

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA 17110

Grantee name: Angela Fanelli

Details of the STSM

Title: Application of a scenario tree model on data collected about Enzootic Bovine Leukosis (EBL) control programmes (CPs)

Start and end date: 09/05/2022 to 20/05/2022

Description of the work carried out during the STSM.

This STSM was organized by Jenny Frössling as the host institution at the National Veterinary Institute (Sweden) visited by Angela Fanelli (Junior consultant, Ausvet Europe, France).

The objectives of the STSM were to:

1. Assess whether the information gathered through the SOUND control data protocol (STSM5) is enough to perform scenario tree analysis and produce reliable estimates of probability of freedom
2. Apply a scenario tree model and estimate the probability of freedom from EBL in several European countries.

The work was carried out individually by the visitor, with two scheduled weekly meetings in which the visitor updated the daily work and received feedback from the host. The host and her team (Thomas Rosendal, Arianna Comin, and Jerome Baron) were also available to solve problems and provide guidance through informal meetings when it was needed.

Hereunder the details of the activities pursued:

Week 1

- Quality assessment of the data received
- Selection of the countries which provided enough data
- Identification of key parameters to build a scenario tree model
- Design the trees for the selected countries (Ireland, Italy, and Slovenia)

¹ This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

- Build the models assuming representative sampling and 10000 iterations

Week 2

- Improve the model for Ireland (account for overlapping of the surveillance components)
- Include temporal discounting for Italy (data from 2018 to 2021)
- Perform a sensitivity analysis (what if-scenario: (a) for Ireland and Slovenia, simulating a risk-based surveillance with 70% dairy herds and (b) for Italy, running the model with one tenth the number of herds and animals tested)

Additionally, since Italy provided data on the surveillance activities carried out in the EBL endemic areas (so called “clusters”), the visitor had the chance of learning and applying the case detection capacity method to estimate the detection fraction (DF) for EBL during the study period (2018-2021). The DF is proportion of diseased herds in the population that are correctly identified, and it can be considered as a measure of the surveillance system efficiency. Given the lack of information on the farm system of the herds tested, we assumed that the same proportion of dairy and non-dairy herds was tested.

Description of the STSM main achievements and planned follow-up activities

Results obtained:

- (1) The overall quality of the data was evaluated as good although some information was not available. This might be due to some technical limitations of the tool used for data collection and to the fact that these the data providers were not able to access these data.
- (2) The models were built considering a design herd prevalence of 0.2% and a within herd prevalence of 15%. The main outputs were:
 - For **Ireland** the estimated median surveillance sensitivity was 0.579 [95%CI: 0.531-0.582] while the posterior probability of freedom from EBL in 2019 was 0.704 [95%CI: 0.681-0.705]. By increasing the number of dairy herds tested (Risk-based surveillance), the median value of the sensitivity of the surveillance system and the probability of freedom increased to 0.774 and 0.815 respectively (Table 1)
 - For **Slovenia** the estimated median surveillance sensitivity was 0.771 [95%CI: 0.720-0.788] while the posterior probability of freedom from EBL in 2019 was 0.814 [95%CI: 0.781-0.825]. In the what if-scenario, the median value of the sensitivity of the surveillance system and the probability of freedom increased to 0.911 and 0.919 respectively (table 1).

Table 1: Sensitivity analysis for Ireland and Slovenia (2019): Median and 95 % credible intervals [CI] of the surveillance system sensitivity and posterior probability of freedom table

Country	SSe [95% CI]	Risk based SSe [95% CI]	Deviation from the default median (%)	Post freedom [95% CI]	Risk based Post freedom [95% CI]	Deviation from the default median (%)

Ireland	0.579 [0.531-0.582]	0.774 [0.658-0.853]	0.337	0.704 [0.681-0.705]	0.815 [0.745-0.872]	0.158
Slovenia	0.771 [0.720-0.788]	0.911 [0.834-0.952]	0.182	0.814 [0.781-0.825]	0.919 [0.858-0.954]	0.129

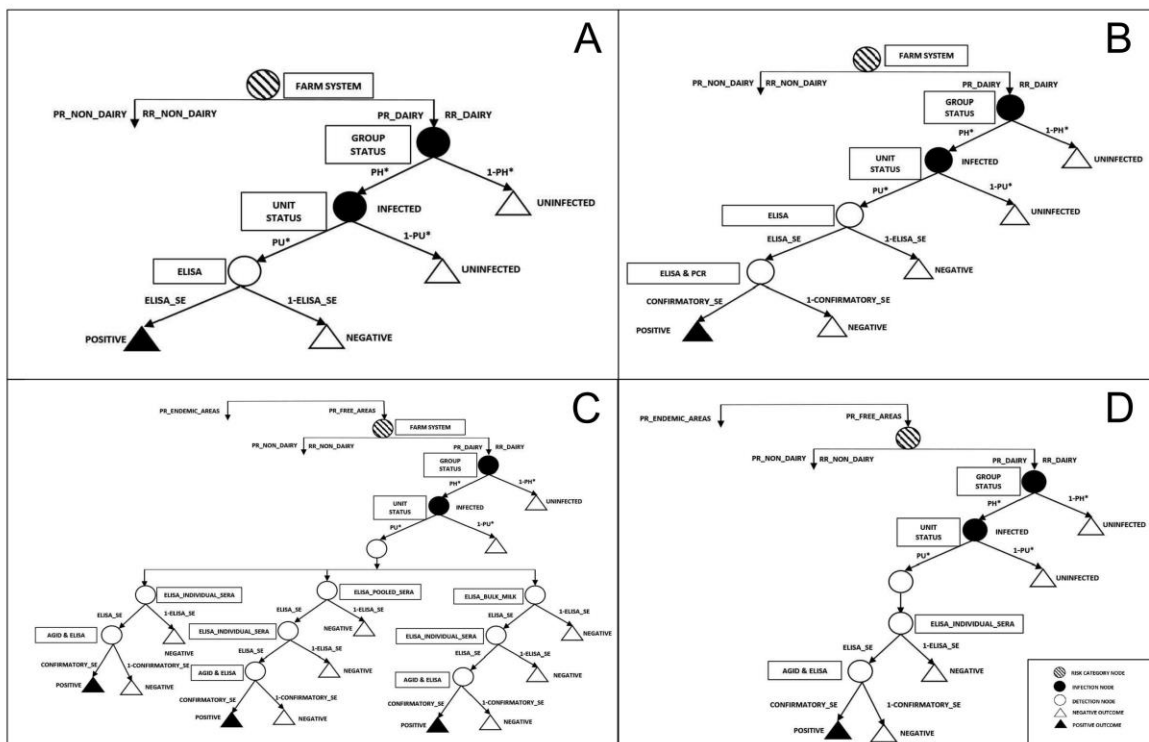
- For **Italy** (free areas), both the estimated median of the surveillance sensitivity and the posterior probability of freedom from EBL from 2018 to 2021 were 100%, with no differences between simulations and years. The estimate of the median probability of freedom also remains high in the model using one tenth the number of herds and animals tested (median over the years=0.980).
- For **Italy** (endemic areas), the median estimate of the detection fraction ranged from 0.676 [0.550-0.795] in 2018 to 0.581 [0.473-0.683] in 2021.

For each country, a R Markdown (.Rmd) file was created to record the analysis process.

This study showed that the data collected via the data collection tool developed in SOUND-control allowed to quantitatively estimate the probability of freedom from EBL for several countries. However, this study also highlighted some technical limitations of the data collection tool. For example, the google form built during STSM5 might be more suitable to collect aggregated data, rather than detailed information which is required for scenario tree modelling. These limitations should be addressed to allow more accurate estimation of the posterior probability of freedom.

Future collaborations (if applicable)

A more thorough report will be drafted to present the results in detail. During the STSM, it was also mentioned to publish on these findings and perhaps to work together again in other projects.



Picture: Scenario tree models illustrating the active surveillance system for EBL in Ireland (2019) (A), Slovenia (2019) (B) and Italy -free areas (2018-2021) (C-D). Please note that for Italy, the first branch dividing the proportion of herds tested in the free areas from those in the clusters is not considered in the calculation. However, the node is included in the model structure to visualize the entire structure of the national surveillance system. Moreover, given the lack of information on the number of herds and animals tested with each testing strategy, the structure of the tree was simplified considering only 2 diagnostic nodes and the most common screening method (ELISA on individual sera) (D).