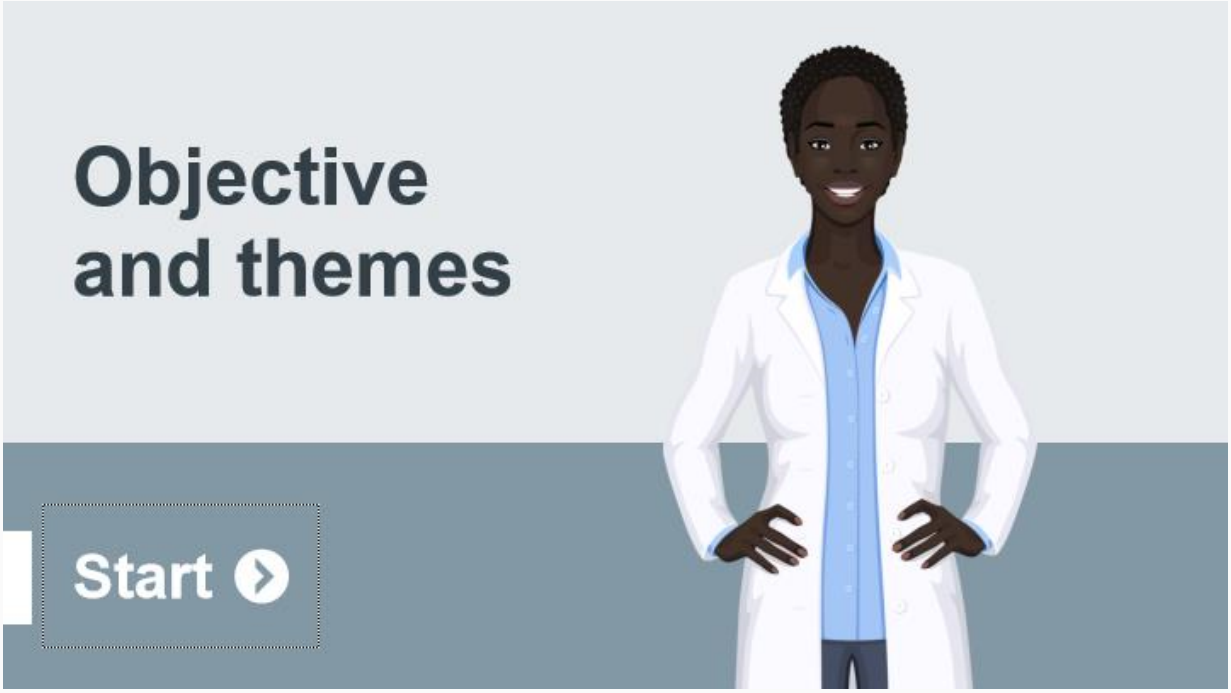
Rift Valley Fever - 6. Prevention and control

Objective and themes



Disease control measures

Epidemiological surveillance is a pillar for planning and guiding proper control and prevention measures:

1. During an epidemic, surveillance should be conducted to define the extent of the affected area.
2. During the inter-epidemic period, surveillance and monitoring of climatic factors predisposing the virus transmission should be carried out in countries or zones infected with RVFV.
3. Countries or zones adjacent to a country or zone in which epidemic have been reported should determine their RVF status through an on-going surveillance programme.

Early **detection** of RVF is of paramount importance for effective control of the disease.

Activities must be focussed on surveillance in at-risk areas in order to have baseline information about inter-epidemic virus transmission patterns and to identify any early evidence of viral and vector activities.

Surveillance activities should be carried out by:

- field surveys,
- active clinical surveillance to detect elevated abortion rates,
- sentinel herds to detect low-level virus circulation,

- raising of farmer awareness.

An effective risk communication plan for farmers and other stakeholders is fundamental in case of epidemic.

Concerning the possible surveillance activities for the European Union, the following options should be taken into account:

- Cattle and small ruminant establishments located in the proximity of the high risk points of disease incursion by vector import (ports, airports, cargo and container yards) should be included in the surveillance.

- Passive surveillance can be considered as first choice for the early detection of the infection under these circumstances: enhanced surveillance of abortions, stillbirths and neonatal mortality of cattle, sheep and goats, therefore, should be applied during summer and autumn (during the peak of and end of vector season) in the areas at major risk of introduction.

Monitoring of climatic parameters

The availability of **Remote Sensing Satellite Data (RSSD)*** allows a continuous monitoring of national rainfall and climatic patterns and their effects upon the environment.

***RSSD. In a recent retrospective study analysing virus populations data over a 25-year period, RSSD was 100% accurate in predicting periods of RVF virus activity.**

Some fundamental parameters can therefore be measured:

- cold cloud density (CCD);

- normalised differentiated vegetation index (NDVI);

- surface sea temperatures (SST);

which enable **the onset of vector activities**, in certain areas, to be predicted in advance.

The advantage of RSSD for RVF predictive epidemiology is the **relatively low cost of the systems used for analysis**. Moreover, national and regional data are readily available and allow time for **preventive measures** to be taken, such as the vaccination of susceptible stock and use of larval mosquito (vector) control methods, wherever possible.

Vegetation index anomalies and Rift Valley fever (RVF) outbreaks in Africa and Middle East during 2000-2018

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Vector Control

Based on:

Preventive measures

- reduction/treatment of breeding sites
- reduction of animal exposure

(physical/chemical barrier)

Control measures

- treatments against larvae/adults in the environment, in the stables, over the animals

All control activities must be surveillance-driven, to increase the efficacy, reduce the environmental impact and avoid to stimulate resistances to insecticides.

Vector control must be based on a detailed knowledge of the mosquito species involved in the RVF transmission:

- Which/where breeding sites are
- Activity peaks (nocturnal, diurnal)
- Flight ranges, flight patterns, active host-seeking (e.g.: flight ranges of Aedes albopictus < 1 Km, and Ochlerotatus taeniorhynchus around 60-110 Km)
- Wind dispersal

- Host preferences
- Temperature and humidity requirements for each stage
- etc.

Larvicidal treatments

Control of animal movements

Movement control does not appear to have any effect upon the course of an outbreak within an infected country. It may however be important with respect to the transport of animals for trade purposes from endemic areas.

In this situation viraemic animals could arrive in an uninfected region within the incubation period for the disease. If this should happen and there were large numbers of mosquito vectors present, the possibility of introducing RVF would be very real.

For this reason, **all import of livestock from infected countries should be banned during RVF epizootic periods.**

Test your knowledge:

The advantages of Remote Sensing Satellite Data (RSSD) for the predictive epidemiology of the Rift Valley Fever is the relatively low costs of the systems used for analysis.

- ◯ True
- ◯ False

SUBMIT

Vector control activities must be surveillance-driven.

- ◯ True
- ◯ False

SUBMIT

The import of livestock from infected country should be allowed during epizootic periods.

- ◯ True
- ◯ False

SUBMIT

Vaccination

Preventive vaccination is the most effective means to control RVF.

Live attenuated vaccines

The first vaccine produced against RVF was a modified live vaccine based on the **Smithburn neurotropic strain (SNS).** Its use since **1950** in **Southern and Eastern Africa** has given a strong contribution to limit RVF epizootics.

This strain originated from Uganda (**mEntebbe strain**) and was neuro-adapted through 106 passages on mice brain. After 6-7 days from inoculation this vaccine gives good immunity which lasts throughout the animal's life. It can be mass produced at very low cost.

Vaccination

The live attenuated Smithburn vaccine has a r**esidual pathogenic power** and can cause:

- abortions in pregnant sheep (7 days after vaccination),
- malformations in lambs and kids when the mothers are vaccinated between the 5th and 10th week of gestation.

Other live modified vaccines are based on:

- **Clone-13**, which is a population clone, obtained from a strain isolated from a medium severe human case in the Central African Republic.
- **MV 12 strain** developed by mutagen induced changes in the Egyptian ZH 548 by cultivation (12 passages) with 5-fluoro-uracil.

In addition, the **R566 strain** has been derived from **Clone-13** and from the **MP12 strain** by re-assortment in VERO cells: it contains the S segment of Clone 13 and the L and M segments of the MP12 strain. Currently no commercially vaccines based on R566 strain are available.

What is the duration of the immunity induced in small stock vaccinated with the live attenuated Smithburn Neurotropic Strain (SNS)?

- ◯ 6 months
- ◯ 1 year
- ◯ 5 years
- ◯ The animal's entire life.

SUBMIT

Inactivated vaccines

These are produced starting from highly immunogenic strains cultivated on cell lines, inactivated and adjuvated. The inactivation can be obtained using formol, β Propiolactone, UV rays, etc. The adjuvants used are potassium alum or aluminum hydroxide.

These vaccines do not show any residual pathogenetic power; however, they induce antibody cover which extends from a minimum of 6 moths to a maximum of 1 year, making annual boosters essential; furthermore, their high production costs mean that their use is reduced.

Onderstepoort Biological Products Laboratories (South Africa) produce an inactivated vaccine that is mixed with aluminium hydroxide gel as an adjuvant, which is suitable for use in pregnant ewes.

Given the **poor antibody response in cattle**, the inactivated vaccine is recommended even in pregnant cows so they can confer colostral immunity to their offspring. A booster **three to six months after initial vaccination** is required, followed by annual boosters

Routine vaccination when animals are not pregnant is recommended.

Table 9: Details of the RVF vaccines commercially available and countries of licence and/or use

Commercial Vaccine (viral strain)	Manufacturer	Animal species	Country of licence or use (u)	Notes
RIFTVAX TM (Smithburn strain)	Kenya Veterinary Vaccine Producing Institute (Kenya)	cattle, sheep and goats	Kenya	
Rift Valley Fever (Smithburn strain)*	Veterinary Serum and Vaccine Research Institute (Egypt)	cattle, sheep and goats	Egypt	Smithburn strain imported from South Africa
Rift Valley formalin inactivated (Menya/ Sheep/258 strain)	VACSERA (Egypt)	cattle, sheep and goats	Egypt	
Rift Valley BEI inactivated (ZH501 strain)	Veterinary Serum and Vaccine Research Institute (Egypt)	cattle, sheep and goats	Egypt	
Rift Valley Fever formalin inactivated (SA field strain)	Ondersterpoort Biological products (South Africa)	cattle, sheep and goats	South Africa, Namibia, Tanzania (u), Botswana (u)	
Rift Valley Fever live attenuated (Smithburn strain)	Ondersterpoort Biological products (South Africa)	cattle, sheep and goats	South Africa, Namibia, Egypt (u), Kenia (u), Zimbabwe (u), Tanzania (u), Sudan (u), Saudi Arabia (u), DRC (u)	From serial passages of the Entebbe strain
RVF Clone13 live attenuated (clone 13)	Ondersterpoort Biological products (South Africa)	cattle, sheep and goats	South Africa, Namibia, Botswana, Zambia, Mozambique, Zimbabwe (u), Kenya (u), Senegal (u)	Clone of 74HB59 strain from a human patient in the Central African Republic
Riftovax-LR live attenuated (clone 13T)	MCI Sante Animale (Morocco)	cattle and camels	Morocco, Senegal (u), Mali (u)	Thermostable Clone 13 vaccine
Riftovax-SR live attenuated (clone 13T)	MCI Santé Animale (Morocco)	sheep and goats	Morocco, Senegal (u), Mali (u)	Thermostable Clone 13 vaccine

*: Not produced at the present.

From: Nielsen SS, Alvarez J, Bicout DJ, Calistri P, Depner K, Drewe JA, Garin-Bastuji B, Rojas JLG, Schmidt CG, Michel V, Chueca M_AM, Roberts HC, Sihvonen LH, Stahl K, Calvo AV, Viltrop A, Winckler C, Bett B, Cetre-Sossah C, Chevalier V, Devos C, Gubbins S, Monaco F, Sotiria-Eleni A, Broglia A, Abrahantes JC, Dhollander S, Van Der Stede Y and Zancanaro G, 2020. Rift Valley Fever – epidemiological update and risk of introduction into Europe. EFSA Journal 2020;18(3):6041, 72 pp. https://doi.org/10.2903/j.efsa.2020.6041

Vaccination strategies


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Vaccination

The **vaccination strategies** and the type of vaccine chosen depend on the conditions of each country. In regions where the Rift Valley Fever is enzootic the attenuated live vaccines are preferable, due to their low cost, but it is advisable to complete the vaccination campaign before the females undergo insemination. RVF is a seasonal and multi-annual disease, for this reason vaccinate only when the risks of an epizootic are real.

Vaccination is **not recommended** once evidence of epizootic virus activity has been already confirmed, because the effectiveness of vaccination is limited in such situation and the risk of iatrogenic transmission may be relevant.

In countries that are not affected but are at risk and in countries next to endemic zones, the use of inactivated vaccines is preferred.

Allocate the different epidemiological contexts to the use of the proper type of vaccine:

Inactivated vaccines

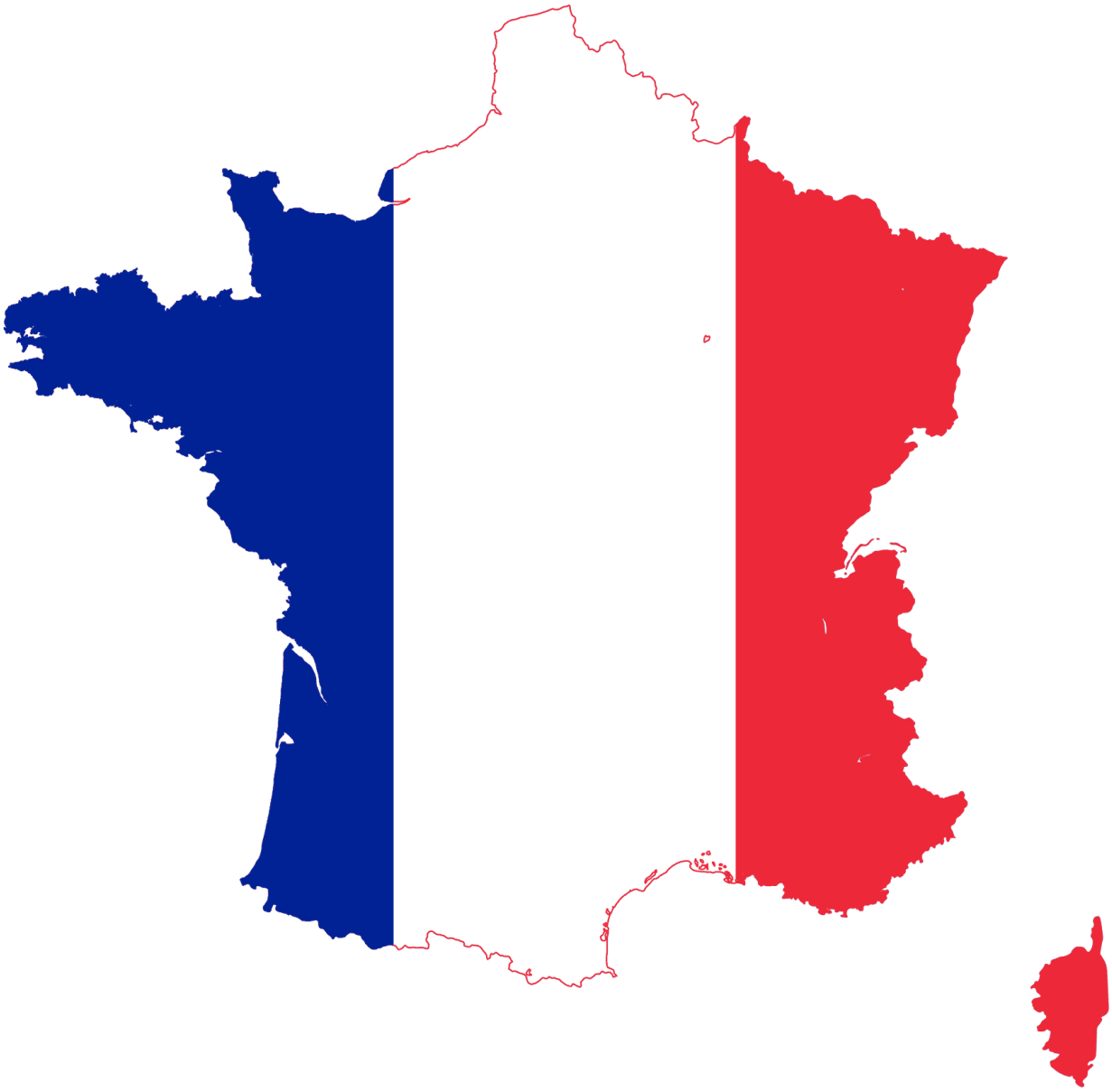
Countries that are not affected but at risk	Countries neighbouring endemic zones

Live attenuated vaccines

Countries where RVF is enzootic

Reference experts and laboratories

OIE Reference laboratories Rift Valley fever:



Source: https://commons.wikimedia.org/wiki/File:France_Flag_Map.svg

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Source: https://commons.wikimedia.org/wiki/File:Flag-map_of_South_Africa.svg


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Summary