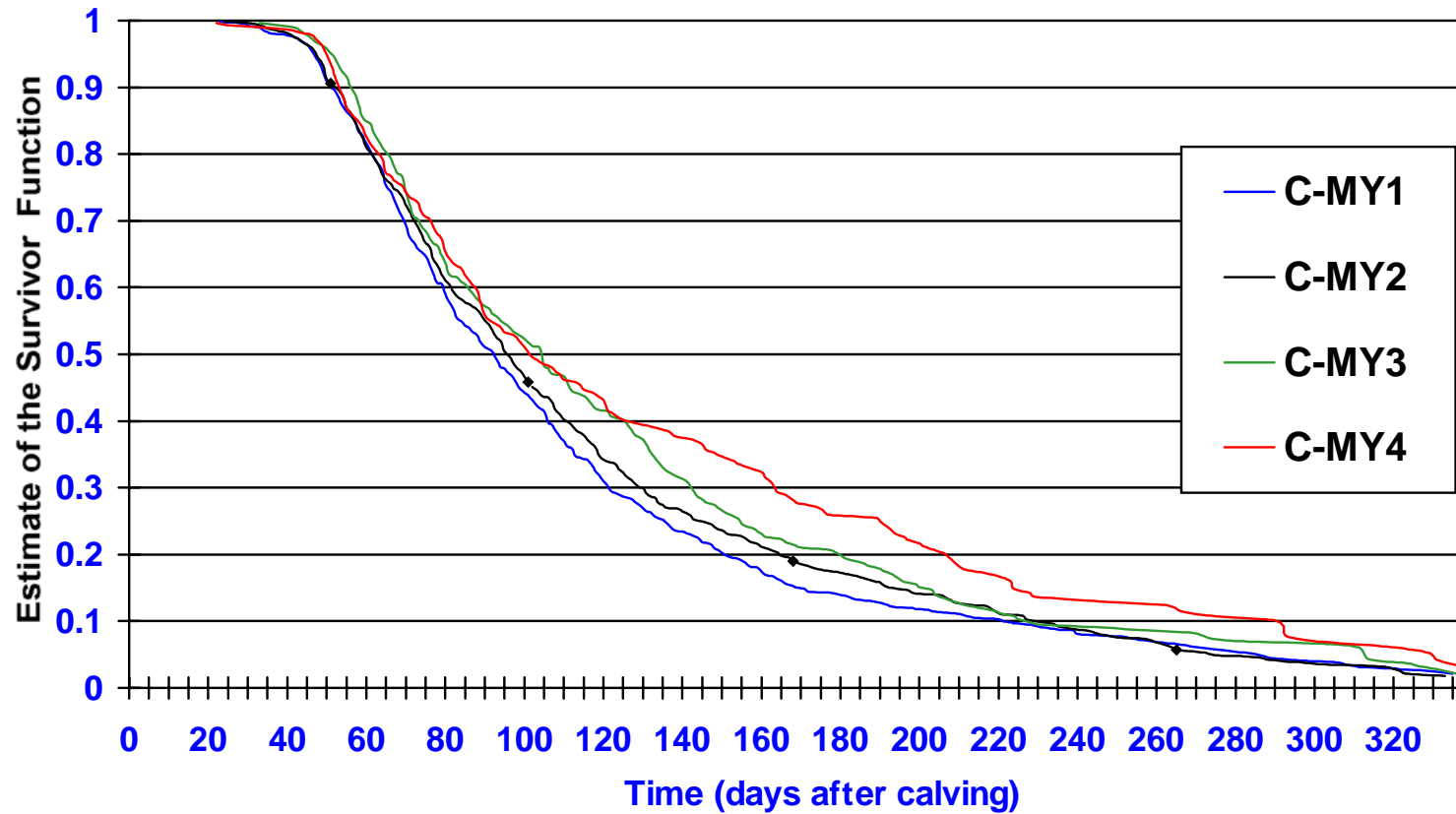
Results-Age at First Calving

Survival curves within Cow-Weight (CWE) Strata



Results-Days Open

Survival curves within Cow-Milk Yield (CMY)



Conclusions



1. There is a significant effect of BW 390-d on Age at First Calving. Heavier heifers calve earlier and have a higher chance of calving.
2. BW 390-d does not have a large impact on the chance of conception after first calving.
3. Cow milk yield does not have a large detrimental effect on the chance of conception after first calving.