Surveillance analysis Tool for Outcome-based Comparison of the confidence of FREEdom

European Food Safety Authority

STOC free: WP5, Deliverable 2

Annual report year 2

10 March 2018-9 March 2019

Comparison of the confidence in freedom from infection based on different control programmes between EU member states: STOC free

September 2019

This study was awarded a grant by EFSA and was co-financed by public organisations in the countries participating in the study

Summary

The STOC free project runs from 10 March 2017 until 9 March 2021 and aims to construct a generic framework that will allow a standardised and harmonised comparison of the output of different control programmes (CP) of cattle diseases that are not regulated by the EU. During the first year, the dynamics of BVD infection were evaluated in a conceptual model. Based on those results and the aim of the project, Bayesian networks were considered the best modelling method for output-based evaluation of surveillance. Detailed CP information was collected for BVDV in the six participating countries and the most important key aspects for inclusion in the STOC free model were identified.

In the second year, a first version of STOC free model was developed and discussed within the consortium. The model estimates the probability of freedom from infection while taking account of the probability for both a new introduction of infection and delayed detection of an existing infection. Introduction is mainly influenced by risk factors such as purchase, neighbourhood risk and herd size. Delayed detection depends on the design of the CP, such as frequency of testing and diagnostic test performance. This first version of the model was tested using French data and will be further developed and tested in the third year.

A literature review/ meta-analysis was initiated to obtain default values for risk factors for BVDV infection to be included in STOC free model. Data on occurrence of risk factors and the design of CPs was collected using the expanded RISKSUR tool. The results were compared between countries using a qualitative risk analysis approach, which highlighted the need for an objective output-based method for comparison of CPs. From this information, and further discussion within the consortium, a draft version of the questionnaire that forms the basis for the data collection tool was developed. It is foreseen that this tool will advance concurrently with model development.

In year three, the developed model will be tested and validated using data from each of the partner countries. Additionally, in collaboration with the SOUND control consortium, aspects for future generalisation of the methods to other diseases will be identified.

Background

Several European Member States (MS) have implemented control programmes (CP) for endemic infections that are not regulated by the EU. Therefore, the design of these programmes is tailored to each country's specific situation and vary extensively. This large variation results in difficulties when comparing these programmes and creates a need to be able to objectively and quantitatively compare programme outputs e.g. confidence of freedom from infection.

In the STOC free project, six countries are collaborating to construct the generic framework that will provide for standardised and harmonised comparison of the output of different CPs for cattle diseases that are not regulated by the EU. The framework will allow the integration of heterogeneous data and will result in standardised and comparable outputs.

During this project, BVD is acting as the case disease because large variations in both programme design and prevalence exist between MS. The framework is being designed and optimised using pilot-scenarios describing the CPs in one of the consortium partner countries. Thereafter, information about BVDV CPs, combined with test specifications and demographic context information, will form the basis of case studies where the developed methods will be applied and optimised in all six consortium member states. In the final stage of the project, the developed methodology will be evaluated for possible generalisation to other cattle diseases.

Overview of activities in year 1

First, a conceptual model was developed that represented the course and dynamics of BVD infection. Thereafter, possible statistical methods were explored that showed potential to be used in this context of output-based evaluation. Bayesian network models were chosen because of their flexibility and the possibility to include heterogeneous input information. At the same time, an approach was developed to describe non-EU regulated CPs using and expanding an existing tool for harmonized description of surveillance programmes (the RISKSUR tool, http://www.fp7-risksur.eu/results/tools). The adapted tool was completed by each MS and the aspects of CPs that influence the confidence of freedom from infection were identified. The first step for development of a data collection tool was subsequently made by developing an extensive questionnaire containing questions regarding quantitative input information for a large number of identifiers.

In this document, the progress of the second year is described.

WP5: management

WP leader and co-leader: G. van Schaik and I. Santman-Berends (Utrecht University, the Netherlands)

WP5: Highlights of year 2

During the second year, monthly Skype meetings were held to discuss the challenges and to monitor the progress of the project. Face-to-face meetings were held in June 2018 (between PhD students), October 2018 (whole consortium), February 2019 (between PhD supervisory groups) and 26 March (whole consortium). The first annual newsletter was delivered in September 2018 in which the progress of the first year was described. An interim report including the financial statement was produced in March 2019. A proposal was submitted and granted to receive a PhD travel grant called

the Van Gogh scholarship which provides a limited amount of travel money for both PhD students to visit and work with each other.

Additionally, in 2018 the COST Action project SOUND control, which is closely related to STOC free, received a grant and started in October 2018 (https://www.sound-control.eu, COST Action CA17110). The COST action aims to coordinate, stimulate and assist initiatives to explore and implement a widely adaptable output-based framework. The project is in support of STOC free and provides an excellent platform to maximise the probability that the STOC free model will be implemented and used by a wide range of stakeholders. In the SOUND control network, more than 100 experts originating from 30 European countries participate in support of output-based surveillance.

Deliverables second year:

- 5.1 Annual progress report year 1 September 2018
https://stocfree.eu/sites/default/files/Annual%20report%20STOC%20free%20year%201._format%20newsletter.pdf
- 5.2 Interim report (technical and financial) March 2019
https://www.stocfree.eu/sites/default/files/documents/Deliverables/5.2_2019_interim_technical_report_stoc_free_final.pdf

WP1: Development of STOC-free model

WP leader and co-leader: C. Fourichon and A. Madouasse, PhD student M. Mercat (ONIRIS, France)

The aim is to develop a method (STOC free model) for the quantitative comparison of the confidence in freedom from infection in different CPs for non-regulated diseases in the EU.

WP1: Highlights of year 2

During the second year, WP1 proceeded with the development of a statistical model based on the chosen method: a special type of Bayesian networks called a hidden Markov model, which allows incorporating infection dynamics in the estimation. The results of the conceptual framework were delivered together with a document containing guidelines for identification and sources of data.

An initial simple version of the model was developed and discussed between the partners. It is a herd-level model in which the probability of becoming infected (τ1) is influenced by the occurrence of risk factors and the probability of clearing an infection (τ2). The latter (τ2), among other things, depends on the CP in place. The first version was discussed and decisions were made about the time steps used in the model (monthly), the risk factors that should be included and the amount of CP information that should be taken into account. Risk factors that are included are herd size, introduction of cattle into the herd and the risk from neighbouring herds (prevalence of disease and/or livestock density). The model includes parameters describing the CP in place (risk mitigation (including vaccination) + test system), the test characteristics and information such as the time since freedom was achieved. Later on the probability of freedom and associated uncertainty will be estimated for specific strata in the population based on risk factors such as herd size (small/medium/large), introduction of cattle (yes/no), test scheme (BTM test, tag test, spot test), and neighbourhood risk (low/high).

In the second year, an initial simple version of the model was developed using French data. In the third year, it is foreseen to expand the model by adding risk factors and more detailed CP information. Thereafter, the model will be tested using case studies to validate and further improve the model.

Deliverables second year:

- 1.1 Guidelines for the design of conceptual models delivered: April 2018
https://www.stocfree.eu/sites/default/files/documents/Deliverables/1.1_conceptual_model_april_2018.pdf
- 1.2 Guidelines for the identification and sources of data delivered: July 2018
https://www.stocfree.eu/sites/default/files/documents/Deliverables/1.2_final.pdf

WP2: Development of STOC-free data

WP leader: S. More (UCD, Ireland), PhD student A. van Roon (Utrecht University, the Netherlands)

The aims of WP2 are two-fold:

1. To develop a generic data collection framework named STOC free data, guided by the methodology developed in WP1, and
2. To use this framework to provide a thorough description of the BVDV control/eradication programmes (CPs) conducted in defined EU MS and, subsequently, to collect specific quantitative information about the CPs.

WP2: Highlights of year 2

In year 2, the results from the expanded and completed RISKSUR tool were combined and analysed resulting in a thorough qualitative comparison of BVDV CPs in the six member states. The results were delivered (deliverable 2.3) to EFSA. Additionally, a scientific paper was written in which an approach was proposed to qualitatively compare elements that influence the likelihood, and associated uncertainty, that cattle from a herd categorized as BVDV-free are truly free from infection. This paper is currently under review with the *Journal of Dairy Science*. As part of the qualitative risk analysis approach, the relevant context and CP characteristics were ranked and discussed between each of the six participating countries. Together with the consortium partners, the first version of the questionnaire that forms the basis for the data collection tool (deliverable 2.1), was transformed in a second version (deliverable 2.2). Ongoing discussions are taking place on the development of this questionnaire tailored to the needs and progress of the statistical model (WP1).

A literature review and meta-analysis was initiated in close collaboration with WP1 to obtain default values for risk factors for BVDV infection to be included in the statistical model. Initially, 6,958 papers were selected and screened for inclusion in the review by title and abstract. Subsequently, a full-text screening was applied to 259 papers and it was decided to eventually include 51 papers in the study. In the third year, a data extraction table will be developed and the essential parameters will be extracted from the selected papers to the table. The quality of the papers will be evaluated and a final selection will be done to identify papers for inclusion in the meta-analysis.

Deliverables second year:

- 2.1 First version questionnaire delivered: April 2018
https://www.stocfree.eu/sites/default/files/documents/Deliverables/2.1_questionnaire_apr_2018_def.pdf
- 2.2 Second version questionnaire delivered: July 2018
https://www.stocfree.eu/sites/default/files/documents/Deliverables/2.2_questionnaire_second_version.pdf
- 2.3 Description of BVDV CPs delivered: July 2018
https://www.stocfree.eu/sites/default/files/documents/Deliverables/2.3_introduction.pdf

WP3: Case studies and generalisation

WP leader and co-leader: A. Lindberg and J. Frössling (SVA, Sweden)

The objective is to validate and optimise STOC free model and STOC free data that are developed in WP1 and WP2, respectively, in case studies that are conducted by all partners. Additionally, the generalizability to other diseases will be evaluated.

WP3: Highlights of year 2

The case studies are foreseen for the third year. The developed method eventually has to be generic enough to be able to transfer to other diseases as well. The model should include generic epidemiological features which are common for multiple diseases. Aspects to take into account for generalizability that might differ between diseases include the preferred time steps, the definitions of freedom and infection, the usability of serology to determine the infectious state, and the relevant target population that should be included in the model. The work that is conducted within the COST Action SOUND control, which is closely linked to STOC free, will provide additional input on how to generalise STOC free model to other species and other diseases. Additionally, within SOUND control aspects such as economics and sociology will also be taken into consideration.

Deliverables second year: None scheduled

WP4: Communication and dissemination

WP leader: J. Gethmann (FLI, Germany)

WP4: Highlights of year 2

During the second project year, the conceptual framework and the overall project were presented with posters at the 2018 SVEPM conference (Society of Veterinary Epidemiology and Preventive Medicine) in Estonia. Oral presentations of the project were delivered at the InnovSur conference in France (May 2018), the VEEC conference in the Netherlands (Nov. 2018) and at the ISVEE conference (International Society for Veterinary Epidemiology and Economy) in Thailand (Nov. 2018). Additionally, the project was presented and discussed by each of the partners with national stakeholder and decision maker meetings and to FESASS. A general article about STOC free was submitted to a special issue in Frontiers of Veterinary Science and accepted for publication.

In October 2018, a COST Action called SOUND control started and the STOC free project was presented in several working groups of this consortium in March 2019. A close link between both projects is assured by participation of multiple partners in both consortia.

Deliverables second year:

- 4.2 Presentations at international conferences On-going
- 4.3 Publications in international journals On-going

https://stocfree.eu/progress/publications-presentations

Paper: STOC Free: An Innovative Framework to Compare Probability of Freedom From Infection in Heterogeneous Control Programmes.
https://www.frontiersin.org/articles/10.3389/fvets.2019.00133/full

Planning year 3

In year 3, the statistical model will be further developed and tested using the BVDV case studies. The simple model will first be tested using Dutch bulk milk data then subsequently using ear notch data from Germany and Ireland. In the meantime, the literature review and meta-analysis will result in default values for the risk of introduction that can be combined with the country-specific occurrence of risk factors as input for the model. Abstracts will be submitted for the ICAHS4 conference and the group will initiate a workshop for possible users of the model which is planned for the spring of 2020 (4th year). Communication and dissemination will proceed. Monthly Skype meetings will be held to discuss the progress of the project and additional PhD meetings will be planned. The annual meeting is planned for 8 and 9 October 2019 in Berlin, Germany, including a presentation about the project to epidemiologists and modellers from the University of Berlin.