Overview of disease effects in SimHerd

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Tabel 1: Overview of disease effects on cow-level [1] in SimHerd

	Milk fever	Dystocia	Retained Placenta	Metritis	Displaced Abom.	Ketosis	Mastitis	Digital Derm.	Foul in the foot	Claw and leg probl.
Yield loss [2]	1.0%	0%	0.9%	2.0%	4.0%	2.2%	7.7%	1.7%	9.6%	4.0%
Reduced [3] conception rate	1	1	0.75	0.74	1	0.28	1	0.64	0.05	0.43
Duration of reduced conception	0	0	119	119	0	63	0	49	21	140
Withdrawal of milk, days	0	7	3	6	6	7	7	0	7	0
Mortality risk [4]	0.13	0.04	0	0	0.07	0	0.02	0.01	0.015	0.042
Risk for involuntary culling [4]	0	0	0	0	0.13	0	0.06	0.009	0.013	0.036

[1] The effect on the cow's cell count, feed intake, weight and inseminationperiod are also included in the model, though not presented in this table.

[2] Yield loss (as a % of lactation yield) depends on the time where the disease occurs in the lactation. A profile for milk loss is represented in the model for each disease (see page 3). In the figure 1 to 10 it is shown how diseases affects milk yield during lactation in case the disease occurs at the, according to the previously mentioned risk profile, most likely time during lactation. The cow's feed intake is reduced proportionally to the drop in milk yield.

[3] Conception rate (CR) for healthy cows (50% for example) is reduced by this factor. An illustration: 0,75 means that a cow with Retained Placenta has a CR of 50% * 0,75 = 37,5%. The duration of this reduced CR is 119 days, where after the cow is healthy again and has a CR of 50% (see also page 2).

[4] Risk of dying or getting culled involuntarily in the week of disease occurrence (see also page 2).

Literature references: the articles below are documentation articles of the SimHerd model. These articles contain all the literature references behind the single assumptions as presented in table 1.

- The incorporation of **milk fever, dystocia, retained placenta, metritis, displaced abomasum and ketosis** in the SimHerd model is documented in Østergaard et al. 2003 (Preventive Veterinary Medicine, vol. 58, page 125-143).
- The incorporation of **mastitis** in the SimHerd model is documented in Østergaard et al. 2005 (Journal of Dairy Science, vol. 88, page 4243-57).
- The incorportation of **digital dermatitis and claw and leg problems** is documented in Ettema et al. 2010 (Preventive Veterinary Medicine, vol. 95, page 64-73).
- The assumed effect of **foul-in-the foot (interdigital phlegmon)** on milk production is based on Hernandez et al. 2002 (Journal American Vet. Med. Association, vol. 220, page 640-644).

How to adjust the assumed effects of disease on production

In case you wish to adjust the assumed effects in SimHerd, this can be done for the effects on conception, involuntary culling, and death. Open the tab details, here each disease has a subcategory in which these parameters can be adjusted.
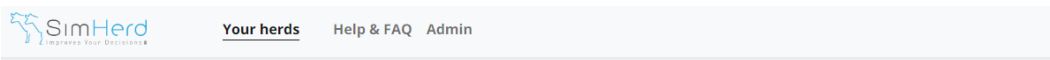
The conception risk for a lame cow is for example 0.43 and can be reduced to 0.20, whereby the model assumes that the conception risk for a lame cow is 80% lower compared to a healthy cow.

Model input parameters

⑦ Hoof and leg

|			
Disease treatments	⑦ Risk mild case	0	risk
Reproduction	⑦ Effect of mild cases	0,5	proportion
Mortality and culling	⑦ Risk of death in week of onset	0,042	probability
Milk yield	⑦ Risk of involuntary slaughtering in week of onset	0,036	probability
Breeding strategy	⑦ Odds Ratio of conception	0,43	odds ratio
Control and settings	⑦ Duration of reduced odds of conception	140	days
Details	⑦ Odds Ration of estrus oberservation	1	odds ratio
	⑦ Duration effect on estrus oberservation	0	days
	⑦ Relative risk sub-clinical case in lactating period	0	relative risk
	⑦ D1 parameter	0	days after calving
	⑦ D2 parameter	140	days after calving
	⑦ D3 parameter	150	days after calving
	⑦ Y2 parameter	1,6	proportion
	⑦ Y3 parameter	0	proportion
	⑦ Y4 parameter	0	proportion

To adjust the effects of the diseases on milk yield is not very straightforward. The effect on milk yield is specified with a "three-line-spline" function that has 7 parameters for primi- and multiparous cows.

SimHerd   **Your herds**   Help & FAQ   Admin

Model input parameters

|			
	⑦ Y4 parameter, effect on SCC, multiparous cows	0	proportion
Disease treatments	⑦ D1 parameter, effect on milk yield, primiparous cows	0	days after calving
Reproduction	⑦ D2 parameter, effect on milk yield, primiparous cows	200	days after calving
Mortality and culling	⑦ D3 parameter, effect on milk yield, primiparous cows	50	days after calving
Milk yield	⑦ Y1 parameter, effect on milk yield, primiparous cows	0,055	kg per day
Breeding strategy	⑦ Y2 parameter, effect on milk yield, primiparous cows	1	proportion
Control and settings	⑦ Y3 parameter, effect on milk yield, primiparous cows	0,6	proportion
Details	⑦ Y4 parameter, effect on milk yield, primiparous cows	0	proportion
	⑦ D1 parameter, effect on milk yield, multiparous cows	0	days after calving
	⑦ D2 parameter, effect on milk yield, multiparous cows	200	days after calving
	⑦ D3 parameter, effect on milk yield, multiparous cows	50	days after calving
	⑦ Y1 parameter, effect on milk yield, multiparous cows	0,055	kg per day
	⑦ Y2 parameter, effect on milk yield, multiparous cows	1	proportion
	⑦ Y3 parameter, effect on milk yield, multiparous cows	0,6	proportion
	⑦ Y4 parameter, effect on milk yield, multiparous cows	0	proportion
	⑦ Direct effect on body weight gain	0,12	proportion

If you want to simulate that the effect of this disease is **twice as large** (or half as large) as specified with the "three-line-spline" parameters, you should use a value for the Y1 that is double (or half) the default value of 0,055. The figure below shows a graphic presentation of the three-line-spline parameters (for both primiparous and multiparous cows) for claw and leg problems when using a value for Y1 of 0,055 and 0,11 (double the value of 0,055). On page 7 you can see what a lactation curve of a cow looks like, when a cow has had a case of claw and leg problems compared to a healthy cow (the value for the Y1 parameter equals 0,055 for the figure on page 7).
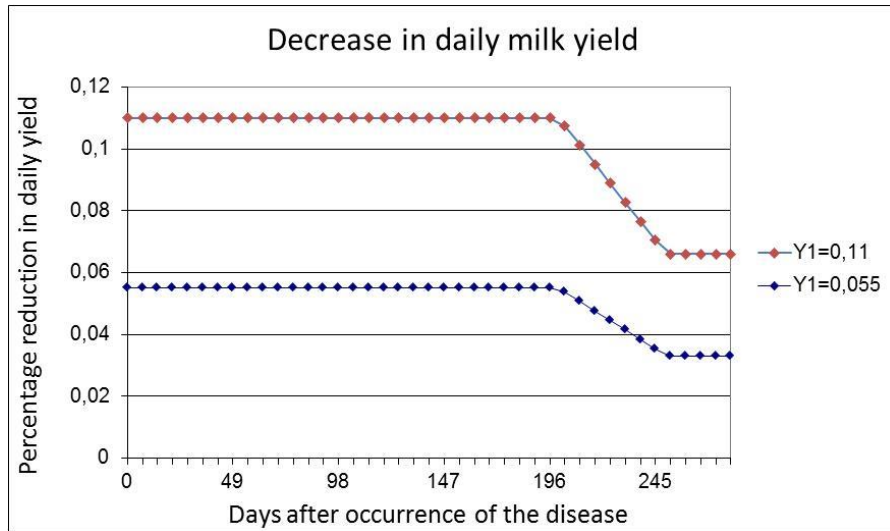

It is also possible to specify different distributions of severities for each disease; you can for example specify that 50% of all diseases are mild and, 25% are moderate and 25% are severe.

How milk yield is affected by diseases in SimHerd
In figures 1 to 10 it is presented how milk yield of a third parity cow is affected by the 10 production diseases simulated in SimHerd (Y-axis=kg Energy Corrected Milk, X-axis= weeks after calving). Milk loss furthermore depends on the time of occurrence of the disease.

Figure 2: effect of dystocia (DYS) on milk yield
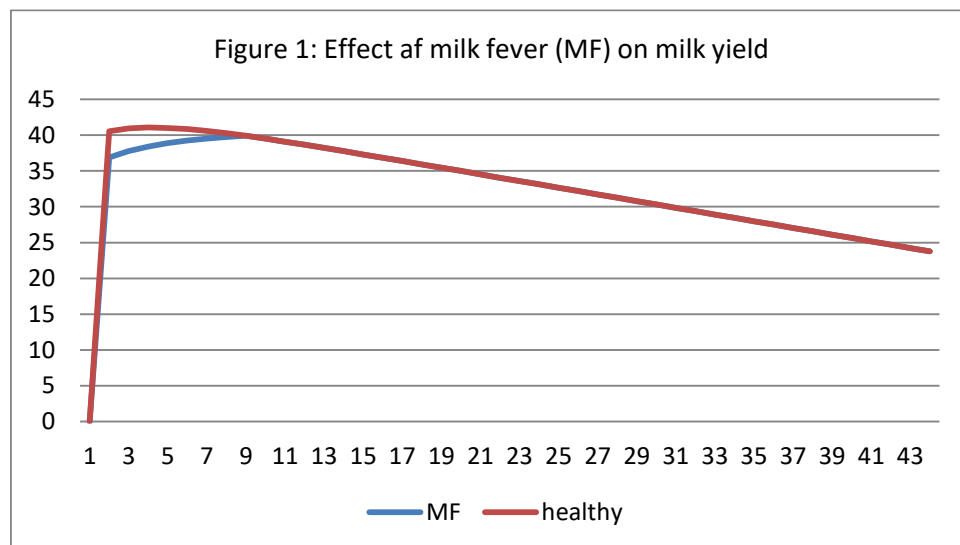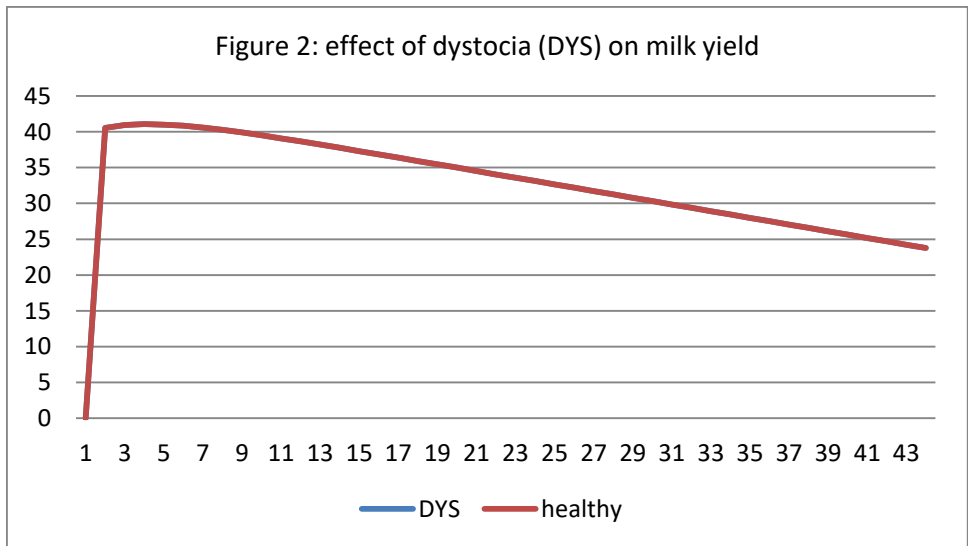
As shown above and in table 1, a case of dystocia does not affect milk yield directly. However, the figure presented on page shows how dystocia is an important risk factor for e.g. Retained Placenta. The cows risk for retained placenta is 3 times higher in case the cow has had dystocia.
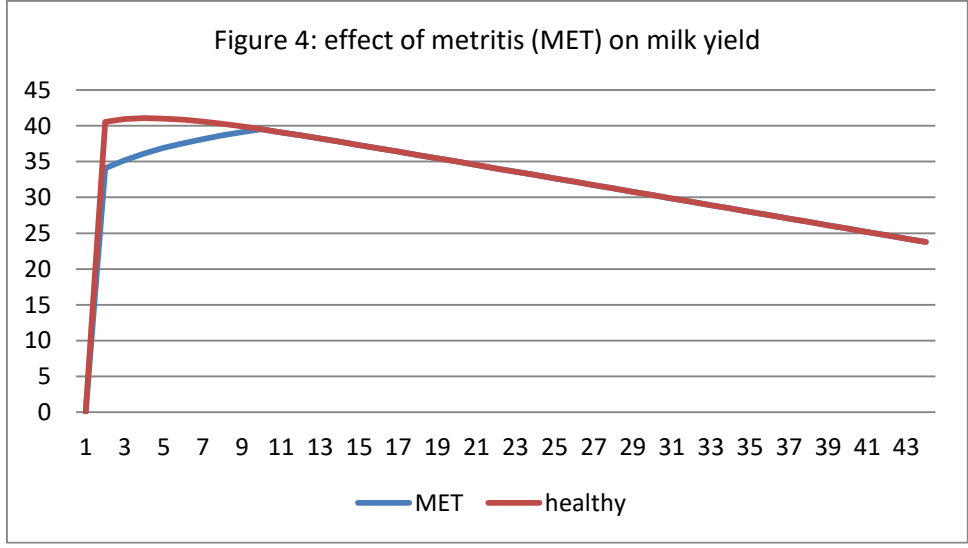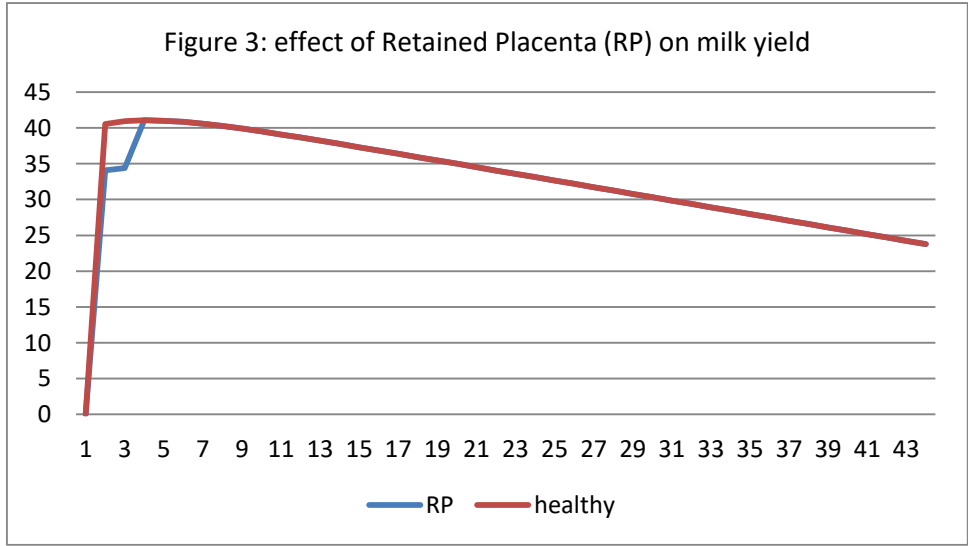

Figure 3: effect of Retained Placenta (RP) on milk yield

Figure 4: effect of metritis (MET) on milk yield
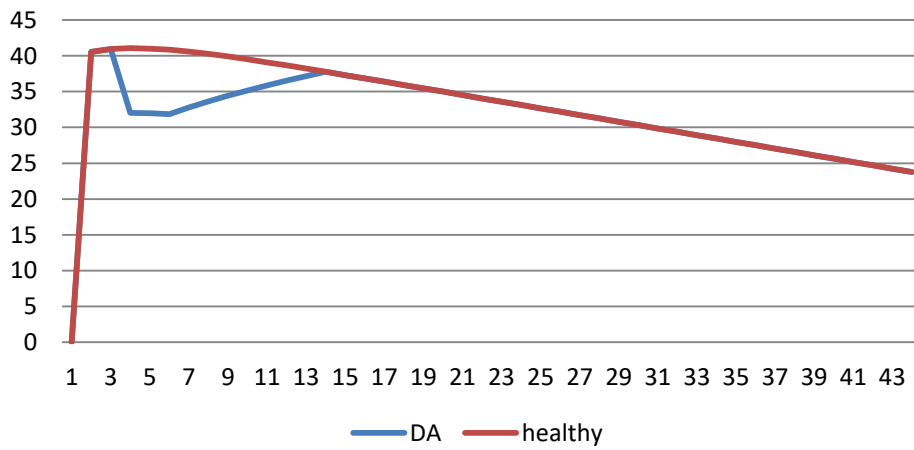
Figure 5: effect of displaced abomesum (DA) on milk yield
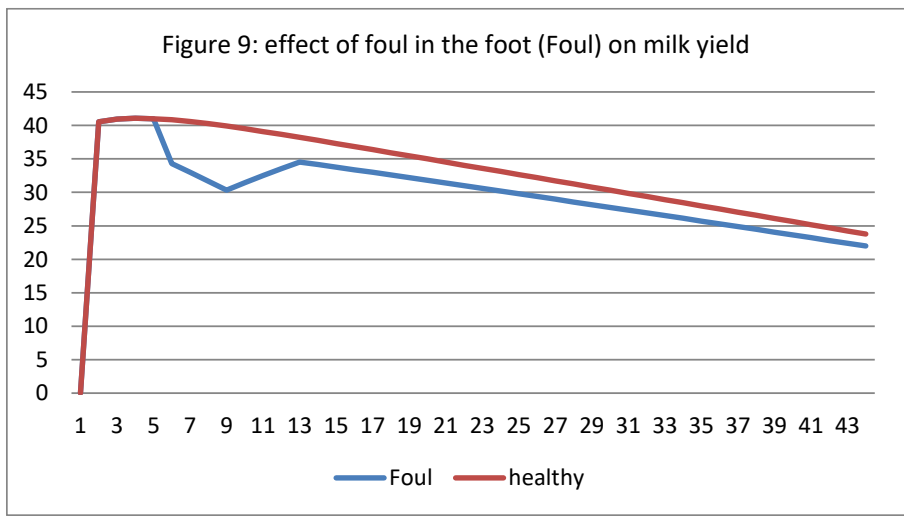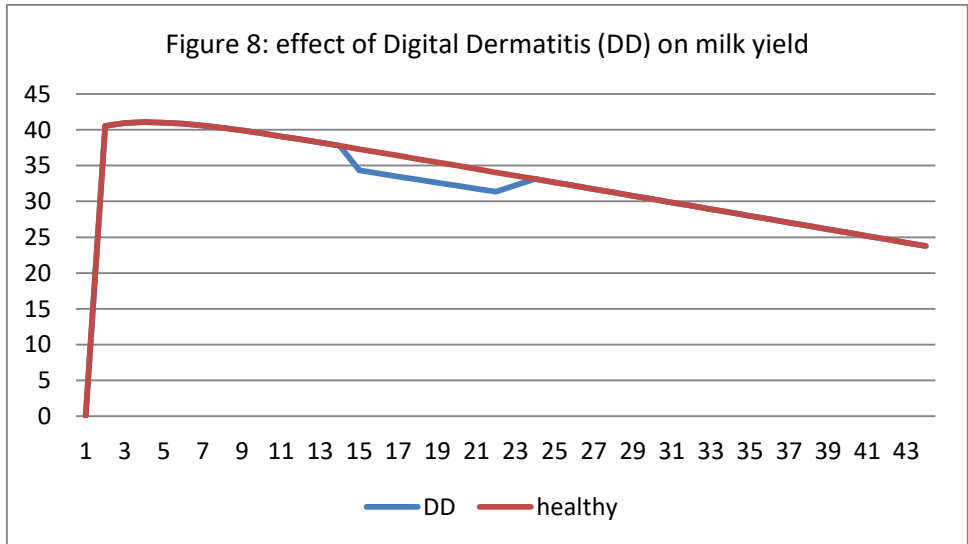

Figure 6: effect of ketosis (KET) on milk yield
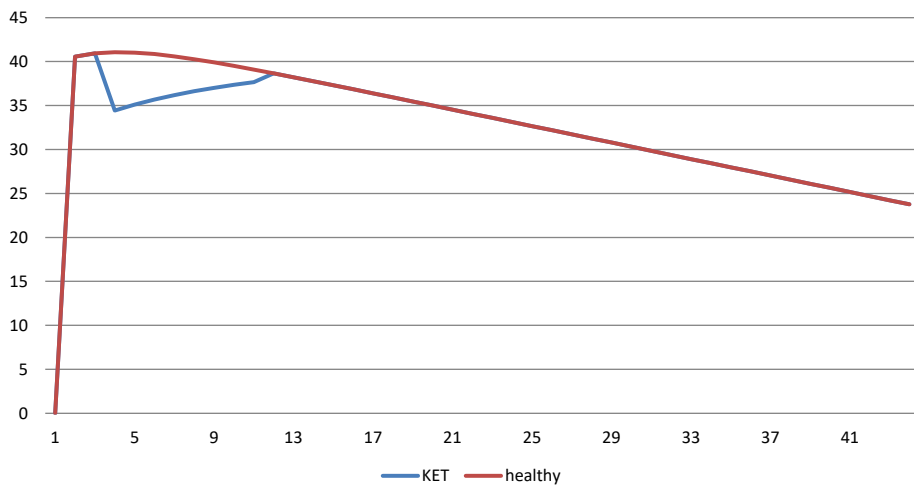
Figure 7: effect of mastitis (MAS) on milk yield

Figure 8: effect of Digital Dermatitis (DD) on milk yield

Legend: DD, healthy

Figure 9: effect of foul in the foot (Foul) on milk yield

Legend: Foul, healthy
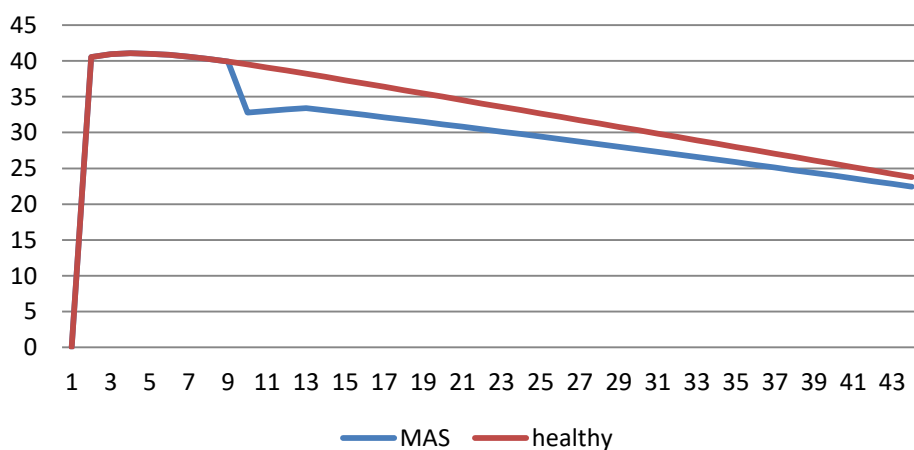
Hoof Horn Diseases=Claw and Leg problems.

Figure 10: effect of Hoof horn diseases (HHD) on milk yield

Legend: HHD, healthy

Mastitis

1,1

Milk fever

3

Metritis

1

2

5

5

Ret. Placenta

3

3

3

2

Dystocia

Ketosis

7

Displ. Abom.

Digital Dermatitis
Foul in the Foot
Hoof Horn Dis.
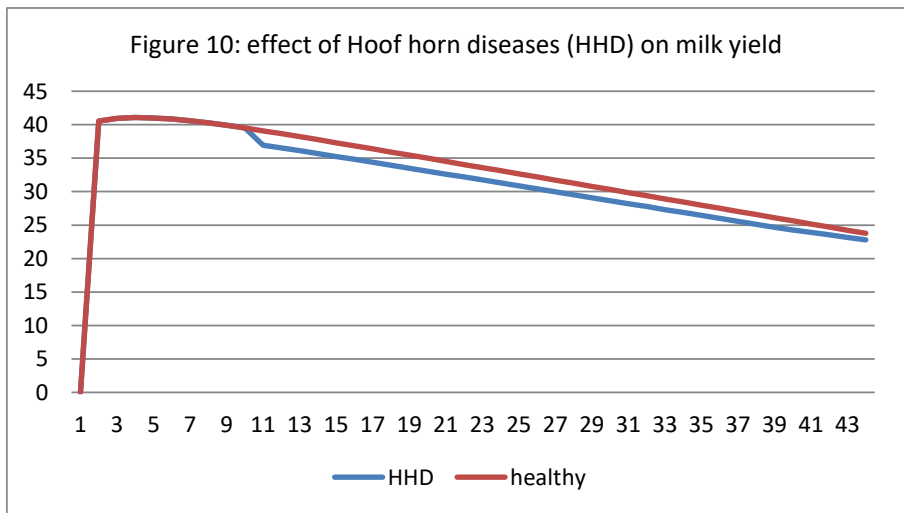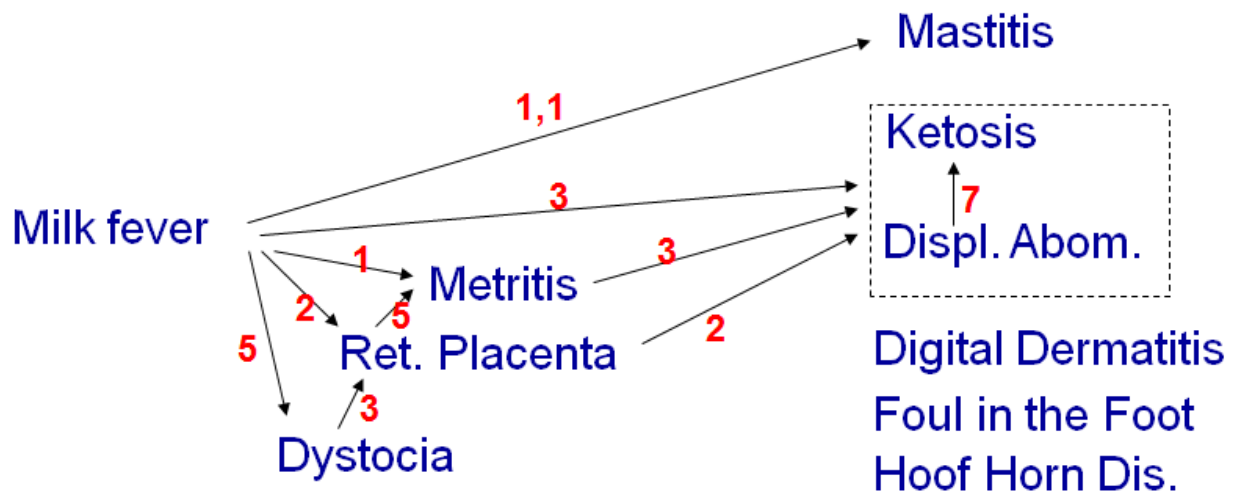
This is the network that describes the interrelationship between diseases; the odds of getting retained placenta are three times higher if the cow has had dystocia. Not all edges are shown in the graph above; metritis is for example a risk factor for both Ketosis (3) and Displaced Abomesum (2,5).