

Online Material

APPENDIX

Assumptions on input parameters of the JohneSSim model based on the literature and opinions of an expert panel (for details, see [17]).

Table A. Assumptions on input parameters related to herd dynamics (part 1).

Parameter	Value
Initial herd size ^a	65 adult cattle and 103 young stock
Annual increase of maximum number of adult cattle	5% per annum
Age at first calving	2 years
Calving interval	1 year
Probability of calf born alive if dam is a heifer	0.88
Probability of calf born alive if dam is older	0.96
Proportion of live-born heifer calves raised in the herd ^b	0.8–1.0

^a Based on median herd size of Dutch dairy herds in October 2003.

^b Depending on the ratio of the number of adult cattle / maximum number of adult cattle in the previous time step. If the ratio was > 0.96, 80% of calves were retained; if the ratio was 0.92 to 0.96, 90% of calves were retained; and if ratio was < 0.92, 100% of calves were retained. A surplus of heifers was sold shortly before first calving.

Table B. Assumptions on input parameters related to herd dynamics (part 2).

Parity	Proportion of cattle at start of simulations (%) ^a	Probability of involuntary culling (%)
0 (calf)	20.4	10.0
0 (pregnant heifers)	16.5	7.5
1	16.5	13.6
2	13.6	14.9
3	11.7	17.9
4	8.7	19.8
5	4.9	22.7
6	3.9	24.5
7	1.9	25.9
8	1.9	27.3
9	0	29.0
10	0	31.0
11	0	32.6
12	0	34.5

^a Based on age distribution of a random sample of 100 Dutch dairy herds with 65 adult cattle in October 2003.

Table C. Assumptions on probability of intra-uterine infection of a foetus, in relation to status of its dam when the dam is either highly infectious or clinically diseased.

	Number of months before becoming clinically diseased			Clinically diseased
	> 12 months	7–12 months	0–6 months	
Probability	0.035	0.07	0.22	0.5

Table D. Assumptions on infection probabilities at birth without additional preventive management measures.

Dam infection status	Herd infection status		
	No infectious cattle	≥ 1 lowly infectious cattle but no highly infectious cattle	≥ 1 highly infectious cattle
Not infectious	0.00	0.025	0.10
Lowly infectious, 2 calvings before highly infectious	N.A.	0.20	0.50
Lowly infectious, 1 calving before highly infectious	N.A.	0.50	0.50
Highly infectious or clinically diseased	N.A.	N.A.	0.95

Table E. Assumptions on infection through colostrum and milk.

Transmission route	Parameter	Value
Colostrum	Number of calves drinking colostrum from one cow if mixed colostrum is being fed (excluding own calf)	2
	Probability of infection by drinking colostrum from highly infectious or clinically diseased cow	1
	Probability of infection by drinking colostrum from lowly infectious cow	0.3
Waste milk	Number of calves drinking waste milk from one cow if waste milk is being fed (excluding own calf)	8
	Probability of infection by drinking waste milk from highly infectious or clinically diseased cow	1
	Probability of infection by drinking waste milk from lowly infectious cow	0.3
Bulk milk	Probability of one highly infectious or clinically diseased cow contaminating bulk milk	0.2
	Probability of infection by drinking contaminated bulk milk	0.95

Table F. Assumptions on infection probability of dairy calves due to environmental contamination with *Map*: infection probability = $1-(1-kS/N)^I$ (modified Reed Frost).

Parameter	Details
S	Susceptibility of calves to infection with <i>Map</i> = $100 \times \exp(-0.01 \times (\text{age in days}))$
k	Total number of effective cow-calf contacts: 7 (0–6 months of age) and 63 (7–12 months of age)
N	Number of adult cattle, determined by the model
I	Number of infectious cattle in the last 6 months; lowly infectious cattle are assumed to only be infectious during the first two months postpartum

Table G. Assumptions on age (years) of cattle becoming highly infectious, modelled as triangular distribution. Infected cattle become lowly infectious two calvings before becoming highly infectious.

Age of infection	Age at which cattle become highly infectious		
	Minimum	Most-likely	Maximum
Congenital infection	1.5	2.5	20
At birth	2	3.5	20
0–6 Month	2	4	20
7–12 Month	4	6	20

Table H. Assumptions on interval between becoming highly infectious and culling in adult cattle.

Interval	Parameters of triangular distribution		
	Minimum	Most-likely	Maximum
Between becoming highly infectious and becoming clinically diseased (years)	0.5	1	2
Between becoming clinically ill and being culled (months)	0.5	1	3

Table I. Simulated risk-profiles used to represent the variation in the ‘background’ herd management.

Risk-profile	“Background” herd management				Proportion of Dutch dairy herds
	Cow-calf separation: immediately postpartum	Colostrum: own dam only or mixed	Milk: artificial milk replacer only	Proper separation of calves 0–6 months of age and adult cattle	
1	No	Own dam	Yes	Yes	0.08
2	No	Own dam	Yes	No	0.10
3	Yes	Own dam	No	Yes	0.08
4	Yes	Own dam	No	No	0.12
5	No	Own dam	No	Yes	0.18
6	No	Own dam	No	No	0.26
7	No	Mixed	No	Yes	0.06
8	No	Mixed	No	No	0.11

Table J. Assumed default effects of additional preventive management measures.

Transmission route	Preventive measure	Effect on infection probability through this transmission route
Intrauterine infection	–	–
At birth	Improved hygiene at birth	90% reduction
Colostrum own dam	–	–
Mixed colostrum	Feeding colostrums from own dam only	100% reduction
Waste milk	Feeding milk replacer only	100%
Bulk milk	Feeding milk replacer only	100%
Environmental contamination	Effective separation of calves from adult cattle	90% reduction of the number of effective cow-calf contacts (k)