**Supplementary material**

**Estimating the economic impact of subclinical ketosis in dairy cattle using a dynamic stochastic simulation model**

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**Supplementary Material S1**

***Cow parameters (part 1)***

Milk production (305 days) (Mi) per parity is determined with a normal distribution function

Mi = Normal (MEANmi, SDmi)

Where

MEANmi = mean milk production (M) in 305 days of cow i,

SDmi= standard deviation of milk production of cow i, which was 5.9% of the mean based on Bruijnis *et al.* (2010).

Fat-and-protein-corrected milk (FPCM) was estimated per day.

FPCMid = (0.337 + 0.116 x %F + 0.06 x %P) x Mid

Where

%F (4.36) is fat percentage in milk (CRV, 2014)

%P (3.54) is protein percentage in milk (CRV, 2014)

Energy requirement for maintenance and milk production of the cow was estimated per day as voeder eenheid melk (VEM), whereas 1 000 VEM was equivalent to 6.9 MJ of net energy.

VEMid = (42.4 x BW0.75id +442 x FPCMid) x (1+(FPCMid -15) x 0.00165)

where

BW0.75id = Body weight of cow (i) at day (d)

FPCMid = Fat-and-protein-corrected milk of cow (i) at day (d)

Cows received additional VEM for pregnancy (450, 850, 1 500, 2 700 during last four months of pregnancy) and parity 1 (660 per day) and parity 2 (330 per day) cows received additional VEM for growth (CVB, 2012). Body weight increased linear per week in parity 1 and 2.

***Dynamic of subclinical ketosis and related diseases (part 2*)**

In the model, subclinical ketosis (SCK) and the diseases mastitis, metritis, displaced abomasum, lameness and clinical ketosis occurring in the first 30 days after calving are included. First, cows have a probability (Pscki) based on their parity to get subclinical ketosis (SCKi), and had SCK (1) or not (0).

SCKi = discrete ({1,0}; {Pscki, 1- Pscki})

Second, cows with SCK had an additional probability on a related disease. Cows had an additional probability based on their parity to get one of the following diseases (o): clinical ketosis (CK), mastitis (MAS), metritis (MET), displaced abomasum (DA), lameness (LAM), no extra disease (SCKONLY) (Berge and Vertenten, 2014).

SCKDISEASEi = discrete ({SCKONLY, SCKMAS, SCKMET, SCKDA, SCKLAM, SCKCK}; {Psckonlyi, Psckmasi, Psckmeti, Psckdai, Pscklami, Psckcki })

Third, cows with SCK could be removed (SCKremi). Cows have a probability to get culled (Pcul) or dead (Pdead) or not culled or death (Plife). The probability of each is dependent on parity of the cow and SCKDISEASE.

SCKremi = discrete ({CUL, DEAD, LIFE}, {Pculi, Pdeadi, Plifei})

Where

Pculi = probability of cow (i) to get culled

Pdeathi = probability of cow (i) to get dead

Plifei = 1- Pculio - Pdeathio

***Losses due to diseases (part 3)***

All cows with SCK had the same percentage of reduced milk production at day 1-30. Cows with a related disease after SCK also had after day 30 a reduced milk production for a period which was diseases specific. Total milk losses because of reduced milk production (ML) were summed.

MLi = Mid x MLTP + Mid x MLOid

Where

Mid = milk production of cow (i) on day (d)

MLTP = % milk production losses of cow (i) with SCK per day on day 1-30

MLOid = % milk production losses of cow (i) with related disease per day (d) after day 30

Cows with a related disease after SCK were treated and the milk during these days was discarded. Milk discarded (Mmd) were summed to estimate the total.

Mmdi = Mid x (1- MLTP) x Dwithd

Where

Dwithd= the withdrawal of milk due to treatment of disease at day(d) (1,0)

Milk production losses due to removal (MLrem) were estimated as the difference between the milk production of the cow without SCK and the milk production of the removed cow during the first 30 days plus the milk production of the new heifer.

**References**

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