FREQUENTLY ASKED QUESTIONS
Epidemiology

During the EuFMD online *FMD Emergency Preparation courses (FEPC)* and *FMD Investigation Training courses (FITC)*, a number of questions are raised by the trainees, discussed in the course forum and answered by the different experts working for EuFMD.

This document summarizes some of these frequently asked questions with the answers given during our courses related to FMD epidemiology.

By what mechanisms do people transmit FMD virus? Can the virus survive in human nasal passages?

FMD virus can be transmitted mechanically as it can be present in secretions and excretions that can be carried on footwear, clothing, vehicles, etc.

FMD virus is sensitive to pH: it is inactivated below pH 6.5 or above pH 9.

Survival in the environment is dependent on pH, temperature, humidity and initial concentration. It has been shown to survive:

- 14 days in dry faeces
- 39 days in urine
- 6 months in slurry in winter
- 3 days on soil in summer
- Up to 20 weeks on hay or straw

(Bartley et al, 2002)

FMD virus can stay in human nasal cavities for some time and therefore there is a risk of the disease being transmitted from farm to farm by someone who visited an infected holding.

A number of experiments have shown that three days would be an adequate waiting period (see references below).

Therefore, in the case of personnel involved in the control of an FMD outbreak, after visiting an infected premises a waiting period before visiting a new farm should always be applied together with very strict biosecurity measures to avoid transmission of FMD virus.

References


Based on David Paton’s answer during FEPC_UK and on the content from EuFMD training courses.

What is the risk of dispersal of FMD virus by wind over long distances?

It is generally accepted that long distance airborne spread of FMD can occur, although it requires quite specific conditions and is an uncommon route for virus to spread between farms. It is important to distinguish this from on-farm spread of FMDv where short distance aerosol spread is one of the most likely mechanisms for the virus to transmit between animals in close proximity.

It is difficult to prove long distance airborne spread, and it tends to be suspected when all other routes have been ruled out. Some of the most suggestive cases, historically, have involved introduction to islands (France to Isle of Wight in 1981; GDR to Funen in 1982). There was a large outbreak of FMD in UK in 1967 in which airborne spread was strongly suspected due to the occurrence of ~300 near-simultaneous virus introductions all downwind of an earlier case.

The requirements for long distance airborne spread are a large source of virus, gentle air flows that do not break up and dilute the virus cloud or plume, low temperature and high relative humidity that favour virus survival, and finally donor animals in the flight path of the virus.

The most likely source of large quantities of airborne virus is an infected pig herd, as pigs excrete by far the most virus in breath and also occur in high density, so many infected animals may be concentrated in the same place. The most favourable climatic conditions are mainly found in temperate latitudes such as Northern Europe. Very long distance spread (more than a few kilometres) is most likely over the sea or very flat land areas. Cattle are the most efficient donors for airborne transmission as the infectious dose by aerosol is very low and they breathe in (sample) large volumes of air.

Regarding distance of spread, the following is extracted from Donaldson and Alexandersen (2002): "If 100 pigs were infected, they could transmit sufficient virus to infect cattle, the species most susceptible to airborne infection, up to 6 km-90 km away. One hundred affected cattle or sheep could generate a plume capable of infecting cattle located less than 1 km away".

Nowadays, quite sophisticated modelling can make accurate predictions, using meteorological data, of the area over which a cloud of virus or other particles will be distributed and if the starting concentration and the infectious dose are known, the probability of infecting animals in a particular downstream location can be estimated. This can be used to help prioritize surveillance. The risk of uncontrolled aerosol spread from pigs to cattle is one reason that priority may be given to rapidly slaughter pigs in mixed pig/cattle areas, possibly, even if the pigs are only at risk of infection and not yet shown to have been infected (pre-emptive slaughter).
Can rats and birds have a role in the transmission of FMDv?

Mechanical vectors such as wild animals and birds have potential to spread FMD if they are able to carry enough live virus and to get it into contact with a susceptible host. The dose of virus to infect by ingestion is rather high, although it is also possible for deposited materials to become aerosolised so that they could be infective at a much lower dose. Biting flies able to inoculate the skin are perhaps a special case, and some work has been done to show that virus can survive on the heads of such insects for several hours at least.

There has been speculation about the possible role of hedgehogs in spreading FMDV in UK, as they have been found with FMD lesions during outbreaks and under experimental conditions infection can pass by contact from infected hedgehogs to cattle and from infected cattle to hedgehogs. Some work to examine the amount of viable virus that can be detected in excreta from rats and birds was carried out in the past.

It is of course difficult to prove the involvement of such pathways in the field and to come up with any general statement about their likely importance. As with other highly contagious diseases, when farms are put under control measures, it is wise to take sensible precautions to limit this type of spread.

References:
McLaughlan and Henderson: Journal of Hygiene, Vol 45 (No. 4), 474-479, 1947

What is the role of wildlife in the transmission of FMD?

African buffalo

In Southern Africa, there is evidence that carrier buffalo play a significant role in transferring virus to domestic ruminants.

There is field evidence from outbreaks in Zimbabwe in 1989 and 1991 that linked carrier African buffalo to outbreaks in cattle.

Experimentally, transmission has been demonstrated from carrier buffalo to cattle.

References:
Based on information from EuFMD RTT Manual.

Elephants

African and Asian elephants can also be infected by FMDv. Nevertheless, they don’t seem to have a relevant role in the epidemiology of the disease in the regions where elephants can be found.

References:


Based on Maud Carron’s answer during FEPC_FRA1.

Wild boar/deer

The FMD outbreaks in south-east Bulgaria in 2011 were a severe wake-up call to those who have discounted wildlife involvement in FMD spread in Europe, since these outbreaks were first detected in wildlife (a lame wild boar was shot) in a forested area - and then wild boars were also involved in the epidemiological ping pong between wild and domestic species for an estimated 6 months (the date of initial introduction being estimated as 1-2 months before the index animal was shot).

The outbreak in domestic stock was controlled in four months, but the time taken from the date of first confirmation of the disease until the OIE accepted Bulgaria as a FMD free country was 17 months. This relates to the difficulty to sample wildlife for active infection, as antibodies in shot wildlife might not be recent but are assumed as evidence of infection ongoing.

So even if NOT important, trading partners in future may call for evidence FMDv is NOT circulating in wildlife, and this may add enormously to costs of the overall epidemic.

The modelling work undertaken by EFSA suggested that wildlife epidemics in the forested ecosystem (wild boar, roe deer mainly) would last between six months and two years. The wild boar density was moderate-to-low for Europe, at two per km², so the epidemic may proceed faster in denser populations in Western Europe. Modelling suggested deer contributed little to the maintenance or duration of the epidemic in wildlife.

Since 2011, the EuFMD has worked on developing surveillance systems (non-invasive sampling involving baits with swabs in them, or swabs on salt blocks), so the idea is early detection in wildlife, or easier proof of non-circulation after an epidemic.

Our telemetry work with collared wild boar and experience elsewhere leads us to the conclusion that it is far better to keep animals to feeding spots than to disperse them, so avoid culling /hunting practises that would disperse them.

Putting it all together, we call the approach "ANIMO" for Active, Non-Invasive Management of Outbreaks, in which the animals are sampled by use of feeding sites/baits, and natural immunity (infection) processes extinguish epidemics within the populations.
Given the risk of long duration wildlife epidemics in wild boar, speeding local processes to extinction of infection followed by non-invasive sampling for freedom is what EuFMD advocates for consideration in contingency plans of countries for FMD where wildlife infection is likely.

In other words, we agree wildlife cannot be discounted as having a role, and where they may be significant for spread, contingency plans should include wildlife control and, as far as practical and ethical, use the ANIMO approach compared to passive observation or hunting/culling.

Some recordings of talks given during the EuFMD Open Session in 2014:

Non-invasive sampling in wild boar: [https://eufmd.rvc.ac.uk/mod/forum/view.php?id=1554](https://eufmd.rvc.ac.uk/mod/forum/view.php?id=1554)


References:


*Based on Keith Sumption’s answer during FEPC_UK*