

## Report on the outcomes of a Short-Term Scientific Mission<sup>1</sup>

**Action number:** CA17110 Standardizing Output-based surveillance to control Non-regulated Diseases of cattle in the EU

**Grantee name:** Eleftherios Meletis

### **Details of the STSM**

Title: Application of the STOC free model for Salmonella Dublin in Denmark

Start and end date: 27/06/2022 to 11/07/2022

### **Description of the work carried out during the STSM**

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

*(max. 500 words)*

The objective of this STSM was to apply the STOC free model, a -state-of-the-art statistical method for the prediction of the herd-level probability of infection from longitudinal data, to the disease *Salmonella Dublin* (S. Dublin). S. Dublin is still present in the Danish cattle population. During the first week, I spent most the time getting familiar with the data and setting the data format suitable for model implementation. In the first week, I had two meetings with the host contact (Beate Conrady) and members of the institution – working on the *Salmonella Dublin* to discuss applications of the model to the available data. During the first week, I performed test simulation runs of the model for a small number of dairy herds (with associated Bulk tank milk (BTM) test results available for each herd at regular time intervals) to make sure that the model is run accurately. For the remaining period of the STSM, I performed the analysis to the total number of dairy herds and addressed the discussion points of the different meetings in the model like to include risk factors in the STOC free model (see below a detail description).

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

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

<sup>1</sup> 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.

(max. 500 words)

Main challenge of the STSM was to set up the data suitable for model implementation. In this context, we discussed different approaches/input for the model such as the validation of the model's predictions with the output of the S. Dublin program and associated infection status of farms. The STOC free model is a Bayesian Hidden Markov model, implemented in STAN used for prediction of the herd-level probability of infection from longitudinal data. The model represents infection as a herd latent status with a monthly dynamic. The latent status (infectious status of the herd – Infected | Healthy) determines test results through test sensitivity [prob of herd testing positive | herd infected] and specificity [prob of herd testing negative|herd healthy]. However, according to the S. Dublin Denmark program, a status is appointed to each herd, depending on the tests performed, so we also run the model using the status variable as a test result (sensitivity: [prob of herd being status = 2 | herd is infected] and specificity: [prob of herd being status = 1 | herd is healthy]). Given that the BTM test is performed at regular time intervals (4 times per year) another approach we tried was to calculate the moving average of the Optical density value (ODC) values (2 tests, 3 tests) of the BTM test and evaluate it at different cut-off values (ODC: 25, 18, 10). Finally, a list of potential risk factors were identified that can be incorporated to the model. As we used encrypted data, we get an agreement that I will have access to the S. Dublin database until the end of September in order to incorporate the additional risk factors. As the next steps is to finalize all analyses and to publish a scientific paper on this study i.e. describing the application of the STOC free model for the disease S. Dublin in the Danish cattle population. This will enhance the model's applicability.