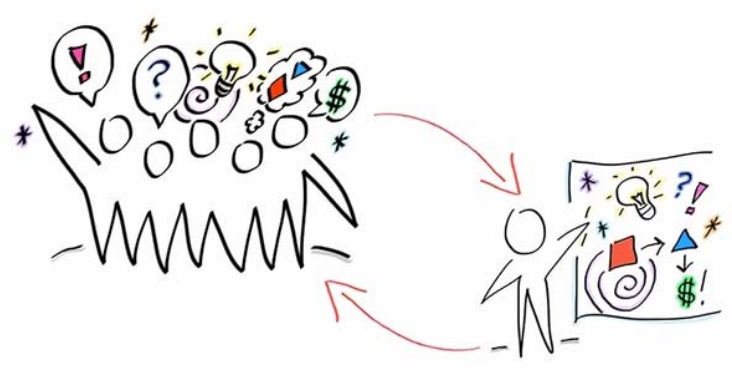

REPORT

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MediLabSecure

3rd Technical Workshop on Public Health: Multisector Risk Assessment for Rift Valley Fever

Tunis 4-6 July 2017

This report was compiled by the MediLabSecure WP5 ISS team: Maria Grazia Dente and Silvia Declich.

This Rift Valley Fever (RVF) Risk Assessment exercise was designed by the WP5 ISS team in coordination with MediLabSecure Work Packages' Teams and the subject-matter experts involved in the exercise (Bertrand Sudre-European Centre for Disease Prevention and Control- and Paolo Calistri-Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "G. Caporale").

This exercise was designed as part of the project activities of the MediLabSecure project.

MediLabSecure is a continuation of the "EpiSouth plus" project (2010-2013). The project is funded by the European Union DEVCO/EuropeAid (Contract Number: IFS/2013/330 961). The Project is led by the Institut Pasteur and counselled by an Advisory Board composed by international experts.

CONTENTS

Introduction

THE MEDILABSECURE PROJECT

Countries of the Mediterranean and Black Sea regions have common sea borders and, as a result, share common public health issues and threats. MediLabSecure is a European project (2014-2017) that aims at consolidating a Public Health and Laboratory Network on emerging zoonotic vector borne viruses.

It represents a cluster for awareness, risk assessment, monitoring and control of these vector borne diseases. This cluster pursues the interaction of four sub-networks, one laboratory network for human health, one laboratory network for animal health, one laboratory network for entomology and one network for public health reinforcement. The MediLabSecure network includes partner countries around the Mediterranean and Black Sea Regions (19 non-EU countries).

General objectives

- Create a framework for collaboration to improve surveillance and monitoring of emerging vector borne viral diseases (arboviruses)
- Provide training for public health experts in participating countries to increase the communicable disease control in the Mediterranean and Black Sea region.
- Promote knowledge development and transfer of biosafety best laboratory practices

Specific objectives

Prevent spread of viruses and concerned vectors (mosquitoes):

- Prevent outbreaks of zoonotic viruses with an existing identified or potential risk in the region (West Nile, Dengue, Chikungunya, Yellow Fever, Rift valley fever, …)
- Improve integrated surveillance (animal, human, entomological)
- Provide risk assessment of the different emerging viruses (transmission, spread, human impact…)
- Recommend and implement public health measures for control where possible

For more information, visit http://www.medilabsecure.com/project.html

Overview of the Public Health Workshop

The Public Health (PH) workshop consisted in the conduction of the 3rd Multisector Exercise on Risk Assessment.

The 3rd Multisector Exercise on Risk Assessment (RA) was designed to foster small group discussion on the status of Rift Valley Fever (RVF) surveillance in the region and to assess level of risk at country level with the support of the methodology applied by FAO for the Risk Assessment for RVF in Niger (March 2017).

OBJECTIVES

The goal of this exercise is:

- To enhance knowledge (and capacity) on multi-sectoral/integrated RA for RVF
- To make the participants aware of RA methodologies to be applied at national level
- To encourage multi-sectoral collaboration and exchange

TARGET AUDIENCE

This exercise was implemented on the second and third day of the MediLabSecure Regional meeting and Technical Workshop on Public Health.

Invited participants to this event include:

- Laboratory staff from human and veterinary sectors (heads of labs and nominees)
- Entomologists (heads of labs and nominees)
- PH officials MoH/IPH (former EpiSouth Network and Vector Born Diseases nominees)

Most participants were mid-career/senior staff with high cumulative expertise from the different sectors in each country.

ENHANCING ABILITIES

Once the participants had completed this exercise, they should have be able to:

- Describe how a multi-sectoral/integrated RA for RVF could be conducted
- Estimate the added value and feasibility of multi-sectoral RA in their national context
- Assess the risk for RVF transmission in their countries

DOCUMENTATION & MATERIALS

MATERIALS
For the Facilitator: • Facilitator Guide • FAO RVF RA in Niger • Background information and selected references on RVF (Annex 1) • National information on RFV provided by the Countries involved in the exercise (Annex 2) • PowerPoint® Template slides for restitution (for the Rapporteur, Annex 4) **Distributed to all Participants one week in advance by e-mail:** • Background information and selected references on RVF (Annex 1) • National information on RFV provided by the Countries involved in the exercise (Annex 2) **Distributed to all Participants *in situ* by the ISS (WP5) team:** • Pre-test (after lunch day 2) and post-test (before lunch day 3) sheets **Distributed to all Participants *in situ* by the Facilitators:** • Participants' guide • Risk questions & Multisectoral added value (Annex 3) • Exercise Evaluation Form

GROUPWORK SETUP

- The exercise involved 3 small groups divided by country :

Groups	Group 1	Group 2	Group 3
N. Participants[1] (excluding facilitators)	13	15	16
Countries	Morocco Algeria Tunisia	Libya Egypt Tunisia	Jordan Lebanon Palestine Tunisia

- Four facilitators were assigned to each group
- Each group conducted the exercise in a separate break-out room.

The exercise step by step

STEP 1: TECHNICAL PRESENTATIONS

Location: Plenary
Time: Wednesday July 5th from 2:00 to 3:15pm
Duration: 75 minutes

Objectives:

- To enhance knowledge on multi-sectoral/integrated Risk Assessment (RA) methodology
- To make the participants aware of the ECDC and FAO RA Methodologies
- To introduce the participants to the multi-sectoral RA exercise on RVF

Content:

- 15 min- Participants pre-test
- 20 min – ECDC Risk assessment aims and methodology

[1] Being the Meeting in Tunisia, Tunisia was "over represented" in the groups. In fact 19 Tunisian referents were involved in the Exercise out of the 44 total participants

- 20 min– FAO methodology for the RVF RA in Niger
- 20 min – Presentation of the RA Exercise on RVF

STEP 2: RA EXERCISE IN GROUP: DISCUSS THE REGIONAL SITUATION AND POTENTIAL RISKS FOR YOUR COUNTRY

Location: Break out room
Time: Thursday July 6 from 9:00 to 9:30 am
Duration: 30 minutes

Objective/s:

- Discuss the regional situation of RVF on the basis of the information delivered with the presentations during the previous days of the Meeting, national data and the Background document with references sent to the participants (Annex 1. and Annex 2.)

STEP 3: IDENTIFY POTENTIAL RISKS FOR YOUR COUNTRY

Location: Break out room
Time: Thursday July 6 from 9:30 to 10:30 am
Duration: 60 minutes

Objectives:

- Identify potential risks for RVF transmission in your country by replying to the risk questions (Annex 3)
- Estimate the added value of multi-sectoral RA in the national context (Annex 3)

Content:

This step has been done by involving in the discussion all the countries of the group but with all the sectors of the same country sitting near for possible “consultation”.

Each participant was asked to follow the risk questions and to discuss and verify the possible replies, in relation to the respective country, with the colleagues of the other sectors in the group.

Particular attention has been paid to the multisectoral added value for each of the *Question* (e.g. Is the added value of identifying preparedness measures for RVF in collaboration with all the sectors low, medium or high?)

STEP 4: ESTIMATE THE RISK LEVEL IN YOUR COUNTRY

Location: Break out room
Time: Thursday July 6 from 11:00 to 12:00 am
Duration: 60 minutes

Objectives:

- Provide replies to the questions 1, 2 and 3 by country
- Assess level of risk for RVF in your country (question 4) on the basis of 1, 2 and 3 replies
- Preparing restitution slide by group (Annex 4)

Content:
The group was divided in sub-groups of only one country each with all the sectors represented, as the outcome will be the replies to the questions and the level of risk by country.

Each country provided the multi-sectoral estimated level of risk and the multi-sectoral added value to the rapporteur to prepare the restitution slides.

STEP 5: RESTITUTION IN PLENARY

Location: Plenary
Time: Thursday July 6 from 12:00 to 12:30 am
Duration: 15 minutes + 15 min- Participants post-test

Objectives:

- Report to the other groups the outcome of the RA exercise (restitution slide by group (Annex 4)
- Discuss possible doubts and uncertainties.

RESTITUTION

On 6 July the rapporteurs of the three groups presented their slides in plenary commenting on the output of the exercise (see Annex 5).

Here below, the three most frequent answers to the risk questions are reported:

Q.1.a Which risk factors affect the occurrence, persistence and spread of RVF infection in Africa and other areas ***with a history of RVF infection or outbreak***?

1st Animal Movements and trade
2nd Climate and weather changes
3rd Changing eco-systems

Q.1.b Which risk factors affect the spread of RVF infection into ***new areas***?
1st Animal Movements and trade
2nd Climate and weather changes
3rd Social and economic instabilities

Q.2 Which ***preparedness measures*** could be put in place to reduce the risk of RVF virus infection in Africa and other at risk areas?
Feasible:
1st Improving veterinary diagnostic laboratories
2nd Improving public health diagnostic laboratories
3rd Enhancing veterinary capacity to recognize clinical signs of RVF in animals
Effective:
1st Control of animal movements/trade **and** Improving veterinary diagnostic laboratories
2nd Enhancing veterinary capacity to recognize clinical signs of RVF in animals

Q.3 Which **prevention and control options** can be put in place to reduce the impact of RVF spreading?
Feasible:
1st Public communication campaigns on measures to reduce exposure to mosquito bites
2nd Communication campaigns for farmers and other professionals to reduce the risk of animal-sourced infections
3rd Animal mass vaccination
Effective:
1st Animal mass vaccination
2nd Public communication campaigns on measures to reduce exposure to mosquito bites
3rd Culling sick and infected animals **and** Communication campaigns for farmers and other professionals to reduce the risk of animal-sourced infections

Q.4

Country	4.a What is the risk of RVF virus infection ***introduction to*** your country in the next 3–5 years?	4.b What is the risk of the RVF virus ***persisting and spreading*** once introduced into your country ?
Tunisia[2]	between 2 and 4 (30-90% chance)	between 2 and 6 (66-100% chance)
Morocco	2 (Unlikely 10%–30% Chance)	1(Very unlikely 1%–10% Chance)
Algeria	4 (Likely 66%–90% Chance)	2 (Unlikely 10%–30% Chance)
Egypt	4 (Likely 66%–90% Chance)	4 (Likely 66%–90% Chance)
Libya	4 (Likely 66%–90% Chance)	2 (Unlikely 10%–30% Chance)
Jordan	1 (Very unlikely 1%–10% Chance)	3 (As likely as not 33%–66% Chance)
Lebanon	3 (As likely as not 33%–66% Chance)	4 (Likely 66%–90% Chance)
Palestine	2 (Unlikely 10%–30% Chance)	3 (As likely as not 33%–66% Chance)

Almost all the countries considered that doing the assessment with a multisector approach had a high added value for the questions 1 (a. and b.), 2, and 3. In other words, the replies to the question 1, 2 and, 3, were highly facilitated by the concomitant presence of different sectors (human, animal and entomological) at the assessment. This has ensured a comprehensive discussion aimed at filling gaps and decreasing uncertainty.

Pre and Post tests

The facilitators asked participants to fill in a pre and post-test questionnaire (see Annex 6) with the following open questions to have some indications on the weak aspects and gaps of the participants on RA and also on aspects of the exercise to be strengthened or modified:

1. Please rank three relevant risk factors/drivers for the occurrence, persistence and spread of RVF infection ***in Africa and other areas with a history of RVF infection or outbreak.***

[2] Tunisian staff participated with three different groups which came out with three different assessment of the risk

2. Please rank three relevant risk factors/drivers for the spread of RVF infection into ***new areas***.

3. Please rank three relevant ***feasible*** measures to increase the rapidity of the response to RVF infection.

4. Please rank three relevant ***effective*** measures to increase the rapidity of the response to RVF infection.

5. Please rank three relevant ***feasible*** prevention and control options for reducing the impact of a possible RVF spreading.

6. Please rank three relevant ***effective*** prevention and control options for reducing the impact of a possible RVF spreading.

7. List ***kind of documents*** to rely on to assess the level of risk for RVF in your country

8. List ***institutions/depts./experts*** to involve to assess the level of risk for RVF in your country and explain the reasons

Eight countries took part in the exercise with 44 participants. Twenty-one (48%) completed pre and posts tests.

In general, all the 21 participants who filled in the pre-test were able to reply as requested by the questions. However, some risks and options were reported by some participants only in the post-test. Among them:
"*animal movements*" included by 11(52%) and 10(48%), in the relevant risks of questions 1 and 2 respectively,
"*social and economic instability*" included by six (29%) in the relevant risks of questions 1 and 2;
"*climate changes"* included by 8 (38%) and 7 (33%) in the relevant risks of questions 1 and 2 respectively.
"*Animal vaccination*" included by 7 (33%), among the effective options of prevention and control (question 6) only in the post-test.

In total 18 (88%) and 19 (90%) of participants were able to mention *kind of documents* useful for RA on RVF in their countries in pre and post-test respectively (question 7).
All the participants were able to mention *institutions/depts./experts* to involve to assess the level of risk for RVF in their countries and explain the reasons in pre and post-tests.

The exercise evaluation

<u>Participants</u>

At the end of the exercise, all participants were asked to compile an evaluation form (Annex 7). Of the 44 participants, 30(68%) provided the evaluation questionnaire.

14/30 (47%), “strongly agree” or “agree” with all the four sentences of the evaluation form:

- The exercise objectives were well communicated
- Discussions were useful
- Adequate time was allotted
- Overall the exercise was satisfactory

Regarding content, participants reported finding the discussion topics addressed useful (Figure 1). In particular, the most recurrently mentioned strengths were the usefulness of discussions, the exchange of expertise and information across sectors and countries.

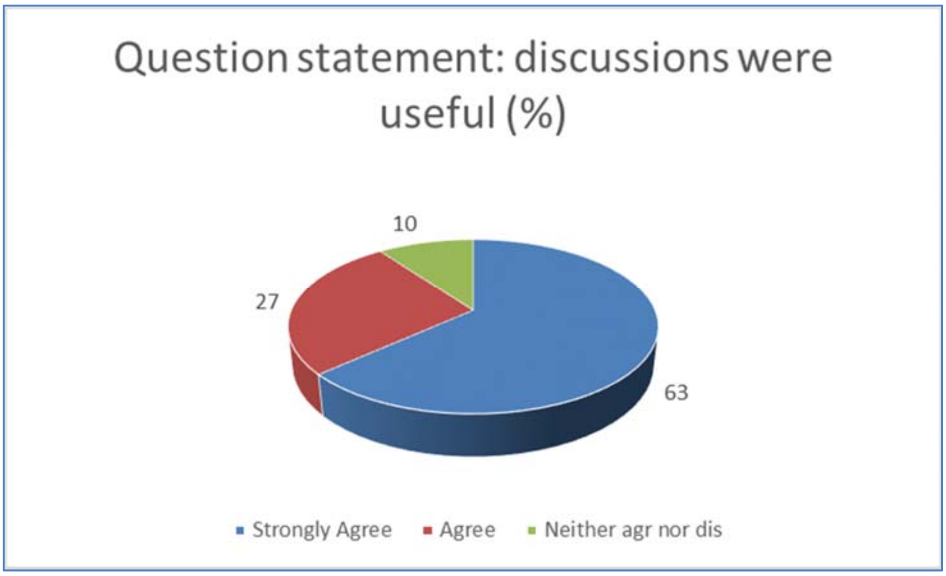

Figure 1. Proportion of answers provided to the question on usefulness of discussions

Overall participants expressed a very high satisfaction with the exercise (Figure 2).

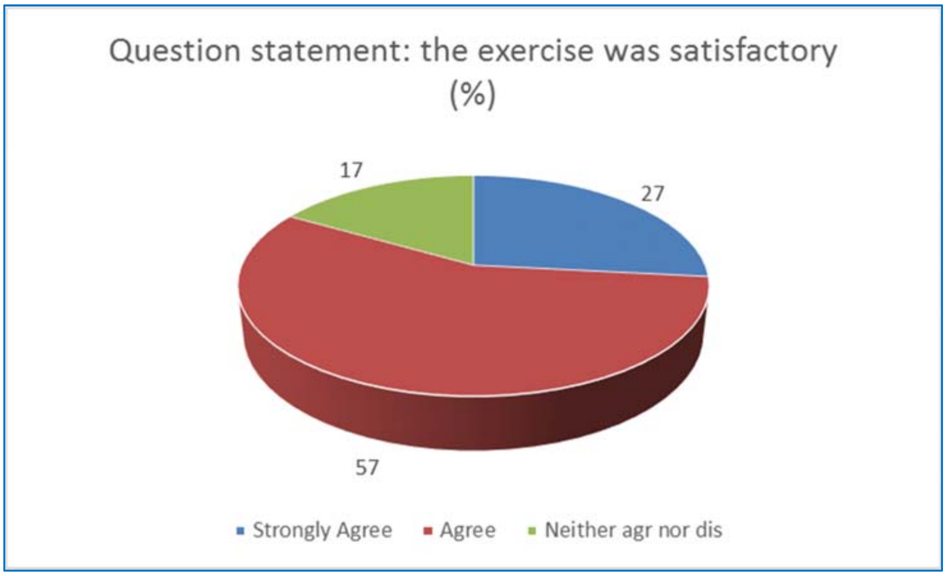

Figure 2. Proportion of answers provided to the question on satisfaction

Concerning more organizational aspects, participants reported finding the exercise to be well designed and implemented. More specifically most participants found that the objectives of the exercise were well communicated (Figure 3).

Figure 3. Proportion of answers provided to the question on communication of objectives

However, it has to be noted, that the time allotted to the exercise activities was considered adequate only by 54% (17% strongly agree and 37% agree) (Figure 4).

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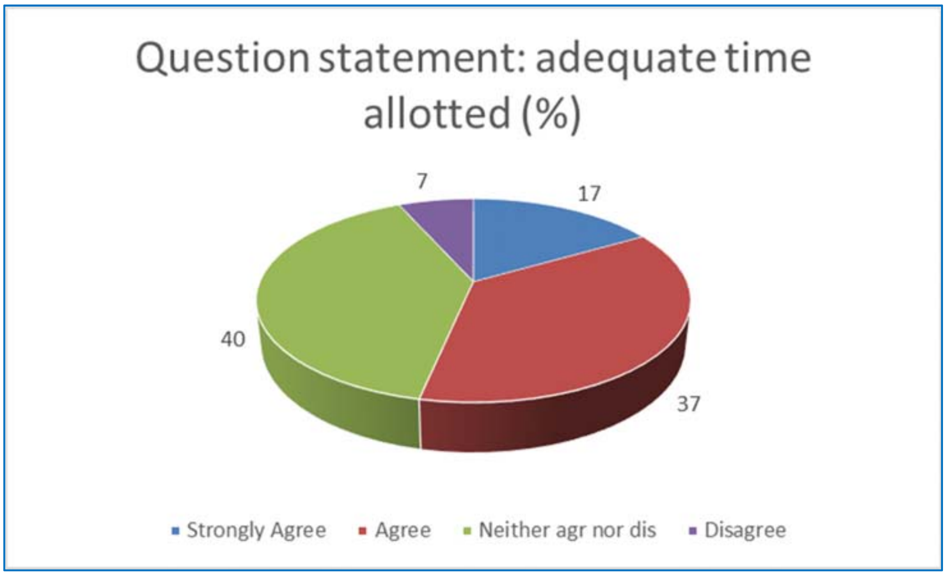

Figure 4. Proportion of answers provided to the question time allotment

Facilitators

The compilation of the evaluation form was requested also to the facilitators (10) who participated in the exercise.

Eight out of 10 (80%) compiled the form and three “strongly agree” or “agree” with all the four sentences of the evaluation form.

All eight “strongly agree” or “agree” on the question statement *discussions were useful*. Seven “strongly agree” or “agree” on the question statements: *exercise objectives well communicated* and *the exercise was satisfactory*. Six “strongly agree” or “agree” on the question statement: *adequate time allotted.*

The following areas of improvement were identified by participants and facilitators:

- More time for discussion and sharing of lessons learned on RA in countries;
- Specific workshops devoted to this kind of exercises;
- To be able to have for each country the appointment of all the professionals required (public health expert, human virologist, veterinarian, entomologist);
- Exercise presentation and exercise implementation on the same day;
- More clear predefined form for collecting the information from the group.

Conclusion

In conclusion, the PH workshop was successful in implementing a practical exercise on RVF risk assessment following an integrated and intersectorial approach in the framework of One Health.

Based on the feedback received, participants were satisfied with the quality of this exercise both in general and specifically in regards to its content and its organization.
The evaluation highlighted that the exercise was successful in providing information on multi-sectoral/integrated RA for RVF and expose participants to the FAO RA Methodology (objectives 1 and 2).

Finally, participants reported that the exercise successfully promoted the exchange of expertise across sectors and countries and multisector team building (objective 3).

Annexes

Annex 1 Background information and selected references on RVF

Annex 2 National information on RFV provided by the Countries involved in the exercise

Annex 3 Risk questions & Multisector added value

Annex 4 PowerPoint® Template slides for restitution

Annex 5 Groups restitution slides

Annex 6 Pre-test and post-test questionnaires

Annex 7 Exercise Evaluation Form

3rd MULTISECTORIAL EXERCISE ON RISK ASSESSEMENT
July 5-6, 2017

Annex 1.

Background information on RVF [1-3, 5]

Rift Valley fever (RVF) is a peracute or acute zoonotic disease of domestic ruminants. It is caused by a single serotype of a mosquito-borne virus of the *Bunyaviridae* family (genus Phlebovirus).
The virus was first identified in 1931 during an investigation into an epidemic among sheep on a farm in the Rift Valley of Kenya.

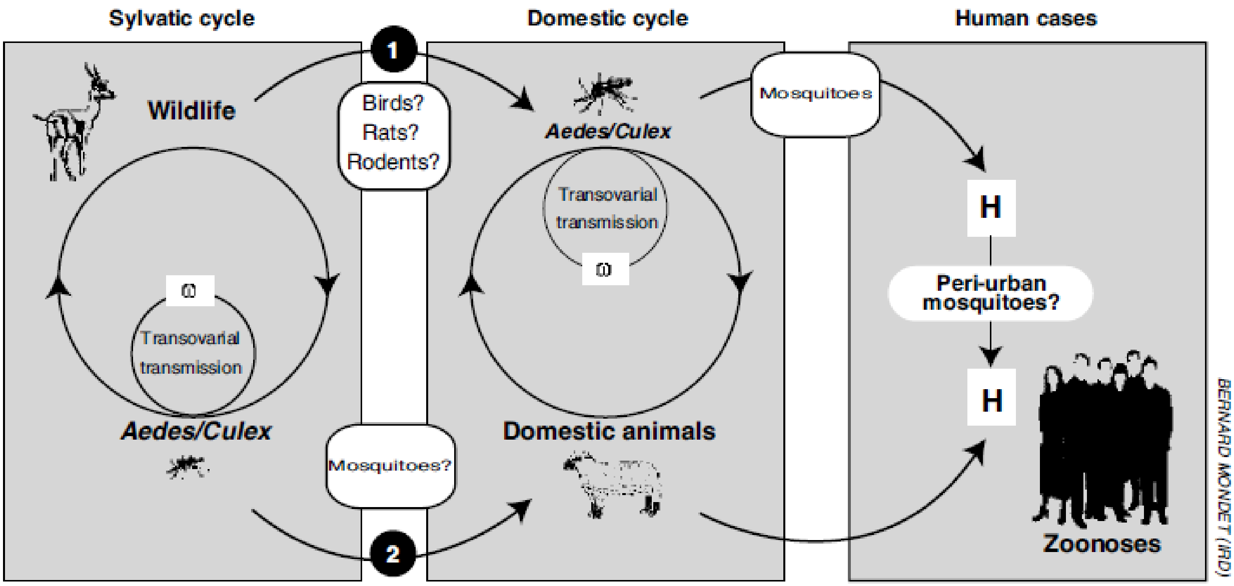

Fig. 1 Theoretical cycle of RVF virus transmission [1]

The disease occurs in climatic conditions favouring the breeding of mosquito vectors and is characterized in animals by abortion, neonatal mortality, and liver damage. The disease is most severe in sheep, goats and cattle. Older, non-pregnant animals, although susceptible to infection, are more resistant to clinical disease. There is considerable variation in the susceptibility to RVF of animals of different species. Camels usually have an unapparent infection, but sudden mortality. Like in cattle, the disease in camels is associated with high rates of spontaneous abortion or neonatal mortality.

Humans are susceptible to RVFV and are infected through contact with infected animal material (body fluids or tissues) or through bites from infected mosquitoes.
Certain occupational groups such as herders, farmers, slaughterhouse workers, and veterinarians are therefore at higher risk of infection than the general population. Humans are dead-end hosts, which means that they are unable to transmit the virus to the vector.

Mild form of Rift Valley Fever in humans

The interval from infection to onset of symptoms for RVF varies from 2 to 6 days. Those infected either experience no detectable symptoms or develop a mild form of the disease characterized by a feverish syndrome with sudden onset of flu-like fever, muscle pain, joint pain and headache. Some patients develop neck stiffness, sensitivity to light, loss of appetite and vomiting; in these patients, the disease, in its early stages, may be mistaken for meningitis. The symptoms of RVF usually last from 4 to 7 days.

Severe form of Rift Valley Fever in humans

While most human cases are relatively mild, a small percentage of patients develop a much more severe form of the disease. This usually appears as one or more of three distinct syndromes: ocular (eye) disease (0.5-2% of patients), meningoencephalitis (less than 1%) or hemorrhagic fever (less than 1%).

The total case fatality rate has varied widely between different epidemics but, overall, has been less than 1% in those documented. Most fatalities occur in patients who develop the hemorrhagic icterus form.

RVFV has also caused serious infections in laboratory workers. Due to high risk of exposure, all laboratory procedures must be performed in biosafety level 3 (BSL-3) facilities and veterinary practitioners involved in the collection of suspected RVF samples from infected animals should take appropriate biosecurity precautions.

Transmission pathways and protective measures

Although no human-to-human transmission of RVF has not been demonstrated, there is still a theoretical risk of transmission of the virus from infected patients to healthcare workers through contact with infected blood or tissues. Healthcare workers should implement standard precautions when handling specimens from suspected or confirmed RVF infected patients.

An inactivated vaccine has been developed for human use. However, this vaccine is not licensed and is not commercially available. It has been used experimentally to protect veterinary and laboratory personnel at high risk of exposure to RVF. Other candidate vaccines are under investigation.

During an outbreak of RVF, close contact with animals, particularly with their body fluids, either directly or via aerosols, has been identified as the most significant risk factor for RVF virus infection. Raising awareness of the risk factors of RVF infection as well as the protective measures individuals can take to prevent mosquito bites is the only way to reduce human infection and deaths.

Live attenuated and inactivated vaccines are available for vaccination programmes in animals. Although both have some disadvantages (need of several doses for the inactivated one or potential spontaneous abortions for the live vaccine), vaccination of ruminants is an option and the impact on control and prevention of the disease is relevant.

The main vectors for transmission of RVFV are *Aedes spp*. but many secondary vectors can also contribute (e.g. *Culex* and A*nopheles*, *Culicoides spp*. and other biting flies). The mosquitoes acquire the virus from feeding on infected animals and transmit the virus during the next meals. However, vertical transmission of the virus from mothers to theirs eggs is suspected. Since the eggs of these mosquitoes may survive for periods of up to several years in dry conditions and that rainfall facilitates mosquito eggs hatching, this would provide a potential mechanism for maintaining the virus in nature.

Low level of RVF activity may take place during inter-epizootic periods.
RVF should be suspected when exceptional flooding and subsequent abundant mosquito populations are followed by disease outbreaks in ruminants (abortions and/or newborn mortality with hepatic lesions). It

can be potentially concurrent with the occurrence of an influenza-like illness in farm workers and people handling raw meat.

Epidemiology

RVFV is endemic in many African countries and may involve several countries at the same time or progressively expand geographically over the course of a few years. In addition to Africa, large outbreaks have been observed in the Arabian Peninsula and some Indian Ocean islands. These generally, but not exclusively, follow the periodic cycles of unusually heavy rainfall, which may occur at intervals of several years, or the flooding of wide areas favouring the proliferation of mosquitoes.

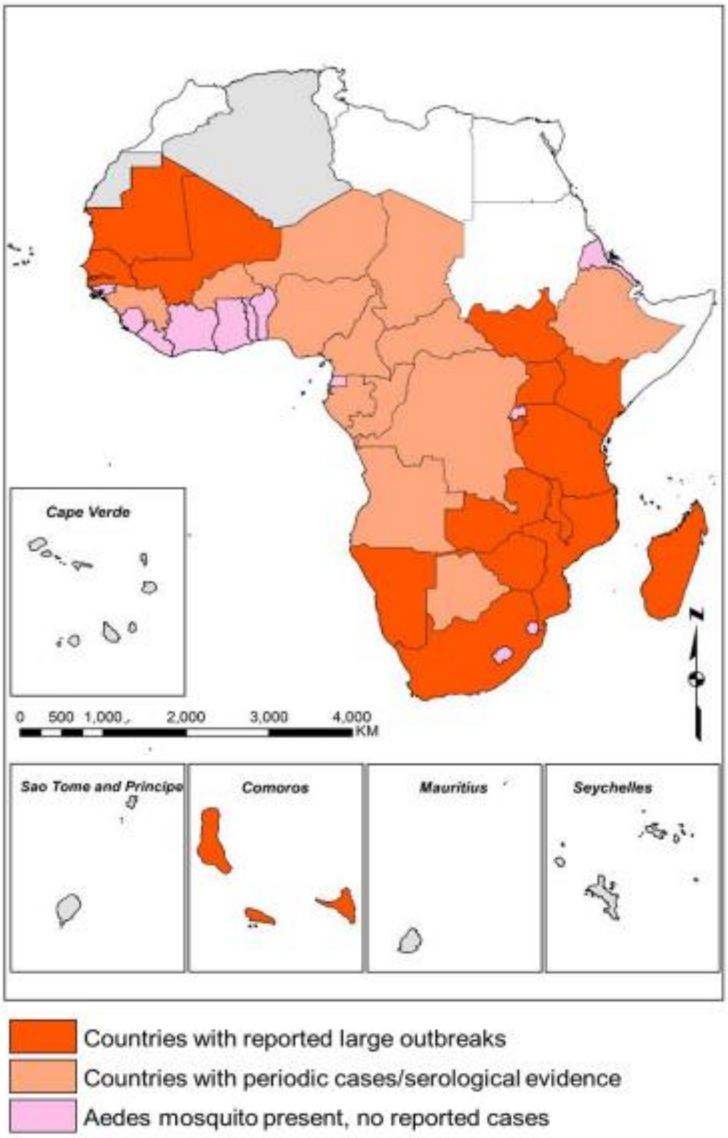

Fig. 2 The risk and distribution of RVF epidemics in the WHO African Region [4]

RVF human outbreaks that have occurred since 2000 [5]:

2016, Republic of Niger: As of 11 October 2016, Ministry of Health reported 105 suspected cases including 28 deaths due to RVF in humans in Tahoua region.

2012, Republic of Mauritania: The Ministry of Health in Mauritania declared an outbreak of RVF on 4 October 2012. From 16 September 2012 (the date of onset of the index case) to 13 November 2012, a total of 36 cases, including 18 deaths, were reported from 6 regions.
2010, Republic of South Africa: From February to July 2010, the Government of South Africa reported 237 confirmed cases of RVF in humans, including 26 deaths from 9 provinces.
2008–2009, Madagascar: From December 2008 to May 2009, the Ministry of Health of Madagascar reported 236 suspected cases including 7 deaths.
2008, Madagascar: The Ministry of Health of Madagascar reported an outbreak of RVF on 17 April 2008. From January to June 2008, a total of 476 suspected cases of RVF, including 19 deaths, were reported from 4 provinces.
2007, Sudan: The Federal Ministry of Health of Sudan, reported an outbreak of RVF on 28 October 2008. A total of 738 cases, including 230 deaths, were reported in Sudan between November 2007 and January 2008.
2006, Kenya, Somalia and Tanzania: From 30 November 2006 to 12 March 2007, a total of 684 cases including 234 deaths from RVF was reported in Kenya. From 19 December 2006 to 20 February 2007, a total of 114 cases including 51 deaths was reported in Somalia. From 13 January to 3rd May 2007, a total of 264 cases including 109 deaths was reported in Tanzania.
2003, Egypt: In 2003 there were 148 cases including 27 deaths of RVF reported by the Ministry of Health of Egypt.
2000, Saudi Arabia and Yemen: There were 516 cases with 87 deaths of RVF reported by the Ministry of Health of Saudi Arabia. In 2000, the Ministry of Public Health in Yemen reported 1087 suspected cases, including 121 deaths.

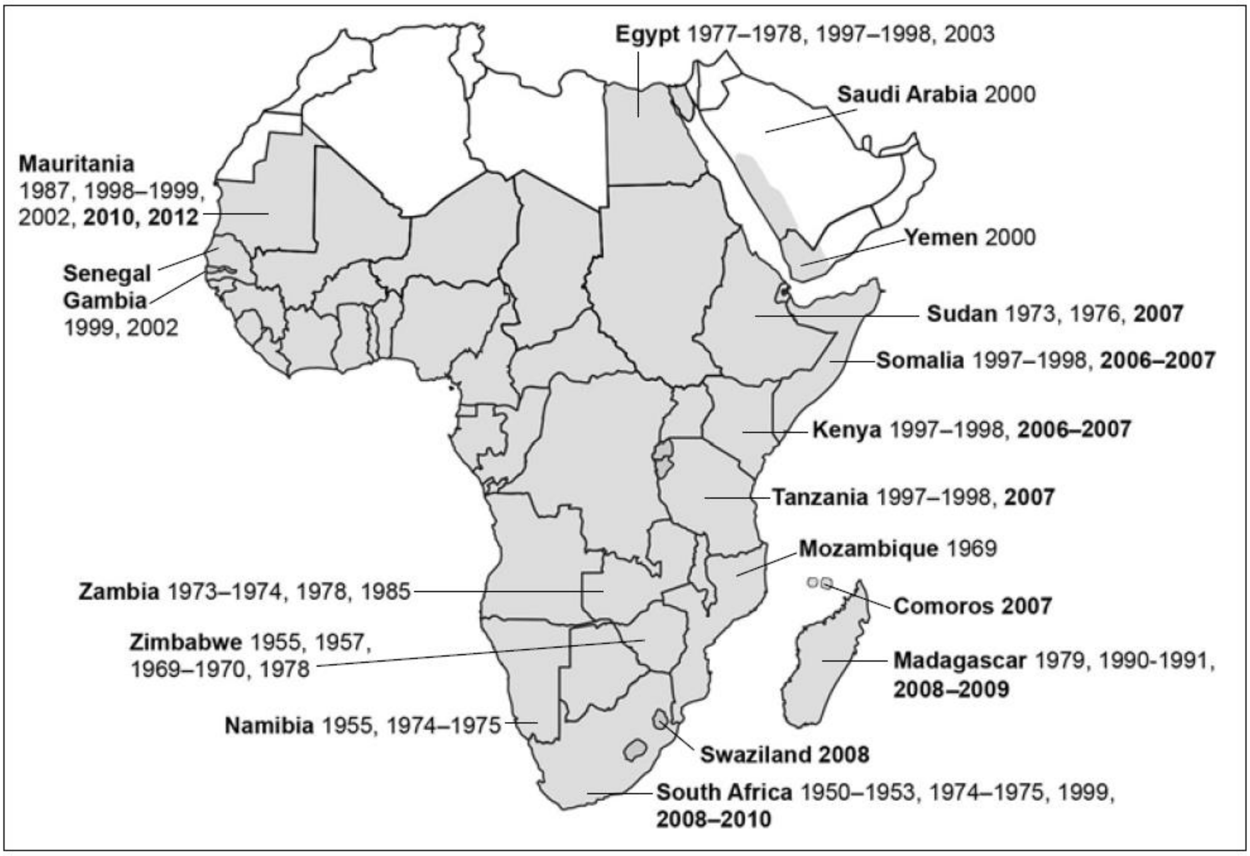

Fig. 3 Countries affected by Rift Valley fever and the dates of major outbreaks [6]

Scientific Opinion on Rift Valley fever by the EFSA Panel on Animal Health and Welfare [7]

Based on a comprehensive review of literature and OIE (World Animal Health Organisation) outbreak reports, this scientific opinion reports, first, that there is no evidence that Rift Valley fever (RVF) has spread to previously uninfected countries during the past 10 years. Nevertheless, RVF has moved North within Mauritania, in a desert area. Secondly, maps of Europe and the Southern Mediterranean Basin are provided, displaying the geographic distribution of nine potentially competent RVFV vectors based on a systematic literature review.

From environmental and eco-climatic data, predicted presence maps were generated that suggest the suitability of several parts of Europe and the Southern Mediterranean Basin for these potentially competent RVFV vectors.

Thirdly, to assess the risk of introduction of RVFV into some designated countries in the Southern Mediterranean Basin (RC)[1] , especially through the movements of live animals and vectors, a quantitative model was constructed and model parameters were derived based on expert knowledge elicitation (EKE). The EKE model indicates that some hundreds of RVFV-infected animals will be moved into the RC when an epidemic in the source areas occurs. The risk of RVFV entering the RC through the movement of vectors is expected to be small in comparison with the risk of entry through infected animals. Because of a lack of quantitative information on the seasonality of vector abundance and vertical transmission of RVFV within local vector species, the risk of endemicity could not be assessed. However, based on the abundance of the vector *Culex pipiens*, the livestock densities and the temperature in the region, there is a potential for RVF spread in the coastal areas of the RC.

REFERENCES

PLEASE EXAMINE THE SYNTETIC MEMO AT THE END OF THIS DOCUMENT WHERE MAIN RELEVANT ASPECTS OF THE IDENTIFIED REFERENCES ARE REPORTED (FROM PAG.10).

THE LIST OF REFERENCES IS NOT EXAUSTIVE BUT INCLUDES THE ARTICLES IDENTIFIED DURING THE PREPARATION OF THE RISK ASSESSMENT EXERCISE.

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[1] Region Concerned (RC): Mauritania, Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Israel, the Palestinian Territories, Lebanon and Syria. Since RVFV was introduced and is probably still present in Egypt and Mauritania, these two countries were excluded from this assessment.

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3rd MULTISECTORIAL EXERCISE ON RISK ASSESSEMENT
July 5-6, 2017

Supporting documents on Rift Valley Fever

Ref. N. in the Background document (Annex 1)	Authors	Title	Journal	Relevant points
1.	FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, Rome, 2003	Recognizing Rift Valley Fever	FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, Rome, 2003	Detailed information on all the aspects related to RVF are reported and clearly described.
4.	WHO AFRO	Mapping the Risk and Distribution of Epidemics in the WHO African Region	2016	A comprehensive picture of all the threats of this regional area including RVF.

6.	S. de La Rocque, P. Formenty	Applying the One Health principles: a trans-sectoral coordination framework for preventing and responding to Rift Valley fever outbreaks.	Rev. sci. tech. Off. int. Epiz., 2014, 33 (2), 555-567	Integrated strategy for the prevention and control of RVF outbreaks reported for each phase (period) and with a suggested framework
7.	EFSA Panel on Animal Health and Welfare (AHAW)	Scientific Opinion on Rift Valley fever	EFSA Journal 2013;11(4):3180. [48 pp.] doi:10.2903/j.efsa.2013.3180.	Detailed info on Mauritania, Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Israel, the Palestinian Territories, Lebanon and Syria. Since RVFV was introduced and is probably still present in Egypt and Mauritania, these two countries were excluded from this assessment.
8.	Maria Baudin, Ammar M Jumaa, Huda J E Jomma, Mubarak S Karsany, Göran Bucht, Jonas Näslund, Clas Ahlm, Magnus Evander*, Nahla Mohamed	Association of Rift Valley fever virus infection with miscarriage in Sudanese women: a cross-sectional study	Lancet Glob Health 2016; 4: e864–71	Of 130 pregnant women with febrile disease, 28 were infected with Rift Valley fever virus and 31 with chikungunya virus, with typical clinical and laboratory findings for the infection in question. 15 (54%) of 28 women with an acute Rift Valley fever virus infection had miscarriages compared with 12 (12%) of 102 women negative for Rift Valley fever virus ($p<0{\cdot}0001$). In a multiple logistic regression analysis, adjusting for age, haemorrhagic disease, and chikungunya virus infection, an acute Rift Valley fever virus infection was an independent predictor of

				having a miscarriage (odds ratio 7·4, 95% CI 2·7–20·1; p<0·0001). This study is the first to show an association between infection with Rift Valley fever virus and miscarriage in pregnant women.
9.	Mark O. Nanyingi, Peninah Munyua, Stephen G. Kiama, Gerald M. Muchemi, Samuel M. Thumbi, Austine O. Bitek, BVM, Bernard Bett,. Muriithi, and M. Kariuki Njenga,	A systematic review of Rift Valley Fever epidemiology 1931-2014	Infection Ecology and Epidemiology 2015, 5: 28024 -	A total of 84 studies were included in this review; majority (50%) reported on common human and animal risk factors that included consumption of animal products, contact with infected animals and residing in low altitude areas associated with favorable climatic and ecological conditions for vector emergence. A total of 14 (16%) of the publications described RVF progressive spatial and temporal distribution and the use of risk modeling for timely prediction of imminent outbreaks. Using distribution maps, we illustrated the gradual spread and geographical extent of disease; we also estimated the disease burden using aggregate human mortalities and cumulative outbreak periods for endemic regions. Interesting maps as per viral distributions and outbreak days.
10.	Ling Xue, H. Morgan Scott, Lee W. Cohnstaed, Caterina Scoglio	A network-based meta-population approach to	Journal of Theoretical Biology 306(2012)129–144	We propose a new compartmentalized model of RVF and the related ordinary differential equations to assess diseases spread in both time and space; with the latter

		model Rift Valley fever epidemics		driven as a function of contact networks. Humans and livestock hosts and two species of vector mosquitoes are included in the model. The model is based on weighted contact networks, where nodes of the networks represent geographical regions and the weights represent the level of contact between regional pairings for each set of species. The inclusion of human, animal, and vector movements among regions is new to RVF modeling.
11.	Monaco F, Cosseddu GM, Doumbia B, Madani H, El Mellouli F, Jiménez-Clavero MA, et al.	First External Quality Assessment of Molecular and Serological Detection of Rift Valley Fever in the Western Mediterranean Region.	(2015) PLoS ONE 10(11): e0142129. doi:10.1371/journal	The Animal Health Mediterranean Network (REMESA) linking some Northern African countries as Algeria, Egypt, Libya, Mauritania, Morocco, Tunisia with Southern European ones as France, Italy, Portugal and Spain aims at improving the animal health in the Western Mediterranean Region since 2009. In this context, a first assessment of the diagnostic capacities of the laboratories involved in the RVF surveillance was performed. The first proficiency testing (external quality assessment—EQA) for the detection of the viral genome and antibodies of RVF virus (RVFV) was carried out from October 2013 to February 2014. Ten laboratories participated from 6 different

				countries (4 from North Africa and 2 from Europe). Six laboratories participated in the ring trial for both viral RNA and antibodies detection methods, while four laboratories participated exclusively in the antibodies detection ring trial. For the EQA targeting the viral RNA detection methods 5 out of 6 laboratories reported 100% of correct results. One laboratory misidentified 2 positive samples as negative and 3 positive samples as doubtful indicating a need for corrective actions. For the EQA targeting IgG and IgM antibodies methods 9 out of the 10 laboratories reported 100% of correct results, whilst one laboratory reported all correct results except one false-positive. These two ring trials provide evidence that most of the participating laboratories are capable to detect RVF antibodies and viral RNA thus recognizing RVF infection in affected ruminants with the diagnostic methods currently available.
12.	Emna Ayari-Fakhfakh, Abdeljelil Ghram, Ali Bouattour, Imen Larbi, Latifa Gribâa-Dridi, Olivier Kwiatek, Michèle Bouloy, Geneviève Libeau,	First serological investigation of peste-des-petits-ruminants and Rift Valley fever in Tunisia	The Veterinary Journal 187 (2011) 402–404	This study, carried out between September 2006 and January 2007, is the first cross-sectional serological investigation of peste-des-petits-ruminants (PPR) and Rift Valley fever (RVF) in Tunisia. The objective was to assess the potential need to develop a dual, recombinant PPR–RVF vaccine and how such a vaccine might be utilised in Tunisia. An

	Emmanuel Albina, Catherine Cêtre-Sossah			overall PPR seroprevalence of 7.45% was determined, a finding supported by the high specificity (99.4%) and sensitivity (94.5%) of the ELISA used. On assessment of the diversity and density of mosquitoes in the sampling area, four species of RVF-vectors of the genus Aedes and Culex were identified. However, no serological evidence of RVF was found despite the use of a highly sensitive ELISA (99–100%). Larger scale investigations are underway to confirm these findings and the continuation of the emergency vaccination program against these two diseases remains valid.
13.	Breiman RF, Njenga MK, Cleaveland S, Sharif SK, Mbabu M, King L.	Lessons learned from the 2006_7 Rift Valley fever outbreak in East Africa: implications for prevention of emerging infectious diseases.	Future Virol 2008; 3: 411_7.	Very interesting. Conclusions of almost 10 years ago are still very alive!
14.	Osama Ahmed Hassan, Clas Ahlm, and Magnus Evander	A need for One Health approach lessons learned from outbreaks of Rift Valley fever in Saudi Arabia and Sudan	Infection Ecology and Epidemiology 2014, 4: 20710	It is interesting the description of the two outbreaks, but the need for One Health approach is not very well supported and discussed.

15.	D. E. Nicholas et al.	Risk factors for Rift Valley fever infection	Tropical Medicine and International Health volume 19 no 12 pp 1420–1429 December 2014	A systematic review identified 17 articles reporting on 16 studies examining risk factors for RVFV. Pooled odds ratios (pOR) were calculated for exposures examined in four or more studies. Being male [pOR = 1.4 (1.0, 1.8)], contact with aborted animal tissue [pOR = 3.4 (1.6, 7.3)], birthing an animal [pOR = 3.2 (2.4, 4.2)], skinning an animal [pOR = 2.5 (1.9, 3.2)], slaughtering an animal [pOR = 2.4 (1.4, 4.1)] and drinking raw milk [pOR = 1.8 (1.2, 2.6)] were significantly associated with RVF infection after meta-analysis. Other potential risk factors include sheltering animals in the home and milking an animal, which may both involve contact with animal body fluids.
16.	Hughes-Fraire, Hagerman, McCarl, and Gaff.	Rift Valley fever: an economic assessment of agricultural and human vulnerability.	in Southern Agricultural Economics Association Annual Meeting, Corpus Christi, TX, February 5–8, 2011	Interesting for indicators identified for the assessment
17.	Sara Moutailler, Ghazi Krida, Francis Schaffner, Marie Vazeille and Anna-Bella Failloux	Potential Vectors of Rift Valley Fever Virus in the Mediterranean Region	Vector-borne and zoonotic diseases Volume 8, Number 6, 2008 DOI: 10.1089/vbz.2008.0009	The presence of competent *Cx. pipiens* in southern France and Tunisia indicates the potential for RVFV epizootics to occur if the virus was introduced into countries of the Mediterranean basin.

18.	V. Chevalier	Relevance of Rift Valley fever to public health in the European Union	Clin Microbiol Infect 2013; 19: 705–708	The epidemiological situation in northern African countries, and the risk of introduction via either animal movements or infected vector 'travel', should be assessed, as well as the performance of both existing northern African and European surveillance systems. In fact, a 'one-health' regional approach and a joint effort by human and animal health authorities is needed to control RVF in endemic countries and protect virus-free areas from introduction of the virus.
19.	Robert F. Breiman ,Bruno Minjauw , S. K. Sharif , Peter Ithondeka , and M. Kariuki Njenga	Rift Valley Fever: Scientific Pathways Toward Public Health Prevention and Response	Am. J. Trop. Med. Hyg., 83(Suppl 2), 2010, pp. 1–4	GAPS IN KNOWLEDGE AND TOOLS: A RESEARCH AGENDA - A variety of gaps in knowledge and in available tools were identified during workshop discussions to be important for controlling RVF in endemic and naive countries in Africa and the Arabian Peninsula.
20.	A. Bosworth, T. Ghabbari, S. Dowall, A. Varghese, W. Fares, R. Hewson, E. Zhioua, M. Chakroun, H. Tiouiri, M. Ben Jemaa, A. Znazen and A. Letaief	Serologic evidence of exposure to Rift Valley fever virus detected in Tunisia	New Microbes and New Infections, Volume 9 Number C, January 2016	This study aimed to ascertain whether RVFv is circulating in regions beyond its known geographic range. Samples from febrile patients (n = 181) and nonfebrile healthy agricultural and slaughterhouse workers (n = 38) were collected during the summer of 2014 and surveyed for exposure to RVFv by both serologic tests and PCR. Of the 219 samples tested, 7.8% of non febrile participants showed immunoglobulin G reactivity to RVFv nucleoprotein and 8.3% of

				febrile patients showed immunoglobulin M reactivity, with the latter samples indicating recent exposure to the virus. Our results suggest an active circulation of RVFv and evidence of human exposure in the population of Tunisia.
21.	Ali S Khan, Carl V Smith	Rift Valley fever: still an emerging infection after 3500 years	www.thelancet.com/lancetgh Vol 4 November 2016	Commenting study in Sudan (7.) but not particularly relevant
22.	Archie C.A. Clements Dirk U. Pfeiffer, Vincent Martin, M. Joachim Otte	A Rift Valley fever atlas for Africa	Preventive Veterinary Medicine 82 (2007) 72–82	We have highlighted sub-national areas of the African continent where evidence synthesized from published serological data indicated high, low or unknown risk of RVFV infection in humans and livestock. Our maps might assist decision-makers to target resources and attention to parts of Africa where RVF poses a greater or unknown threat and to assist risk management in non-affected regions by identifying potential sources of the infection and areas from which animals and animal products may be imported with lower risk of introduction of RVF.
23.	Assaf Anyamba, Jean-Paul Chretien, Jennifer Small, Compton J Tucker and Kenneth J Linthicum	Developing global climate anomalies suggest potential	International Journal of Health Geographics 2006, 5:60	Hotspots of potential elevated risk for disease outbreaks under El Niño conditions: 2006 – 2007: Dengue Fever; Respiratory

		disease risks for 2006 – 2007		illness; Cholera; Malaria; Rift Valley Fever; Hanta Virus Pulmonary Syndrome; Plague.
24.	William A. Geering and F. Glyn Davies	FAO Animal Health Manual Preparation of RVF Contingency Plans	Food and Agriculture Organization of the United Nations, Rome 2002	Detailed chapter also on Risk Assessment methodologies and stakeholders

Annex 2.

NATIONAL INFORMATION ON RFV PROVIDED BY THE COUNTRIES

June 2017

Country	Information provided by:	Information and references
Palestine	Ibrahim Salem Central Public Health Laboratory Director Ministry Of Heath Palestine	1- no evidence and no cases of RVF till now in Palestine, KEEP in mind that the vectors of Aedes and Culex are present in the country. 2- we have not any reports or articles about RVF . 3- there is not an active surveillance system for RVF in animals, humans and vectors
Tunisia	Imène Ben Dhifallah Institut Pasteur de Tunis	no evidence of the circulation of Rift Valley Fever (RVF). In 2016, we carried out an investigation in dromedaries from the south of Tunisia to detect RVF and no evidence for circulation of this virus was revealed. A RFV surveillance system is active in our country (done by the Observatoire National des maladies nouvelles et émergentes) and Institute Pasteur (Pr Ali Bouattour is implicated in this surveillance).We have never seen also any reports of RVF in Morocco, Algeria and Libya.
Algeria	Nadera Bouayed Institut National de Médecine Vétérinaire, Algiers,	Many serological and molecular surveys have been conducted in Algeria during last decade: 2006-2007-2010-2012-2013-2014-2015-2016-2017 (postponed because the FMD outbreak). There is no article or report on RVF evidence circulation in Algeria In the Website of the OIE we can see the evidence of RVF in Mauritania, Senegal, Mali and Niger. Animals: *Passive *active: in the area neighbouring the infected countries (Mali, Niger, Mauritania) Vectors: *Entomological: surveys on BTV vectors (culicoides).
Algeria (human)	Dr. Hachid Aissam Laboratoire des Arbovirus Département de Virologie humaine Institut Pasteur d'Algérie	Until now, there is no report for human cases of RVFV. However, there are some not published serosurvey data for IgG anti-RVFV prevalence in Slaughterhouse staff located in Sahara provinces bordering affected countries (Mauritania, Niger). We have an active surveillance system for RFV in Algeria for human. It focus on high risk population (people with regular contact with animal, traveller's returning from endemic countries ...) and for severe forms (haemorrhagic, neuro-invasive and ocular form).

Egypt	Dr. Mohamed Amin Kenawy Prof. of Medical Entomology, Department of Entomology, Faculty of Science, Ain Shams University, Abbassia, Cairo	Report (Annex A of this Memo)
Egypt	Prof.Dr. Momtaz Shahein Director of Animal Health Reserach Instiute (AHRI) Cairo	History: • Egypt 1977-78: Outbreak of RVF occurred along the Nile in Egypt. This was the first epidemic out of sub-Saharan Africa. - 18,000 human cases. - 598 human deaths. - Many abortions and deaths were reported in sheep, goats, cattle, water buffalo and camels. - In 1993,1994: RVFV outbreaks were reported in cattle and sheep in Kafr El Sheikh and El Behara Provinces within the Nile delta Region. • In 1997: • affected herds were reported in the Aswan and Assiut Provinces, Upper Egypt. Aswan, the nearest Egyptian province to the Sudan, is the focus of RVF virus infection in Egypt. • In June - October 2003. • The outbreaks occurred in in Kafr El Sheikh Province 150 kilometres north of Cairo and all cases were Egyptian farmers. -45 cases of RFV were diagnosed with 17 deaths. • Considered on a regular monthly basis specially on the months of late summer August-November. Surveillance Activities • National institutions to monitor data (Goves, AHRI, and ministry of health) • Decision either: – no risk epizootic RVF – Possible risk. Passive surveillance (clinical disease base lie) Abortions/Mortality neonates Sudden onset many high temperatures Gastro enteric/ hepatitis/jaundice Haemorrhagic signs • Active surveillance (Virus Activity): Sero-surveillance (IgM). Testing Mosquitoes pools: (RT-PCR, Virus isolation).
Lebanon	Nabil Haddad, Laboratory of Immunology and Vector-Borne Diseases Faculty of Public Health Lebanese University	No human cases have been reported in the country. Moreover, the focal contact (Mrs Jeanne EL Hage) for the animal virology confirms that no animal cases have neither been reported. Mrs El Hage stated that, in their laboratory, which is accredited for the Ministry of agriculture, they don’t test for this virus in their routine control testing. On the entomological level, I can confirm that some potential vectors exit in the country (as in many other countries in the

	Beyrouth-Lebanon	MediLabSecure). These vectors belong to the *Culex and Aedes* genera. The vector competence of *Culex pipiens* , a widely spread mosquito in Lebanon, was assessed under experimental conditions. This mosquito showed a limited capacity to transmit the virus. Moreover, the tiger mosquito (*Aedes albopictus*) is spread in Lebanon, however, the vector competence of this mosquito for RVFV was never assessed.
Lebanon	Nada Ghosn (Head of Epidemiological Surveillance Unit) Ministry of Public Health Directorate of Prevention Epidemiological Surveillance Program	No evidence in Lebanon that RVF virus has been circulating RVF surveillance system is active for humans: via syndromic approach: acute hemorrhagic fever is investigate for potential travel, animal contact, entomological context...
Libya	Dr. Taher Shaibi Director of the Administration of Zoonotic Diseases Control, National Centre for Diseases Control University of Tripoli LIBYA	950 human blood samples were examined to determine the seroprevalence (baseline exposure) to zoonotic viruses and bacteria causing acute febrile illness. Antibodies against RVFV have been detected, the prevalence was 0.4%. RVF surveillance system is not active in Libya.
Jordan	Prof. Nabil Hailat, Professor of Veterinary Pathology, Dept. of Pathology and Public Health, Faculty of Veterinary Medicine, Jordan University of Science and Technology (JUST)	There has been no evidence suggestions that RVF virus has been circulating in the country, but no studies have been conducted. there are few reports from Yemen and Saudi Arabia which are published. In Jordan, there no capacity to my knowledge for the detection and diagnosis of the RVF. I have submitted a proposal for funding regarding capacity building of RVF and waiting for a response. I included only few countries from the region, but I think there is some potential for the virus to spread up North, that we should be aware of. There is no surveillance system for RVF, but I think, we should. There should be some education and awareness about this disease. More focus is put on FMD, PPR, LSD, Pox, abortions, diarrhoea...etc.
Morocco	Merieme LAHRACH Office National de Sécurité Sanitaire des Produits Alimentaires (ONSSA) Laboratoire Régional d'Analyses et de Recherches de Casablanca	- Rift Valley Fever (Never Notified) 1-Factors of risk : - the virus has been particularly active in Mauritania , outbreaks notified in 2010, 2012 and 2015. - Favorite Biotope - Susceptible species. 2- Control Measures: -Surveillance reinforcement in risk areas (Notification of diseases and border precautions) South and East of Morocco. -Communication, collaboration and coordination with Public Health Authorities -Epidemiological investigation (Serology) in 2011 on 4011 sera (ov-cp, bv, cm) : Negative results No evidence of viral circulation.

Annex A

RIFT VALLEY FEVER (RVF) IN EGYPT

By Dr. MOHMED A KENAWY, PhD Prof. of Medical Entomology; Faculty of Science, Ain Shams University, Cairo, Egypt

The Rift Valley fever (RVF) is a neglected, emerging, mosquito-borne disease with severe negative impact on human and animal health and economy [**01**] and is caused by a virus (RVFV, genus: *Phlebovirus*, family: Bunyaviridae), which causes significant morbidity and mortality in animals and humans

Two RVF epidemics have been recorded in Egypt, in 1977-1978 [**02**] and in 1993. Shortly after RVF has been reported in Sudan [**03**], extensive epizootics occurred in 1977-1978 in several areas of the Nile Delta and Valley resulted in unpredicted human disease with severe clinical manifestations and heavy mortality as well as abortion and death in sheep and cattle [**04, 05**]. The disease was observed first in animals in Aswan, and then extended north into the Nile Valley and Delta in eight governorates mainly Sharqiya, Qalyubia, and Giza. It is estimated that 18,000 persons suffered from the disease and 598 died in 1977 [**06**]. In 1978, the number of human cases officially reported was 114 with 12 deaths, all from Sharqiya Gov. [**07**]. Importation of infected ruminants, especially camels from the Sudan, was suggested as the principal source of infection [**02**]. After an absence of 12 years, in May 1993 RVF recorded again in man and in domestic animals (cattle and buffaloes) in Aswan Governorate [**08**]. By August, RVF has spread to most of governorates in the Nile Delta as well as in El-Faiyum oasis [**09**, **10**]. This outbreak was much less severe than 1977-78 epidemics as it was limited to estimated 600-1500 infections [**08**]. After this major outbreak, RVF epidemics re-occurred in irregular intervals between 1993 and 2003 [**11**]. RVFV was detected in human clinical samples (29 cases out of 375: 7.7% RVF infection rate) collected during June-October, 2003 in Kafr el Sheikh Governorate (Nile Delta) [**12**].

During the 1977-1978 epidemics, *Culex pipiens* was implicated as the primary vector of RVFV, based on abundance, susceptibility to infection, virus isolation from an unengorged females, ability to experimental transmission of the virus [04, **13**) and its blood feeding habits [**14, 15**]. The transmission rate of mosquitoes that fed on viremic hamsters was 40.0% (46.2% based only on infected mosquitoes) [**13**]. *Aedes caspius* and *Cx. antennatus* were also suspected of disseminating the virus among livestock, based on feeding patterns [**14, 15**] and vector competence [**16**]. However, these studies of host selection by mosquitoes were carried out after RVF virus was last documented in 1981 [**07**].

During 1993 outbreak, the abilities of *Aedes caspius*, *Culex pipiens, Cx. antennatus, Cx. perexiguus, Cx. poicilipes* and *Anopheles pharoensis* collected in the Aswan area and *Cx. pipiens* collected in the Nile Delta were evaluated to transmit RVFV [**17**]. None of *An. pharoensis* transmitted RVFV by bite. In contrast, other species transmitted virus with overall transmission rates were 7.0-20.0%. Based on abundance, susceptibility to infection, ability to transmit virus and feeding behavior, *Ae. caspius* appeared to be the most efficient vector of the Egyptian mosquitoes evaluated. While

less susceptible than *Ae. caspius, Cx. pipiens, Cx. antennatus* and *Cx. perexiguus* were also potential vectors during this RVF outbreak in Egypt. During the 2003 outbreak, Hanafi et al. [**12**] reported for the first time three isolates of RVFV from naturally-infected *Cx. antennatus* mosquitoes so that it was implicated as a vector of RVFV during an outbreak in the Nile Delta of Egypt.

The epidemiological factors related to the introduction, spread and maintenance of RVF which have contributed to the explosive nature of the RVF epizootics in Egypt are:

1. A more virulent RVFV which caused extensive morbidity and mortality to the dense non-immune population of Egypt.
2. The local practice of keeping domestic animals closely associated to households [15].
3. Human hosts in Egypt are more susceptible to the virus because of local endemic diseases mainly Shistosomiasis [05,18].
4. Local custom of sheep slaughter and distribution of fresh meat. The 1977 epidemic coincided with the timing of a religious occasion (Eid el-Adha) at which sheep are sacrificed [19].
5. Sick animals are often slaughter for human consumption so that RVFV could easily be spread by infected meat.
6. *Culex pipiens* is the most ubiquitous and prevalent mosquito species in the Nile Valley and Delta. Isolation of RVF virus from unengorged *Cx. pipiens*, and demonstration of laboratory transmission of the virus by this species, strongly implicate it as the chief vector in Egypt [04].
7. Virus transmission to man also occurs by contamination when handling infected meat [04]

To-day, no national surveillance system is active in the country, only sporadic ones (animals) by individual research workers are carried out for examples:

1. Mroz et al. [11] conducted (2014/2015) a serosurvey in non-vaccinated livestock including camels, sheep, goats and buffalos (born after the last RVF epidemic in 2003) in Nile Delta and southeast of Egypt to investigate the presence of anti-RVFV antibodies for further evaluating the risk exposure for animal and human health. The authors concluded that currently low level of circulating virus in the investigated areas suggests minor indication for a new RVF epidemic.
2. Mroz et al. [20] examined the current anti-RVFV antibody status in immunized as well as non-immunized dairy cattle from the Nile Delta. During 2013-2015, a total of 4,167 dairy cattle from four governorates: El-Dakahlia, Damietta, El-Gharbia and Port Said were investigated. All cattle were born after 2007, i.e. after the last reported RVFV outbreak in 2003. The results indicated that the RVFV is still circulating in Egypt as about 10% of the non-immunized animals exhibited RVFV-specific antibodies.

Entomologically, some recent surveys were carried out in some governorates where virus was reported during the RVF outbreaks and some other governorates. Such surveys further indicated that *Culex pipiens*, the chief vector is the most common or predominating mosquito species in Egypt for examples:

1. Culicine mosquitoes were surveyed (11/2007 – 5/2008) in some villages representing the different districts of El Sharqiya Governorate (Nile Delta) [21]. Totally 6 species were reported: *Culex pipiens, Cx. perexiguus, Cx. antennatus, Cx. pusillus, Cx. sinaiticus* and *Aedes detritus. Cx. pipiens* was the predominant or the most common species (*ca* 88% larvae & 47% adults, $P<0.01$).
2. Mosquitoes were surveyed (3 – 5 & 11/2007) in all centers of El Gharbia Governorate (Nile Delta) [22]. Seven species (6 culicine and 1 anopheline) were collected. These are *Culex*

pipiens, Cx. perexiguus, Cx. antennatus, Cx. theileri, Ochlerotatus detritus, Culiseta longiareolata and *Anopheles tenebrosus*. *Cx. pipiens* was the most common or predominating species (*ca* 45% adults and 86%, 63 larvae, P<0.01). *Cx. antennatus* (*ca* 38% adults) was also a common species (P<0.01).

3. Mosquitoes were surveyed (11/2009 – 3/2010) in El Ismailia Governorate (Suez Canal Zone) [23]. Nine species were reported: *Culex pipiens, Cx. perexiguus, Cx. antennatus, Anopheles tenebrosus, An. pharoensis, An. multicolor, Ochlerotatus detritus, Oc. caspius* and *Culiseta longiareolata. Culex pipiens* was the predominant species (*ca* 87% larvae & 57% adults). The abundance of mosquito vectors in El Ismailia with its old history of vector transmitted diseases contributes to the risk of mosquito borne disease transmission in this area.
4. Culicine mosquitoes were surveyed (10 - 11/2008 & 4 - 5/2009) in villages representing eight districts of El Menoufia Governorate (Nile Delta) [24]. Six species were reported: *Culex pipiens*, *Cx. perexiguus, Cx. antennatus, Aedes caspius, Aedes detritus* and *Culiseta longiareolata. Cx. pipiens* was the commonest or predominating species (*ca* 47% adults & 92% larvae, P<0.01).
5. Mosquitoes were surveyed over one year period in two localities in Cairo governorate representing different levels of urban planning: El-Muqattam (planned) and Abu- Seir (unplanned) [25]. *Culex pipiens, Cx. perexiguus, Cx. pusillus*, *Ochlerotatus caspius*, *Culiseta longiareolata* and *Anopheles multicolor* were the collected species at both sites. Mosquitoes were more common in Abu-Seir than in El-Muqattam, with larvae of *Cx. pipiens* accounting for 81% and 52% of recorded individuals at these sites, respectively.
6. Mosquitoes were surveyed (Oct. 2010 & Apr - Oct. 2011) in some localities representing 13 centers of El-Dakahlia Governorate (Nile Delta) [26]. Six mosquito species were collected: *Culex pipiens, Cx. antennatus, Cx. perexiguus, Ochlerotatus detritus*, *Anopheles pharoensis* and *An. tenebrosus. Culex pipiens* was predominating (*ca* 79% larvae & 51% adults). *Culex antennatus* and *Cx. perexiguus* were also common.
7. The prevalence and feeding patterns of mosquitoes in 5 villages of Aswan governorate where the RVFV was active during 1993 outbreak were examined [27]. Of 10 species recovered, *Aedes caspius, Culex pipiens, Cx. antennatus* and *Cx*. *perexiguus* constituted 99% of > 35,000 mosquitoes captured. *Ae. caspius* was most prevalent and *Cx. pipiens* ranked 2nd. Most blood meals analyzed reacted to > or = 1 antiserum. *Cx. pipiens* was mainly anthropophagic, and therefore may have been the main vector of RVFV among humans. *Ae. caspius* feeds were chiefly from humans, bovines, and equines. *Cx. antennatus* and *Cx*. *perexiguus* fed generally on bovines. Because potential vectors are abundant, susceptible domestic animals are associated closely with humans, and surveillance of imported livestock is not systematic, the authors concluded that RVFV sporadically will recur in Egypt.

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3rd MULTISECTORIAL EXERCISE ON RISK ASSESSMENT
July 5-6, 2017

Annex 3.

Risk questions & Multisectoral added value

§ The questions should be discussed in group, then within each country team, and finally the replies should be provided by country to the rapporteur.

Considering the possibility that in the future years a RVF outbreak might occur in your country, how would you reply to the following questions:

1.a Which risk factors affect the occurrence, persistence and spread of RVF infection ***in Africa and other areas with a history of RVF infection or outbreak***?

Please rank from most to least relevant the risk factors and drivers for the occurrence, persistence and spread of RVF infection in Africa and other areas with a history of RVF infection or outbreak.

Six-level ranking system (with 0 as least relevant and 5 as most relevant factor).

	0	1	2	3	4	5
bioterrorism						
technological underdevelopment						
social and economic instabilities						
changing host susceptibility						
changing ecosystems						
climate and weather changes						
microbial adaptation						
animal movements and trade						
international travel						

1.b Which risk factors affect the spread of RVF infection into ***new areas***?

Please rank from most to least relevant the risk factors and drivers for the spread of RVF infection into new areas

Six-level ranking system (with 0 as least relevant and 5 as most relevant factor)

	0	1	2	3	4	5
bioterrorism						
technological underdevelopment						
social and economic instabilities						
changing host susceptibility						
changing ecosystems						
climate and weather changes						
microbial adaptation						
animal movements and trade						
international travel						

2. Which ***preparedness measures*** could be put in place to reduce the risk of RVF virus infection in Africa and other at risk areas?

Please rank from most to least ***feasible*** and from most to least ***effective*** measures to increase the rapidity of the response to RVF infection.

Six-level ranking system (with 0 as least relevant and 5 as most relevant factor)

		0	1	2	3	4	5
Improving veterinary diagnostic laboratories	feasible						
	effective						
Enhancing veterinary capacity to recognize clinical signs of RVF in animals	feasible						
	effective						
Improving public health diagnostic laboratories	feasible						
	effective						
Increasing medical capacity to recognize clinical signs of RVF in humans	feasible						
	effective						
Developing risk assessment forecasting models	feasible						
	effective						
Control of animal movements/trade	feasible						
	effective						

Developing early-warning systems based on regular animal testing: examples include sentinels and cross-sectional testing.	feasible						
	effective						

3. Which ***prevention and control options*** can be put in place to reduce the impact of RVF spreading?

Please rank from most to least ***feasible*** and from most to least ***effective*** the prevention and control options for reducing the impact of a possible RVF spreading.

		0	1	2	3	4	5
culling sick and infected animals	feasible						
	effective						
eliminating insects and controlling mosquitoes	feasible						
	effective						
animal mass vaccination	feasible						
	effective						
vaccination of infected flocks/herds only	feasible						
	effective						
partial stamping out – culling of sick animals and vaccination of the remainder –	feasible						
	effective						
public communication campaigns on measures to reduce exposure to mosquito bites	feasible						
	effective						
Control of animal movements/trade	feasible						
	effective						
communication campaigns for farmers and other professionals to reduce the risk of animal-sourced infections	feasible						
	effective						

4. In view of the repeated outbreaks of RVF in recent years in some West African countries:

4.a What is the risk of RVF virus infection ***introduction to*** your country in the next 3–5 years?

0	1	2	3	4	5	6
Extremely unlikely 0%–1% Chance	Very unlikely 1%–10% Chance	Unlikely 10%–30% Chance	As likely as not 33%–66% Chance	Likely 66%–90% Chance	Very likely 90%–99% Chance	Extremely likely 99%–100% Chance

4.b What is the risk of the RVF virus ***persisting and spreading*** once introduced into your country?

0	1	2	3	4	5	6
Extremely unlikely 0%–1% Chance	Very unlikely 1%–10% Chance	Unlikely 10%–30% Chance	As likely as not 33%–66% Chance	Likely 66%–90% Chance	Very likely 90%–99% Chance	Extremely likely 99%–100% Chance

5. Multisectoral added value

Please rank low, medium or high the added value of discussing the proposed issues in multidisciplinary teams (animal and human virologists, entomologists and public health officers)

	Added Value		
Question	Low	Medium	High
1.a risk factors in Africa and other areas with a history of RVF infection or outbreak			
1.b risk factors for new areas			
2. preparedness measures			
3. prevention and control options			
4.a Risk of introduction in your country			
4.b Risk of persistence in your country			

Annex 4 Restitution slide (1)

Country	**Question 1.a**	**Question 1.b**	**Question 2**	**Question 3**	**Question 4.a & 4.b**
	The three most relevant risk factors in Africa and other areas with a history of RVF infection or outbreak	**The three most relevant risk factors** for **new areas**	***preparedness measures*** The three most feasible The three most effective	**prevention and control** options The three most feasible The three most effective	**Level of risk assessed:** - Introduction - Persisting and spreading

Annex 4 Restitution slide (2)

Country	**Added value of multi-sectorial assessment** (Low/medium/high)					
	1.a Risk factors in Africa and other areas with a history of RVF infection or outbreak	1.b Risk factors for new areas	2. Preparedness measures	3. Prevention and control options	4.a Risk of introduction in your country	4.b Risk of persistence in your country

Annex 5 Restitution slide GROUP 1 (1)

Country	Question 1.a	Question 1.b	Question 2	Question 3	Question 4.a & 4.b
	The three most relevant risk factors in Africa and other areas with a history of RVF infection or outbreak	**The three most relevant risk factors** for **new areas**	***preparedness measures*** The three most feasible The three most effective	**prevention and control** options The three most feasible The three most effective	**Level of risk assessed:** - Introduction - Persisting and spreading
Algeria	- Animal movements and trade - Change in the ecosystem - Social and economic instabilities	- Animal movements and trade - Social and economic instabilities - Climate change and weather change	- Enhancing vet capacities to recognize clinical cases - Improving vet lab - Improving PH lab	• Partial stamping out and vaccination - Animal mass vaccination - Controlling mosquitos (no elimination)	Risk 4-5
			- Enhancing vet capacities to recognize clinical cases - Control animal movement/trade - Improving PH lab	- Partial stamping out and vaccination - Animal mass vaccination - Controlling mosquitos (no elimination	Risk 2-3

Annex 5 Restitution slide GROUP 1 (2)

Country	Question 1.a	Question 1.b	Question 2	Question 3	Question 4.a & 4.b
	The three most relevant risk factors in Africa and other areas with a history of RVF infection or outbreak	**The three most relevant risk factors** for **new areas**	***preparedness measures*** The three most feasible The three most effective	**prevention and control** options The three most feasible The three most effective	**Level of risk assessed:** - Introduction - Persisting and spreading
Morocco	- Animal movements and trade - Social and economic instabilities - Change in the ecosystem	- Animal movements and trade - Social and economic instabilities - Climate change and weather change	- Enhancing vet capacities to recognize clinical cases - Improving vet lab - Increase medical capacities to recognize case	- Culling sick and affected animals - Animal mass vaccination - Mosquitos control (not elimination)	Risk 2 10-30%
			- Control animal movement/trade - Enhancing vet capacities to recognize clinical cases - Improving vet lab	- Culling sick and affected animals - Animal mass vaccination - Mosquitos control (not elimination)	Risk 1 1-10%

Annex 5 Restitution slide GROUP 1 (3)

Country	**Question 1.a**	**Question 1.b**	**Question 2**	**Question 3**	**Question 4.a & 4.b**
	The three most relevant risk factors in Africa and other areas with a history of RVF infection or outbreak	**The three most relevant risk factors** for **new areas**	***preparedness measures*** The three most feasible The three most effective	**prevention and control** options The three most feasible The three most effective	**Level of risk assessed:** - Introduction - Persisting and spreading
Tunisia	- Changing ecosystem - Social and economic instabilities - Weather changes	- Animal movements and trade - Presence of vector and changing ecosystem - Social and economic conditions	- Early warning system - Improving vet lab - Increase med capaceties to recoonize cases	- Communication campaign farmers - Public communication campaign - Mosquitoes control	Risk 4
			- Early warning system - Control of animan movement/trade - Increase vet capacities to reconize animal cases	- Culling sick and infected - Control of animal mouvoments and trade - Partial stamping out and vaccination	Risk 4

Annex 5 Restitution slide GROUP 1(4)

Country	Added value of multi-sectorial assessment (Low/medium/high)					
	1.a Risk factors in Africa and other areas with a history of RVF infection or outbreak	1.b Risk factors for new areas	2. Preparedness measures	3. Prevention and control options	4.a Risk of introduction in your country	4.b Risk of persistence in your country
Algeria	High	High	Medium	High/medium	High	medium
Morocco	Medium	Medium	High	Medium	Medium	medium
Tunisia	High	High	High	High	Medium	medium

Annex 5 Restitution slide GROUP 2 (1)

Country	Question 1.a	Question 1.b	Question 2	Question 3	Question 4.a & 4.b
	The three most relevant risk factors in Africa and other areas with a history of RVF infection or outbreak	**The three most relevant risk factors** for **new areas**	***Preparedness measures*** The three most feasible The three most effective	***Prevention and control options*** The three most feasible The three most effective	**Level of risk assessed:** - Introduction - Persisting and spreading
Tunisia (8)	Animal movement and trade Changing ecosystems Climate changes	Animal movement and trade Microbial adaptation Changing host susceptibility	– Improving vet. diagnostic labs – Enhancing vet capacity to recognise RVF signs – Improving PH diagnostic labs	- Public communication campaigns - Communicationfor farmers - Control of animal movement and trade	As likely as not
			– .Improving vet. diagnostic labs – Enhancing vet capacity to recognise RVF signs – Improving PH diagnostic labs	- Public communication campaigns - Communicationfor farmers - Control of animal movement and trade	Extremely likely

Annex 5 Restitution slide GROUP 2 (2)

Country	Question 1.a	Question 1.b	Question 2	Question 3	Question 4.a & 4.b
	The three most relevant risk factors in Africa and other areas with a history of RVF infection or outbreak	**The three most relevant risk factors** for **new areas**	***Preparedness measures*** The three most feasible The three most effective	***Prevention and control options*** The three most feasible The three most effective	**Level of risk assessed:** - Introduction - Persisting and spreading
Libya (4)	Animal movement Climate changes Changing ecosystems	Animal trade International trade Climate changes	- Early warning system - Improving vet diagnostic labs - Increasing medical capacity to recognise RVF signs	- Communication to farmers - Public communication - Culling sick/infected animals	Likely
			- Early warning system - Improving vet diagnostic labs - Increasing medical capacity to recognise RVF signs	- Culling sick/infected animals - Animal mass vaccination - Communication to farmers	Unlikely

Annex 5 Restitution slide GROUP 2 (3)

Country	Question 1.a **The three most relevant risk factors in Africa and other areas with a history of RVF infection or outbreak**	Question 1.b **The three most relevant risk factors** for **new areas**	Question 2 ***Preparedness measures*** The three most feasible The three most effective	Question 3 ***Prevention and control options*** The three most feasible The three most effective	Question 4.a & 4.b **Level of risk assessed:** - Introduction - Persisting and spreading
Egypt (3)	Bioterrorism Changing ecosystems Climate change	Bioterrorism Changing host susceptibility /ecosystems Animal movement	- Improving vet. Diagnostic labs - Improving PH diagnostic labs	- Animal mass vaccination - Public communicatiion - Farmer communication	Likely
			- Improving vet. Diagnostic labs - Improving PH diagnostic labs	- Animal mass vaccination - Public communicatiion - Farmer communication	Likely

Annex 5 Restitution slide GROUP 2 (4)

Country	**Added value of multi-sectorial assessment (Low/medium/high)**					
	1.a Risk factors in Africa and other areas with a history of RVF infection or outbreak	**1.b Risk factors for new areas**	**2. Preparedness measures**	**3. Prevention and control options**	**4.a Risk of introduction in your country**	**4.b Risk of persistence in your country**
Tunisia (7)	High	Medium	Medium	High	Medium	High
Libya (4)	Medium	High	High	Medium	Medium	Low
Egypt (3)	High	High	High	High	High	Medium

Annex 5 Restitution slide GROUP 3 (1)

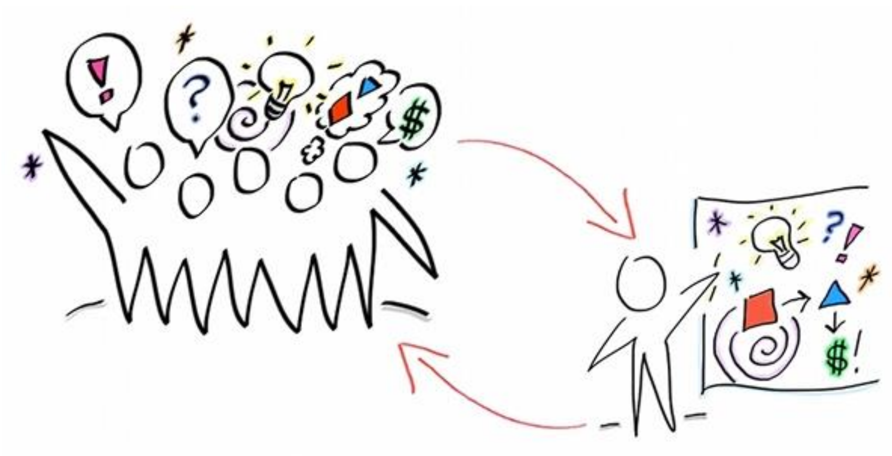
Country	Question 1.a	Question 1.b	Question 2	Question 3	Question 4.a & 4.b
	The three most relevant risk factors in Africa and other areas with a history of RVF infection or outbreak	**The three most relevant risk factors** for **new areas**	***preparedness measures*** The three most feasible The three most effective	**prevention and control** options The three most feasible The three most effective	**Level of risk assessed:** - Introduction - Persisting and spreading
PALESTINE	- Animal movements and trade - International travel - Changing host susceptibility	- Social and economical instabilities - Animal movements and trade - Climate and weather change	Most feasible: - Improving vet diag lab - Improving PH diag lab	Most feasible: -Public communication campaigns -Communcation for farmers	2
			Most effective: - Improving vet diag lab - Control of animal movements and trade	Most effective: -Animal vaccination -Public communication	3
LEBANON	- Climate and weather changes - Animal movements and trade - Social and economic instabilities	- Animal movements and trade - Climate and weather change - Changing ecosystems	Most feasible: - Improving vet diag lab - Enhancing vet capacities	Most feasible: -Communication for farmers - Animal mass vaccination	3
			Most effective: - Improving vet diag lab - Developing RA forecasting models	Most effective: -Communication for farmers - Animal mass vaccination	4

Annex 5 Restitution slide GROUP 3 (2)

Country	Question 1.a	Question 1.b	Question 2	Question 3	Question 4.a & 4.b
	The three most relevant risk factors in Africa and other areas with a history of RVF infection or outbreak	**The three most relevant risk factors** for **new areas**	***preparedness measures*** The three most feasible The three most effective	**prevention and control** options The three most feasible The three most effective	**Level of risk assessed:** - Introduction - Persisting and spreading
JORDAN	- Changing host susceptibility - Animal movements and trade - Climate and weather changes	- Social and economic instabilities - Climate and weather changes - Animal movements and trade	Most feasible: - Improving vet diag lab - Improving PH diag lab	Most feasible: - Public communication - Partial stamping out	1
			Most effective: - Control of animal movements and trade - Developing RA models	Most effective: - Culling sick and infected animals - Eliminating insects and controlling mosquitoes	3
TUNISIA	-Animal movements and trade - Climate and weather changes - International travel	- Animal movements and trade - Climate and weather changes - Microbial adaptation	Most feasible: - Increasing medical capacities - Improving PH diag lab	Most feasible: - Public communication - Communication for farmers	2
			Most effective: - Control of animal movements and trade - Developing RA models	Most effective: - Public communication - control of animal movement	3

Annex 5 Restitution slide GROUP 3 (3)

Country	**Added value of multi-sectorial assessment** (Low/medium/high)					
	1.a Risk factors in Africa and other areas with a history of RVF infection or outbreak	1.b Risk factors for new areas	2. Preparedness measures	3. Prevention and control options	4.a Risk of introduction in your country	4.b Risk of persistence in your country
PALESTINE	HIGH	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
LEBANON	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
JORDAN	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
TUNISIA	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH



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3rd MULTISECTORAL EXERCISE ON RISK ASSESSMENT

MediLabSecure

Regional meeting and Technical Workshop on Public Health

Tunis 4-6 July 2017

PRE TEST

Name: ____

Family Name: ____

Institution: ____

Country: ____

1. Please rank three relevant risk factors/drivers for the occurrence, persistence and spread of RVF infection ***in Africa and other areas with a history of RVF infection or outbreak.***

____

____

____

2. Please rank three relevant risk factors/drivers for the spread of RVF infection into ***new areas***.

____

____

____

3. Please rank three relevant ***feasible*** measures to increase the rapidity of the response to RVF infection.

____

____

____

4. Please rank three relevant ***effective*** measures to increase the rapidity of the response to RVF infection.

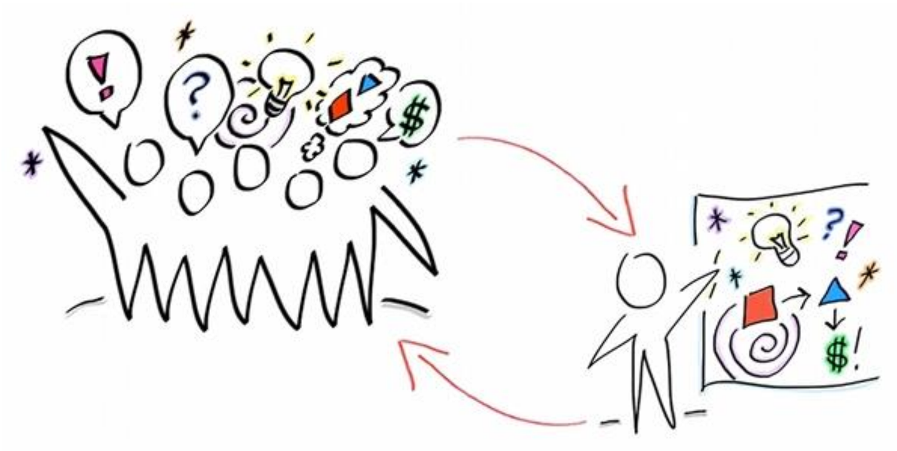
5. Please rank three relevant ***feasible*** prevention and control options for reducing the impact of a possible RVF spreading.

6. Please rank three relevant ***effective*** prevention and control options for reducing the impact of a possible RVF spreading.

7. List ***kind of documents*** to rely on to assess the level of risk for RVF in your country

8. List ***institutions/depts./experts*** to involve to assess the level of risk for RVF in your country and explain the reasons

institutions/depts./experts	Reason for involvement



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3rd MULTISECTORAL EXERCISE ON RISK ASSESSMENT

MediLabSecure

Regional meeting and Technical Workshop on Public Health

Tunis 4-6 July 2017

POST TEST

MediLabSecure

ISTITVTO SVPERIORE DI SANITÀ

Name: ____

Family Name: ____

Institution: ____

Country: ____

1. Please rank three relevant risk factors/drivers for the occurrence, persistence and spread of RVF infection ***in Africa and other areas with a history of RVF infection or outbreak.***

____

____

____

2. Please rank three relevant risk factors/drivers for the spread of RVF infection into ***new areas***.

____

____

____

3. Please rank three relevant ***feasible*** measures to increase the rapidity of the response to RVF infection.

____

____

____

4. Please rank three relevant ***effective*** measures to increase the rapidity of the response to RVF infection.

5. Please rank three relevant ***feasible*** prevention and control options for reducing the impact of a possible RVF spreading.

6. Please rank three relevant ***effective*** prevention and control options for reducing the impact of a possible RVF spreading.

7. List ***kind of documents*** to rely on to assess the level of risk for RVF in your country

8. List ***institutions/depts./experts*** to involve to assess the level of risk for RVF in your country and explain the reasons

institutions/depts./experts	**Reason for involvement**

Do you agree to report the country information on RVF surveillance provided for the exercise in report/s or manuscript/s to be disseminated?

YES

NO

Other____

ANNEX 7

EXERCISE EVALUATION FORM

Evaluation

Please help us improve the workshop by responding candidly to the following statements:

Scale Definition: 1 – Strongly Disagree 2 – Disagree 3 – Neither Agree nor Disagree 4 – Agree 5 – Strongly Agree

Exercise objectives were well communicated	1 2 3 4 5
The discussions were useful	1 2 3 4 5
Adequate time was allotted for explanations/practice	1 2 3 4 5
Overall the exercise was satisfactory	1 2 3 4 5

What did you like most about the exercise?

How can we improve the exercise?

Do you have any additional questions regarding this topic?

If you wish us to contact you, please provide the following information:

Name	Email	Telephone Number