



Food and Agriculture
Organization of the
United Nations



Preparing to use emergency vaccination for Foot-and-mouth And Similar Transboundary animal diseases in European countries

Second meeting

14 June 2022

European Commission for the Control of Foot-and-Mouth Disease



Funded by the
European
Union

EuFMD's programme, tools and initiatives

FAST

Foot-and-mouth And
Similar Transboundary
animal diseases

Dt

eufmd digital
transformation

vlearning

eufmd virtual learning
centre

microLearning

eufmd virtual learning

vlc EA

virtual learning centre
for East Africa

Tom

eufmd training
management system

SimExOn

simulation exercises
online

KnowBank

eufmd knowledge bank

GetPrepared

emergency preparedness toolbox

RiskComms

risk communications

SQRA

a method for spatial qualitative
risk analysis applied to fmd.

Pragmatist

prioritization of antigen management
with international surveillance tool

EuFMDiS

european foot-and-mouth disease
spread model

RMT-FAST

risk monitoring tool for foot-and-mouth
and similar transboundary animal diseases

Vademos

fmd vaccine demand
estimation model

GVS

global vaccine
security

PQv

vaccine
prequalification

PCP

progressive control
pathway

PSO

pcp practitioner
officers

VPP

veterinary
paraprofessionals

PPP

public private
partnership

Sustainable development goals, UN-SDGs. EuFMD's programme has a focus on



Together against wasting resources, think twice before printing.

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Abbreviations and acronyms

EuFMD	European Commission for the Control of Foot-and-Mouth Disease
EuFMDiS	European Foot-and-Mouth Disease Spread model
FAST	Foot-and-mouth And Similar Transboundary
FMD	Foot-and-Mouth Disease
MN	Member Nations (of EuFMD)
PPP	Public Private Partnership

Background

In 2020/2021, the EuFMD conducted scoping activities to better understand the state of preparedness for emergency vaccination for FMD and Similar Transboundary (FAST) animal diseases in EuFMD Member Nations (MN). The scoping work, using a survey and workshop with contingency planners/risk managers, identified specific needs in the preparedness for emergency vaccination as well as areas where EuFMD can offer support to Member Nations.

A workshop held on 10 March 2022 was planned as the first in a series of two workshops to improve preparedness to use emergency vaccination against FAST diseases in EuFMD Member Nations. The aim of the workshop was to identify criteria that could assist EuFMD Member Nations to decide whether to implement emergency vaccination as a control measure for FAST diseases. A [report](#) describes the conduct and outputs of this workshop, including the key decision criteria for vaccination as identified by participants.

A second workshop was held on 14 June 2022, in which selected decision criteria for emergency vaccination, identified during in the first workshop, were applied to FMD outbreak scenarios modeled in four countries of Europe.

The workshops form part of a programme of work by EuFMD to identify and address constraints to using emergency vaccination for FMD and similar Transboundary Animal Diseases (TADs) in Europe and its neighbourhood. Although the development of criteria initially focused on FMD, the intent is for this work to be adapted in future to apply to emergency vaccination for control of other FAST diseases.

Introduction

The decision to use emergency vaccination in response to a Foot and Mouth Disease (FMD) outbreak is based on many complex factors including:

- unique features of each outbreak.
- populations at risk.
- animal welfare issues that arise during outbreaks.
- resources (human, equipment, physical) to eradicate the disease and dispose of carcasses.
- economic factors, including the importance of export trade.
- social and political factors, including the attitude to culling livestock to control the disease.

The objectives of the second workshop were to:

- Present an example from Australia of how modeling key decision criteria has influenced the consideration of different response options (including emergency vaccination) for contingency planning for FMD.
- Compare how the decision to vaccinate, based on key decision criteria from workshop 1, affected simulated FMD outbreaks in selected European countries.
- Discuss the modelling outcomes of selected control measures, including emergency vaccination, in different FMD scenarios in a European country.

Workshop planning

The workshop was planned by a team from EuFMD with assistance from Tatiana Marschik from the University of Veterinary Medicine, Vienna and Beate Conrady from the University of Copenhagen. The agenda (**Appendix 1**) included a presentation, followed by breakout room discussions based on individual country scenarios. FMD outbreak scenarios were developed and control measures compared using the European Foot-and-Mouth Disease Spread model (EuFMDiS).

A second round of break-out discussions focused on more detailed consideration within a single country (Austria scenario). The workshop then finished with a plenary discussion on the potential role of emergency vaccination in European countries.

The key decision criteria, considered in modelling for the workshop were livestock density and resourcing for the response. Social and political factors were discussed but not included in modelling the scenarios.

The scenarios set in Bulgaria, Spain, Denmark and Austria, developed for workshop 1, formed the starting point for the first break-out discussions in the second workshop. These scenarios were used to illustrate the effect of emergency vaccination commencing at seven, 14 and 21 days, compared with baseline control measures (described below).

Scenario development

- The starting location, method of FMD introduction, and time of year were provided by representatives from Bulgaria, Spain, Denmark and Austria.
- The scenarios were developed using the EuFMDiS model for each affected country.
- There was a 21-day 'silent spread' period from the first introduction, with the confirmation of the outbreak occurring at the end of this period, followed by implementation of a control program.
- Each simulation included the following 'baseline' control measures:

- For Bulgaria, Spain and Austria, a 48-hour country-wide ban on livestock movements of susceptible species was declared following diagnosis. For Denmark, the movement ban was 72 hours, consistent with Denmark's contingency plan for FMD.
- All susceptible livestock on confirmed infected holdings were culled, followed by disinfection of the holding. No pre-emptive culling of animals in suspected, contact, or neighbouring herds was applied in the baseline scenario.
- The model considered a 3 km protection zone and a 10 km surveillance zone around each infected holding, with continued movement restrictions and surveillance activities.
- The control program included tracing of contact herds following movements onto and off infected holdings, reporting of suspect cases, and surveillance in the protection and surveillance zones around infected holdings.
- All scenarios involved infection in a single country only.
- Resources available for control were based on estimates provided by each of the four countries.
- For vaccination programs, the assumptions were that high potency vaccines (≥ 6 PD50/dose) were available for use, and that onset of immunity occurred between 4-6 days.
- Consideration of post-vaccination management of animals was not within the scope of this workshop.

Comparison of control measures

For comparison of control measures, the following parameter settings were used in the model.

Baseline control measures	Vaccination
<ul style="list-style-type: none"> ● 48–72 hours livestock movement ban ● Culling of susceptible livestock on infected holdings ● Movement restrictions and surveillance activities in restrictions in 3 km protection zone ● Movement restrictions and surveillance activities in restrictions in 10 km surveillance zone ● Tracing of contact herds 	Baseline control measures plus: <ul style="list-style-type: none"> ● 3 km emergency ring vaccination around all infected holdings ● All susceptible species, all herds vaccinated ● Vaccination commencing at seven, 14, or 21 days ● Vaccination commencing from outside – in

Second breakout discussions: Austria

The second break out discussions focussed on outbreaks in a single country (Austria). Additional scenarios were developed to compare the effects of FMD control measures in locations of differing livestock density, and with different levels of resourcing, in Austria.

Scenarios were modelled in two regions of differing livestock density: Region North, with a higher livestock density, and Region West with a lower livestock density. In each case, the outbreaks were initiated in a randomly selected large-scale commercial pig herd (median size 660 pigs) with a silent spread phase of 21 days. The various control strategies were modelled in both regions. In order to show the impact of the limited capacity of the resources for selected operational activities (surveillance, cleaning and disinfection), all scenarios were run with both sufficient and constrained resources respectively. ‘Sufficient

resources’ was defined as the capacity of personnel that does not constrain the performance of operational activities such as surveillance, culling or disposal.

Baseline control measures (stamping out infected herds)	Vaccination	Pre-emptive culling (Region North only)
<ul style="list-style-type: none"> • 48–72 hours livestock movement ban • Culling of susceptible livestock on infected holdings • Movement restrictions and surveillance activities in restrictions in 3 km protection zone • Movement restrictions and surveillance activities in restrictions in 10 km surveillance zone • Tracing of contact herds 	<p>Baseline control measures plus:</p> <ul style="list-style-type: none"> • 3 km emergency ring vaccination around all infected holdings starting at day seven OR • Vaccination of all cattle within 3 km starting at day seven OR • Vaccination of dairy cattle and breeding pigs within 3 km starting at day seven 	<p>Baseline control measures plus:</p> <ul style="list-style-type: none"> • pre-emptive culling of susceptible livestock within 1 km of infected herds

Participants

Participants were invited from EuFMD Member Nations through the EuFMD contingency planning focal points network. Livestock industry participants were invited through the EuFMD Public-Private Partnership (PPP) Initiative¹ for Anticipating FAST-Disease Outbreaks.

Fifty-six participants attended the workshop, including facilitators from EuFMD (**Appendix 2**).

Workshop conduct

The workshop was held online. A presentation on the use of modelling to inform contingency planning for FMD in Australia was followed by discussions in four breakout rooms.

Session 1: Each breakout room discussed an FMD scenario for one of the four countries (Bulgaria, Spain, Denmark or Austria). Participants were allocated to the breakout rooms based on their Member Nations and/or role, with the breakout room having participants from the scenario-country, neighboring countries, European private sector organizations and some with representatives from the European Commission.

Each scenario was run 100 times and the results were presented to participants as ‘box-and-whisker plots’ for comparison.

Comparisons between control measures was made on the basis of:

- Total number of infected holdings.
- Duration of the response.
- Total animals culled.
- Total animals vaccinated.

¹ The PPP Initiative explores collaborations between private and public partners and academia in the prevention and control of FAST diseases.

Following breakout room discussions, representatives from the breakout rooms reported back on the effect of vaccination on the outcome of their scenario, and what factors may have contributed to this result.

Session 2: All four breakout rooms discussed the same Austrian scenarios. This was followed by a plenary discussion of the potential role of emergency vaccination for FMD control in Europe.

Workshop outputs

Effect of vaccination on individual country outbreak scenarios

The scenarios modeled in workshop 1 were selected on the basis that they would lead to discussion about the key decision criteria for implementing emergency vaccination. These scenarios were not necessarily typical of the outcome of FMD introduction and spread in the four countries.

For the Denmark and Spain scenarios, vaccination (all susceptible stock within 3 km) offered no clear benefit over the baseline control measures. For both countries, estimated response resources were adequate for culling and disposal of the infected holdings, even while livestock density differed greatly between the two countries.

In Bulgaria, resources available for the response were constrained. For this scenario, vaccination reduced the chance of very large outbreaks, but there was little clear benefit of vaccination over the baseline control measures.

For the Austrian scenario, in which resourcing was considered adequate for culling and disposal, emergency vaccination commencing at seven days resulted in a lower total number of infected holdings compared with the baseline and reduced the likelihood of a longer duration of outbreak response (Figure 2b).

Effect of livestock density, resourcing and control measures on FMD scenarios in Austria

The results of the conducted simulations in Austria showed that the epidemiological impact of an FMD outbreak strongly depends on the geographical location of the initial disease incursion, types of control measures chosen, and the availability of resources to control an outbreak. In general, the epidemic size (as measured by number of infected holdings and outbreak duration) was greater in the more densely stocked Region North than the sparsely stocked Region West.

In the presence of sufficient resources and under the stamping out policy, the median (5th and 95th percentiles) number of infected holdings was 86 (56-126) and the outbreak control duration 59 (45-100) days. To compare, the epidemiological results in Region West showed that the outbreak would most likely be relatively small and of short duration and would result in 14 (10-25) infected holdings and an epidemic control duration of 36 (28-53) days.

When simulating with sufficient resources in Region North, vaccination control strategies slightly reduced the number of infected holdings and thus the size of the outbreak, however, the effect was not significant. A significant reduction in the number of infected holdings was achieved only under the strategy with pre-emptive culling of premises within 1 km of infected holdings, including culling of dangerous contact herds, resulting in 64 (43-89) infected holdings. However, this efficacy comes at the cost of having to depopulate 73,065 (61,423-89,432) animals, seven times as many as under the stamping out policy.

In region West, there was no clear benefit of vaccination in the presence of sufficient or constrained response resources, compared with baseline control measures. Thus, the control measures under the stamping out policy would be sufficient for bringing the outbreak under control in this region.

In more densely stocked areas (Region North), when resources were constrained, vaccination strategies reduce the dimension of the outbreak significantly (app. 30% reduction in the number of infected holdings). According to our findings, vaccination of targeted species (cattle only, or dairy cattle and breeding pigs) appeared to be as effective as vaccination of all susceptible species in reducing the total number of infected holdings and the outbreak duration. This might be of great importance when considering the post-outbreak management of vaccinated animals and the trade impact of vaccination strategies with the possibility of reduction of export losses.

Discussion

Participants discussed the potential role of emergency vaccination against FMD in the event of an FMD outbreak occurring in a previously free European country.

The early detection of an outbreak was considered key to being able to control FMD without the need for emergency vaccination. Some early indicators of a large outbreak might include number of infected premises, density of livestock, cumulative number of new infected holdings at certain time points, total area under control measures (Garner et al 2016). Livestock movements that have occurred early in an outbreak, before movement restrictions are imposed, may also be an important factor.

In the scenarios modelled for this workshop, emergency vaccination reduced the chances of a large outbreak in some circumstances (particularly if response resources were constrained). However, emergency vaccination was not the solution for all outbreaks. In three out of the four country scenarios there was no obvious benefit of vaccination over the baseline (stamping out only) strategy. The limited nature of the scenarios used here (which were selected for demonstration purposes only) means that no general conclusions on the effectiveness or otherwise of vaccination should be drawn from this work.

Emergency vaccination may be more important and effective if an FMD outbreak occurs in densely stocked areas and if resources for control are constrained. However, if vaccination is deployed, it may be necessary to identify a workforce which can administer vaccines, but does not impinge on resources available for other response activities, and which is acceptable to the authorities. In Austria, the use of veterinary students is considered for this purpose. In the past, farmers have provided emergency vaccination for other diseases, such as bluetongue.

Workshop participants agreed that realistic estimation of available response resources is important for contingency planning. Response resourcing is an important parameter for inclusion in any disease spread model. Availability of resources can have dramatic effects on model outputs, and therefore on policy or planning decisions made on the basis of pre-outbreak simulation modelling.

For countries that export livestock and livestock products, negative trade impacts, associated with a longer interval to regain recognition of FMD freedom, are a disincentive to considering emergency vaccination as an economically viable option control option for FMD.

The apparent complications of managing a vaccinated livestock population were also considered a constraint to using emergency vaccination, which might be mitigated if trade could continue from unvaccinated zones following completion of eradication activities. Post-outbreak management of vaccinated animals was not discussed in detail in this workshop.

While it may be technically feasible to manage an FMD outbreak in a previously free country with stamping out measures and pre-emptive culling, participants acknowledged that social and political factors may contribute to the decision implement emergency vaccination. It is therefore important that contingency plans take into account the potential role for emergency vaccination, when and how to best implement it, and the management of vaccinated livestock populations.

The use of scenarios based on simulation modeling of actual country data was an engaging way for participants to consider the pros and cons of emergency vaccination for foot-and-mouth disease. Use of modelling can provide a valuable means to develop and review contingency plans for FAST diseases before they occur.

Next steps

Further work on emergency vaccination will be presented at the EuFMD Open Session in October 2022. Emergency vaccination and response resourcing will continue to be a major part of the EuFMD work program.

Appendices

1 Agenda

2 List of Participants

3 PowerPoint Presentations

Appendix 1: Workshop agenda

14 June 2022, online		
Time	Topic	Presenter
10:00 - 10:15	Welcome, housekeeping, opening remarks	F. Rosso (EuFMD) K. Gibson (EuFMD)
10:15 - 10:30	Recap from workshop of 10 March 2022	K. Gibson (EuFMD)
10:30 - 11:10	Modeling control measures, including emergency vaccination, to inform contingency planning for FMD - Australia	G. Garner (EuFMD)
11:10 - 11:20	Coffee break	
11:20 - 12:00	Breakout room discussions. Use of emergency vaccination in FMD scenarios in four countries	Breakout rooms with moderators
12:00 - 12:30	Plenary discussion	All
12:30 - 13:15	Lunch break	
13:15 - 14:15	Breakout room discussions. Comparison of control measures, including emergency vaccination, for different FMD outbreak scenarios	Breakout rooms with moderators
14:15 - 15:00	Plenary discussion. Potential role for emergency vaccination for FMD and other FAST diseases in European countries	All

Appendix 2: Workshop participants

Country/ Organization	Name	Last name	Role
EuFMD	Fabrizio	Rosso	EuFMD Deputy Executive Secretary
EuFMD	Kathy	Gibson	Planning team/facilitator
EuFMD	Tsviatko	Alexandrov	Planning team
EuFMD	Koen	Mintiens	
EuFMD	Shankar	Yadav	
University of Veterinary Medicine, Vienna, Austria	Tatiana	Marschik	
University of Copenhagen, Denmark	Beate	Conrady	
EuFMD	Graeme	Garner	
Spain	German	Caceres Garrido	Moderator/Participant
Denmark	Sten	Mortensen	
EuFMD	Tiziano	Federici	Ops Team
Austria	Beate	Liehl	Participants
Belgium (UECBV)	Carolina	Cucurella	
Belgium (FESASS)	Alain	Cantaloube	
Bulgaria	Daniel	Pavlov	
Bulgaria	Tsvetan	Iliev	
Bulgaria	Ventsiana	Pekova	
Bulgaria	Daniel	Pavlov	
Czechia	Petr	Kučínský	
Czechia	Hynek	Sikstra	
Denmark	Jan	Dahl	
Denmark	Anette	Boklund	
Estonia	Luisa	Leinberg	
Estonia	Maarja	Kristan	
European Union	Dimitrios	Dilaveris	
European Union	Francesco	Berlingieri	
EuFMD	Martin	Ilott	
Finland	Leena	Suojala	
Finland	Hanna	Lounela	
Finland	Tapani	Lyytikainen	
Germany	Christa	Jeske	
Germany	Mark	Holsteg	
Germany	Ulrike	Bange	
Hungary	Anikó	Schmidt	
Hungary	Lázár	Márton	
Iceland	Sigurbjorg	Bergsdottir	
Ireland	Padraig	Hyland	
Ireland	Pat	Meskill	

Italy	Erica	Molica Colella
Italy	Francesco	Plasmati
Italy	Tiziana	Trogu
Lithuania	Marius	Masiulis
Norway	Kari	Lybeck
Norway	Siri	Løtvedt
Serbia	Boban	Djuric
Slovenia	Damjana	Grobelsek
Spain	Maria	Munos Mendoza
Spain	Sergio	Bonilla
Spain	Carmen	Elduque Palomo
Spain	Xose	Gonzales Ares
Spain	Berta	Vilas Rego
Spain	Carmen	Lopez Benito
Spain	Eva Cristina	Giron Romero
Spain	Maria	Salvador
Sweden	Annica	Wallen Norell

Appendix 3: PowerPoint presentations

PowerPoint presentations are available in [SlideShare](#)

EuFMD Committees

Executive Committee, Standing Technical Committee (STC), Special Committee for Surveillance and Applied Research (SCSAR), Special Committee on Biorisk Management (SCBRM), Tripartite Groups.

Hold-FAST tools

AESOP. Assured emergency supply options; EuFMDiS, FMD spread model; GET PREPARED toolbox. Emergency preparedness; GVS. Global Vaccine Security; Online Simulation Exercises; Outbreak Investigation application; Pragmatist. Prioritization of antigen management with international surveillance management tool; PCP-FMD. Progressive Control Pathway for foot-and-mouth disease; PCP-Support Officers; SAT. PCP Self-Assessment Tool; RTT. Real Time Training; SMS Disease reporting; SQRA toolkit. A method for spatial qualitative risk analysis applied to FMD; Telegram; TOM. EuFMD training management system; Global Monthly reports; VADEMOS. Vaccine Demand Estimation Model; VLC. Virtual Learning Center. Microlearning.

United Nations Sustainable Development Goals (UN-SDGs)

EuFMD's programme has a main focus on



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environmental
footprint

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Animal Production and Health Division,
NSHA / European Commission for the
Control of Foot-and-Mouth Disease
(EuFMD)

eufmd@fao.org

fao.eufmd.org

eufmdlearning.works

eufmdvirtual.com

eufmd-tom.com

Food and Agriculture Organization of the
United Nations
Rome, Italy