USAID
FROM THE AMERICAN PEOPLE

AFRICAN UNION
INTERAFRICAN BUREAU
FOR ANIMAL RESOURCES

Standard Methods and Procedures (SMPs) for Control of Foot and Mouth Disease (FMD) in the Greater Horn of Africa

Standard Methods and Procedures (SMPs) for Control of Foot and Mouth Disease (FMD) in the Greater Horn of Africa

This information product is made possible by the support of the American People through the United States Agency for International Development (USAID). The contents of this information product are the sole responsibility of the authors and do not necessarily reflect the views of USAID, the United States Government or AU-IBAR.

The Director
African Union – Inter-African Bureau for Animal Resources (AU-IBAR)
Kenindia Business Park
Museum Hill, Westlands Road
P.O. Box 30786
00100, Nairobi, KENYA
or by e-mail to: ibar.office@au-ibar.org

ISBN: 978-9966-077-10-3

Citation: AU-IBAR, 2014. Standard Methods and Procedures (SMPs) for Control of Foot and Mouth Disease in the Greater Horn of Africa. Nairobi.

Table of Contents

Foreword

The arid and semi-arid lands of the Horn of Africa (HOA) are home to poor and vulnerable populations, the majority of whom rely on livestock to sustain livelihoods. However, the performance of livestock in the region remains low, given the widespread occurrence of transboundary animal diseases (TADs) that are responsible for production losses, and reduced performance of intra- and inter-regional trade in livestock and livestock products. Because of disease outbreaks, live animal exports have been severely constrained during the past two decades, by bans imposed by importing countries to reduce risks associated with these diseases.

To address the negative impact of TADs on livestock trade, AU-IBAR and ICPALD together with the participating countries in the region, with financial support from the United States Agency for International Development (USAID), have developed a framework to support harmonization and coordination of the control of the diseases, referred to as the Standard Methods and Procedures (SMP) Approach. The SMP approach involves strengthening capacities of member states for surveillance, epidemiology, laboratory diagnostics, disease control programmes, and communications. The fundamental aspect of the approach is the linking of disease prevention and control activities in a country, to a set of regional minimum standards and procedures for TADs prevention and control in line with the World Organization for Animal Health (OIE) standards.

The minimum standards, procedures, methods and goals for a particular disease are contained in an individual SMPs. It deals with subject areas of surveillance, laboratory procedures and disease control, and states minimum standards, procedures and goals that must be met for harmonized regional control of a disease.

This booklet presents the SMPs for Foot and Mouth Disease (FMD) and deals with the specific dynamics of FMD prevention and control in the Greater Horn of Africa (GHoA).

The compilation of the materials in the SMPs for FMD, taking into consideration the characteristics of the Greater Horn of Africa, was made possible by technical experts from the region with technical support from AU-IBAR, FAO, OIE and AU-PANVAC. AU-IBAR is indebted to many scientists who reviewed the document and especially to Dr. James Wabacha the coordinator of the SMP-AH project for coordinating the preparation of the SMPs.

The SMPs for FMD targets field veterinary personnel, policy makers, laboratory personnel and veterinary students in the region.

Professor Ahmed El-Sawalhy
Director
African Union Inter-African Bureau for Animal Resources (AU-IBAR)

1.0 Introduction

1.1 The Standard Methods and Procedures (SMP)

The Standard Methods and Procedures (SMP) approach is designed to guide and harmonize the work of Departments of Veterinary Services (DVSs) in the Greater Horn of Africa (GHoA) region in their approach to the control of trade-related Transboundary Animal Diseases (TADs).

Standard Methods and Procedures are operational protocols to create uniformity in animal disease detection, diagnostics and control procedures throughout the GHoA. An individual SMP is a protocol for detection and control that outlines the measures to be undertaken in respect to a given disease. The SMP deals with subject areas of surveillance, laboratory procedures and disease control, and specifies procedures, minimum standards, and goals that must be met for harmonized regional control of the disease. It is supported with details as specified in Standard Operating Procedures (SOPs) for each subject area that are designed to fit the structure and capabilities of a given nation.

An SMP is a functional, action oriented management support document and is not intended to provide a detailed description of the disease. It is a live and flexible document that can be changed as new science and new techniques for detection, diagnosis and control are discovered.

This SMP deals with the dynamics of Foot and Mouth Disease (FMD) and specifies standards, methods, and procedures for management and control of FMD domesticated to the peculiarities of the GHoA. The design is also intended to support the entry and progression of the GHoA countries in the FAO-OIE Progressive Control Pathway for the Foot and Mouth Disease (PCP-FMD).

1.2 Foot and Mouth Disease

Foot and Mouth Disease (FMD) (*Aphthae epidemicae*) is a highly infectious disease caused by a virus in the genus *Aphthovirus*, family Picornaviridae. There are seven serotypes of FMD virus (FMDV) namely O, A, C, SAT 1, SAT2, SAT3 and Asia 1 that affect cloven-hoofed animals, including domestic and wild bovids, ovines, caprines and porcines. In the Greater Horn of Africa region, all the listed strains are present except Asia 1 though serotype C is now less frequent and was last reported in Kenya in the year 2004. Infection with any one serotype does not confer immunity against another and in essence the serotype and their many sub-serotypes are like different FMD diseases in the region. The virus causes a high fever for two or three days, followed by vesicles inside the mouth, mammary gland and on the feet that may rupture to blisters and cause drooling and lameness.

Clinical signs can vary from mild to severe and fatalities may occur especially in young animals. The epidemiological roles of different species vary. Domestic pigs, wild pigs and warthogs in the GHoA act as amplifier hosts, while the African buffalo (*Syncerus caffer*) can maintain sub-clinical infection with low intermittent viral excretion and act as a reservoir for the SAT viruses. The disease may be spread by infected animals through aerosols, contact with contaminated farm equipment, vehicles, clothing or feed, and by domestic and wild predators. Animal movement and wildlife reservoirs are important for transmission of FMD in the region. Geographic barriers that restrict movements are a key to stopping or limiting the spread of the disease in the GHoA.

FMD is considered a Transboundary Animal Disease (TAD) with threat to trade of live animals and their products, and is also considered a livestock production disease because of its negative impact on meat and milk production. How active FMD is handled in the differing production systems, e.g. pastoral livestock production, intensive dairy and beef production, and swine production, all present significantly different options and goals. Containment of FMD demands considerable efforts in movement restrictions, including quarantine and vaccination. FMD is considered endemic throughout the GHoA and regional coordination is essential for its improved control. GHoA countries should all enter the FAO/OIE Progressive Pathway Plan for FMD control with each nation developing a strategic plan for FMD control to fit its farming systems and known FMD prevalence.

2.0 Definitions

2.1. Surveillance and Epidemiology

Surveillance

Means the systematic collection, collation and analysis of information related to animal health, and the timely dissemination of information so that action can be taken.

Passive surveillance

A method of surveillance that enables veterinary authorities to collect animal health information from disease reporting stakeholders.

Active surveillance

A method of surveillance in which animal health information is collected through purposeful and planned interventions.

Syndromic surveillance

This is a surveillance approach based on observation of the main signs of disease.

Targeted surveillance

A form of active surveillance based on probability of occurrence of disease in a given area.

Risk based surveillance

A form of active surveillance that focuses on a certain area or livestock population based on perceived level of threat, risk and/or consequences.

Participatory disease surveillance

This is a form of active surveillance that uses participatory approaches in search of disease, including input from local livestock producers and others in the livestock value chain.

Epidemiological unit

Means a group of animals with a defined relationship that share approximately the same likelihood of exposure to a pathogen. This may be because they share a common environment (e.g. animals in a pen), or because of common management practices. Usually, this is a herd or a flock. However, an epidemiological unit may also refer to groups such as animals belonging to residents of a village, or animals sharing a communal animal handling facility. The epidemiological relationship may differ from diseases to diseases, or even strain to strain of the pathogen.

Risk mapping

A tool used for identification, assessment, communication and mitigation of a disease in a certain geographical area.

Zero reporting

Periodic standard reports noting that surveillance in any form for a given disease has been carried out and no disease occurrence has been encountered. Zero reports are a valuable tool to indicate negative results of constant and ongoing passive and/or active surveillance.

2.2 Disease Status Areas

Endemic areas

Geographic areas where FMD disease is known to be always present at a low level of incidence.

Area of no known disease status

It is an area where the disease has never been reported.

2.3 Planning Documents

Standard Operating Procedure (SOP)

A plan of action for a particular undertaking that stipulates details of what must be done to accomplish the task.

Preparedness Plans

Preparedness planning involves readiness action beforehand like capacity building, equipment procurement, personnel responsibility allocation, and training in all the disciplines that support effective disease control, e.g. epidemiology, laboratory, disease management, etc. Preparedness and contingency planning approaches may be critical response tools in areas that are free of disease to prevent new infection or re-infection.

Rapid Response Plan

A pre-programed plan for immediate action to a report of an outbreak of a TAD or other emergency disease with the goal of eliminating the index case and preventing spread. The Rapid Response Plan includes three components: the Epidemiology Section for disease investigation; the Laboratory Section for sampling and confirmation; and the Disease Control Section for immediate disease control interventions.

Contingency Plan

An operational plan designed for immediate response and control of a disease outbreak, typically composed by the Department of Veterinary Services, for use within that country.

The Progressive Control Pathway for FMD Control (PCP-FMD)

A global FMD control strategy produced by OIE and FAO that outlines a progression of stages from "Risk Not Controlled" to "Free Without Vaccination" with details on how a country can improve their FMD control and progress through the Five Stages.

2.4 Personnel

Veterinary Officer

Government employed veterinarians.

Veterinary Personnel

All people associated with veterinary work including public veterinary staff (government at any administrative level) and private veterinarians and their staff members.

3.0 Surveillance and Epidemiology

For FMD disease control, there is need for effective programmes that include surveillance, epidemiology and laboratory diagnosis as necessary elements. It is essential for surveillance to use a standardized case definition.

3.1 Case Definition for FMD

FMD will be suspected in cattle, sheep, goats, pigs and other cloven-hoofed animals if any one or more of the following clinical signs are encountered: unruptured vesicles; blisters and sores in the mouth, tongue, teats and feet at the coronary band and interdigital space; lameness, salivation, discharges from the nose and the mouth.

Differential diagnosis includes Rinderpest, Bluetongue, Foot Rot, Malignant Catarrhal Fever (MCF), Vesicular Stomatitis, physical injuries (feet and tongue), Contagious Ecthyma, Peste des Petits Ruminants (PPR), Rabies, mineral poisoning.

3.2 Predisposing Factors

The surveillance and epidemiological investigations should consider the predisposing factors:

3.2.1 Close contact associated with availability of water and feed

FMD transmission is by close contact. In pastoral production systems particularly during drought periods, animals congregate at the limited pasture and watering points available and this increases the risk of spread of the disease.

3.2.2 Breed and immunological status

Severity of FMD outbreaks varies with breeds and immunological status of the susceptible population. Improved breeds and exotic breeds show more severe disease compared with local breeds. Infection of isolated naive populations is usually more severe when compared to endemic populations. Endemic populations may only show sub-clinical or mild infections as seen in pastoral areas of the GHoA.

3.2.3 Closed and open management systems

Endemicity is supported by open systems and frequent livestock movements and mixing of different herds as seen in the pastoral areas of the GHoA. Closed systems, like in the dairy systems of the highlands of the GHoA, where biosecurity is breached occasionally, may give rise to epidemic situations of FMD.

3.2.4 Unregulated trade, livestock movement and proximity between open endemic and closed systems

Unregulated trade without quarantine between relatively closed systems is another key predisposing factor for FMD emergence and spread as is proximity between open endemic and closed systems.

3.3 Categorization of FMD Status Areas

For purposes of this SMP, FMD surveillance in both pastoral and intensive livestock production systems will be categorized in the following areas:

a. Area of no known disease status
b. Infected areas

3.4 Objectives of Surveillance

a. Demonstrate the presence or absence of clinical disease or infection and early detection;
b. Delineate the distribution and occurrence of the disease or infection;
c. To understand the epidemiology of FMD and virus biology in the domestic animals and wildlife;
d. Provide data for use in risk analysis, mapping, social economic impact studies and for targeted interventions;
e. Monitor and measure success of interventions.

3.5 Administrative Preparations for Surveillance

A functional surveillance system requires improvement and maintenance of capacity for FMD control including the following:

a. Sensitize, create awareness and train livestock value chain actors, including producers, both farmers and pastoralists, middle men, traders and transporters, and slaughter house attendants on disease recognition and reporting (using convenient methods such as mobile phones, digital pen and paper, etc).
b. Train field veterinary personnel (public and private) on FMD recognition and reporting, use of appropriate standardized case definitions, a well-organized reporting system, and a good animal health data management system, e.g. ARIS 2.
c. Equip veterinary services with necessary logistical materials and provide adequate technical staff to undertake investigation of reported FMD cases. The veterinary services itself should be equipped, at appropriate administrative levels, with necessary sample collection equipment, disease reporting tools and materials including standardized reporting formats, mobile phones, digital pens, etc.
d. Policy/legal frame work supportive of surveillance.

3.6 Surveillance in Areas of no Known Disease Status

In areas of no known disease status, surveillance is aimed at detecting presence or absence of FMD.

3.6.1 Passive surveillance and passive surveillance field actions

a. The national veterinary authorities will engage and sensitize livestock value chain actors, including producers, traders and transporters, and abattoir workers to report any disease events encountered to the nearest animal health facility, either public or private. This will include educational and informative materials on disease recognition and reporting, and use of methods such as mobile phones, digital pens, pen and paper, radio and television programmes, posters, information leaflets, community meetings, etc.).
b. Veterinary personnel undertaking routine animal health activities e.g. market stock route inspection, vaccination campaigns, extension services, abattoir activities, etc. are expected to carry out syndromic surveillance during which they will inspect livestock for signs of clinical disease and collect data from livestock keepers.
c. Communication materials including field syndromic manuals shall be developed and disseminated to make it easier for FMD-related syndromes to be easily recognized by value chain actors, including producers, traders and transporters; and wildlife actors.
d. Stakeholders along the value chains (livestock producers, traders, transporters, butchers, abattoir workers, veterinary personnel and private animal health providers, and others) will be sensitized.
e. In case of reports (written or rumors) of suspected FMD from the community and other stakeholders, the responsible veterinary personnel will conduct further investigation with sample collection and submission to the laboratory.The responsible veterinary personnel will immediately report to the CVO and make a record in the standard reporting format.
f. If a disease outbreak is confirmed, veterinary authorities shall institute appropriate control measures as indicated under section five.
g. The records will also be submitted to the Central Epidemiology Unit by the 15th of the following month in the standard monthly report.

3.6.2. Active surveillance

The following are the major approaches to be considered under active surveillance. Each of these approaches can be used alone or in combination as deemed necessary.

3.6.2.1 Sero-surveillance

a. Design a survey protocol outlining sample size determination, sampling method,

target population, sampling units and sampling frame taking into consideration livestock and wildlife;

b. Prepare data collection tools, including, questionnaires for epidemiological interviews, forms, and data collection software;
c. Mobilize survey teams composed of properly trained personnel;
d. Develop a survey programme together with the survey teams;
e. Share the programme with relevant stakeholders in targeted areas;
f. Ensure that all necessary technical and logistical equipment is in hand;
g. Collect blood samples using appropriate tools and techniques such as vacutainers, filter paper, microbleeders, syringes, etc.;
h. Ensure proper environment and time for serum separation, and proper storage of sera;
i. Ensure accurate labeling of samples, maintenance of test and identification records, the samples cold chain, and proper laboratory submission procedures;
j. Data will be entered in the Central Epidemiology Unit database for analysis and reporting;
k. If laboratory testing detects a positive sample, the responsible veterinary personnel should conduct an investigation;
l. If a disease outbreak is confirmed, veterinary authorities should institute appropriate control measures;
m. Ensure that activity reports are compiled as soon as the exercise is completed in the standard monthly report.

3.6.2.2 Syndromic (clinical) surveillance

a. Veterinary departments should develop programmes to undertake syndromic surveillance in predefined areas to include among others: farms, livestock markets, stock route, holding grounds and abattoirs, during which they will inspect livestock for signs of clinical disease and collect data from livestock keepers.
b. Any disease syndrome characterized by laboured breathing, discharges from the eyes, nose and mouth, sores in the mouth and diarrhoea should be reported to the CVO and will be investigated in order to confirm or rule out FMD.
c. If disease is confirmed, the responsible veterinary personnel should immediately report to the CVO in the standard reporting format.
d. If the disease is not confirmed the reporting officer should file a zero report, indicating that FMD was not found in the flock/herd.
e. Submit records to the Central Epidemiology Unit by the 15th of the following month.
f. Share reports generated thereof promptly with the relevant stakeholders.

3.6.2.3 Wildlife surveillance

a. If possible conduct retrospective studies using preserved wildlife sera;
b. Disease information generated out of such studies should be submitted to relevant veterinary authorities to benefit disease control programmes among livestock keeping communities in areas within the livestock-wildlife interface;
c. Ensure sharing of periodic reports between veterinary authorities and wildlife managers regarding disease outbreaks.

3.7 Surveillance in an Infected Area

3.7.1 Passive surveillance field actions

The passive surveillance field actions will be undertaken as described in the section, 3.6.1 on passive surveillance and passive surveillance field actions in areas of no known disease status.

3.7.2 Active surveillance

Targeted/risk-based surveillance that focuses on a certain area based on risk will be undertaken. Active surveillance will also be undertaken when a report of possible FMD has been accepted as credible. The purpose of the surveillance will be to confirm the presence or absence of FMD in an area; to determine the extent of the disease/infection; and to identify the strain involved to inform the disease response.

The following are the major approaches to be considered under active surveillance. Each of these approaches can be used alone or in combination as deemed necessary.

3.7.2.1 Sero-surveillance field actions

The sero- surveillance field actions will be undertaken as described in the section, 3.6.2.1 on sero-surveillance field actions in areas of no known disease status.

3.7.2.2 Syndromic (clinical) surveillance

The syndromic (clinical) surveillance will be undertaken as described in the section, 3.6.2.2 on syndromic (clinical) surveillance in areas of no known disease status.

3.7.2.3 Participatory disease surveillance (PDS)

The purpose of PDS is to identify disease foci, establish and map the history of FMD in infected areas using the case definition of FMD. PDS is a good tool to establish the disease history for "the syndrome" or the disease in an area. It can be used to map the history of the disease in an infected area. There may be areas where disease occurred in the last month or half a year ago or more than a year ago. Obtaining this information would help in understanding the epidemiology of the disease. PDS is based

on communication and transfer of indigenous knowledge for animal diseases, using a variety of procedures. To implement PDS follow the actions below:

a. Training (capacity building) of veterinary personnel on the technique of PDS;
b. Relevant veterinary authorities identify targeted risk areas and communities concerned;
c. Prepare relevant checklists;
d. Draw up a PDS programme and share it with the target communities;
e. Identify key contact people and if possible translators to be used;
f. Implement informal interviewing;
g. Undertake ranking/ scoring, seasonal calendar, time lines, mapping and any other relevant tools in a participatory manner with the local communities;
h. Undertake visualization of data to achieve a common understanding with the communities;
i. Undertake data cross-checking by probing, triangulation and laboratory diagnosis for confirmation;
j. Complement information so far collected with secondary information sources, direct observation and laboratory diagnosis;
k. Submit a report to veterinary authority;
l. Share reports generated thereof promptly with the relevant stakeholders to enhance ownership.

3.7.2.4 Wildlife surveillance

Where there is a suspicion of a spillover of the FMDV from the wildlife to the domestic animals and vice-versa, particularly at the interface, then an active surveillance may be undertaken to identify the serotype involved to inform intervention.

A better understanding of the epidemiology of FMDV in wildlife and wildlife/livestock interface areas in the countries and in the region is needed as it will determine circulating strains of FMDV and inform effective disease control programmes.

Use of opportunistic sera and/or tissue samples collected by wildlife personnel during programmes they undertake such as translocation, research, or disease monitoring for their own purposes should be taken advantage of. There has been a great deal of research done on the subject of the wildlife reservoir that should be reviewed in addition to any new research particularly reviewing cryopreserved sera, retrospectively.

3.8 Epidemiological Investigation

a. Collect information to trace source and spread of FMD, including trace back and forward;

b. Collect data for geospatial analysis and risk mapping;
c. Gather information for investigation of factors related to livestock management and movement to determine source of outbreaks and spread of disease and for identification of appropriate intervention strategies;
d. Collect information to assess if the disease outbreak has been controlled;
e. Post FMD outbreak surveillance may be intended to confirm freedom of the area/ herd(s) from infection, to detect viral activity in a vaccinated population, and to establish whether or not a vaccination campaign has been effective;
f. Collect data on socioeconomic impacts of the disease outbreak for use in PCP-FMD reports.

4.0 FMD Laboratory Detection, Diagnosis

All laboratory procedures described in this SMP are based on the OIE Manual of Diagnostics.

The choice of what laboratory tests to use for national disease control programmes is at the discretion of the Veterinary Authority. For livestock export trade and for any other FMD susceptible animals moving internationally, they require OIE approved laboratory testing or other tests as agreed between importer and exporter. All laboratory diagnosis and serotyping should be carried out in a facility that meets requirements for the containment of Group 4 pathogens. Sample testing will be carried out in laboratories approved by the veterinary authorities. Serological tests for FMD are performed in support of four main purposes:

- To certify individual animals prior to import or export, i.e. for trade;
- To confirm suspected cases of FMD;
- To substantiate absence of infection;
- To demonstrate the efficacy of vaccination.

4.1 Minimum Pre-requisites

a. Ensure the laboratory has capacity to carry out basic specific and sensitive assays for confirmatory diagnosis of FMD;
b. Create a schedule for performance of proficiency testing to maintain laboratory standards;
c. Processing of tissue samples or whole blood for virus identification or isolation in the laboratory should be under appropriate bio-containment;
d. Laboratory has standard operating procedures for sample collection, handling, packaging, transportation and storage of the samples.

4.2 Diagnosis of FMD

4.2.1 Clinical diagnosis

For field diagnosis of FMD look for one or more of the following main clinical signs in cattle, sheep, goats, pigs and other cloven-hoofed animals that are suggestive of FMD:

- Vesicles, blisters and sores in the mouth, tongue, teats and interdigital space and coronary band in the feet;
- Salivation;
- Discharges from the nose and the mouth;
- Lameness;
- Sudden death in young animals.

Wildlife showing these signs should also be reported and investigated for FMD or appropriate differential diagnosis.

While a tentative diagnosis of FMD can be made based on clinical signs, laboratory testing is required for confirmation of the disease; and to identify the strain involved for vaccine matching.

Whereas clinical FMD is frequently reported in the more arid and remote areas of GHoA under traditional extensive pastoral production, laboratory isolations, confirmations and typing are infrequent, relative to the same in sedentary populations. This could partly be attributed to the logistical constraints of collecting viable specimens and transmission to laboratories, often hundreds of kilometres away.

4.2.2 Post mortem examination

The following main post mortem signs are suggestive of FMD:

- Erosions on the tongue, mouth, nose, teat, interdigital space and coronary band feet;
- Myocarditis and myositis in young animals.

4.2.3 Collection of samples

Ensure sample collection procedures in the field are in line with requirements for laboratory assays to be performed, either for antibody or antigen detection or virus isolation. Observe the following requirements:

a. Collection and handling of field samples;
b. Proper biosecurity precautions are essential to ensure that qualified personnel employed in surveillance and diagnosis do not transfer virus between premises;
c. Samples from suspected cases of FMD must be transported under bio-secure conditions to authorized laboratories;
d. It is imperative that proper FMDV transport media be used for FMD epithelial samples, and samples must be kept refrigerated or on ice until received by the laboratory;
e. Animals should be properly restrained during sample collection to avoid injury to the personnel and for animal welfare reasons;
f. Samples in the laboratory must be properly preserved in appropriate conditions.

4.2.4 Suitable samples

4.2.4.1 In live animals

a. Epithelium from unruptured or freshly ruptured vesicles from the tongue, buccal mucosa, teat or feet;
b. Vesicular fluid;

c. Whole blood in anticoagulant tube for virus and whole blood in dry tube for serum;
d. Probang samples of oesophageal/pharyngeal fluids;
e. Buccal cavity and throat swabs if probang not available.

4.2.4.2 In dead animals

Sample collection in dead animals, wherever possible, is as described in live animals (4.2.4.1), and additionally myocardial tissue and blood clots may be taken.

4.2.5 Transport of samples

The samples should be transported in phosphate buffered saline with glycerol (50%) at PH 7.2-7.6 or other appropriate media as described in the OIE Manual of Diagnostics and chilled and transported under refrigeration or on ice to the laboratory.

4.2.6 Laboratory testing

A variety of tests for FMD are available depending on the requirement of the test, intended purpose and the capabilities of the laboratory.

4.2.6.1 Direct diagnostic assays - Identification of the agent

a. Virus Antigen detection
    i. Indirect Sandwich ELISA (Ferris &Donaldson, 1992; Roeder & Le Blanc Smith. 1987) i.e. OIE preferred test.

b. Virus Nucleic acid recognition methods
    i. Reverse transcription PCR (RT-PCR) techniques (Reid et al., 2000)
    ii. Real-time RT-PCR (Reid et al., 2003 and Shaw et al., 2007)

c. Virus isolation methods: observation of cytopathic effect on tissue culture
    i. Suitable samples are animal tissues - tongue epithelial tissue (preferred), lymph nodes, lungs, spleen and liver. Whole blood and swabs at early stage of the disease
    ii. Suitable cell cultures for FMDV isolation are:
        - Primary cells (thyroid - bovine and kidney cells of pig, lamb and calf)
        - Cell lines (Baby Hamster Kidney – BHK21, IBRS2)

4.2.6.2 Indirect diagnostic assays – Antibody Detection tests

Two types of serological tests for FMD are those that detect antibodies to viral structural proteins and non-structural proteins (SP and NSP respectively):

a. Antibodies directed against structural protein (SP) indicate both vaccination and infection. These tests are the prescribed tests for trade and are appropriate for confirming previous or ongoing infection in non-vaccinated animals as well as for

monitoring the immunity conferred by vaccination in the field. The tests are serotype specific and are highly sensitive. These include the following:

i. Virus neutralisation test – VNT
ii. Solid-phase competition ELISA
iii. Liquid-phase blocking ELISA

b. Antibodies directed against Non-Structural Protein (NSP) can be used to indicate infection if purified vaccine is used. The detection of antibody against the NSPs can be used to identify past or present infection with any of the seven serotypes of the virus, whether or not the animal has also been vaccinated. Therefore the tests can be used to confirm suspected cases of FMD and to detect viral activity or to substantiate freedom from infection on a population basis.
c. For certifying animals for trade, the NSP tests have the advantage over SP methods in that the assay can screen any FMD infection. These include the following:
   i. Indirect Enzyme-Linked Immunosorbent Assay (Indirect ELISA-) and
   ii. Enzyme-Linked Immunoelectro Transfer blot assay

5.0 Disease Control

In the Greater Horn of Africa region, eradication of FMD is complicated by multiple serotypes, pastoralist systems, and the presence of huge wildlife populations, in particular the African buffalo which can play a significant role in maintenance and spread of SAT serotypes of FMD virus. The prevention of FMD in different ecosystems should take into consideration the following:

a. In arid and semi arid lands, to keep a balanced ecosystem with maximum multiple economic benefits, whilst sustaining the environment for future generations, control will rely on attention to the breed of livestock and avoidance of susceptible exotic breeds as much as possible. However, the trade-off between susceptibility and production should be kept in mind.
b. In ASAL, once endemic stability is reached with local strains, movement control in combination systematic vaccination will lead to herd immunity that will significantly reduce viral excretion and disease risk.
c. Use of vaccines in susceptible populations. However, virus variability, short immunity period will remain a challenge.
d. Control of animal movements from outside the ecosystem to reduce incursion of new serotypes and sub-serotypes.
e. Challenges such as uncontrolled movement of animals in the region, limited financial and human capacity, inadequate supply of quality and efficacious vaccines, and limited coordination between bordering countries all need to be taken into consideration for effective control of FMD in the GHoA region.

5.1 FMD Vaccine and Vaccination

5.1.1 General consideration for selection of appropriate vaccine

a. There is no cross-protection between specific serotypes and within serotype sub-strains;
b. FMD vaccine batch must be matched with serotype/strain in the field;
c. Any vaccine batch used should have AU-PANVAC Certificate;
d. For differentiation of vaccinated animals from infected ones during sero-surveillance, particularly in export animals, use new purified vaccines free from non-structural protein (NSP);
e. The duration of protection conferred by the vaccine is determined by whether the vaccine is oil-based or aqueous-based.

5.2 FMD Vaccine Quality Control

5.2.1 Vaccine strain matching with circulating field strains

a. Vaccination against one serotype of FMDV does not cross-protect against other serotypes and may also fail to protect fully or at all against other strains of the same

serotype;

b. Routinely undertake vaccine matching between the vaccine strain and the circulating field strains to optimize vaccination programme and to assess the suitability of the vaccine reserve;
c. Vaccine matching should be a preliminary consideration before importing or producing FMD vaccine;
d. Undertake quick matching using rapid kits but the results should be verified by regional support laboratories or OIE/FAO reference laboratory;
e. Vaccines must not be provided for field use until field virus and vaccine strain matching are complete;
f. Always submit samples from outbreaks to OIE reference laboratories to confirm the serotype of the circulating virus. This is important for vaccine matching and also for risk and outbreak mapping and for epidemiology footprint investigations;
g. Establish strong collaboration between national diagnostic laboratories and vaccine producing laboratories in order to improve vaccine matching.

5.2.2 FMD vaccine use and registration

a. All vaccines manufactured or imported to the country must be registered;
b. Encourage private-public partnerships to establish FMD vaccine production units.

5.3 Procedure for Vaccination in GHOA

a. In designated FMD vaccination areas, all cattle, irrespective of age, must be vaccinated against FMD according to directions for use of the vaccine;
b. Vaccination dates, herd identities and number of cattle vaccinated will be recorded; as much as possible make provision for appropriate protective clothing or staff uniform to increase public confidence in the professionalism of teams.
c. Mobilization of the community and creation of awareness, e.g. informing the affected communities of FMD outbreak, possible exposure, and response for control of the outbreak;
d. Mobilization of resources – financial, technical, and human – according to prepared contingency plans;
e. Vaccination should not be done in infected farms;
f. During an outbreak, ring vaccination within 10 km radius will be applied around outbreak areas starting from clean areas inward;
g. Routine scheduled mass vaccination using the specific field strain in vaccination areas within the countries will be carried out;
h. There is need for the countries to build capacity for local vaccine production;
i. Efforts should be made to have coordinated and harmonized vaccinations programmes across GHOA transboundary ecosystems. This should include harmonized vaccine

delivery and definition of the roles of the Government and private sector.

j. Identification of vaccinated animals with an appropriate system so that vaccination status is known;

k. It is recommended to undertake pre- and post-vaccination monitoring to know the serotype-specific immune status; and assess the efficacy of the vaccinations.

l. It is, however, noted that in the region, due to resource constraints and inaccessibility of large populations of livestock in extensive pastoral production systems, the efficacy of vaccination is rarely optimal with regard to desired frequency of vaccination, vaccine and field strain matching, and adherence to the standardized guidelines and operating procedures in vaccine cold chain management, asepsis and data recording.

m. It is further noted that the use of non-purified water-based vaccine also presents critical challenges in duration of conferred immunity and differentiation of infected as opposed to vaccinated animals.

5.4 Disease Control Planning

Advance planning is critical for effective disease control operations. Following are three different planning necessities that must be designed within the framework of the SMP for FMD.

5.4.1 Preparedness planning

Preparedness planning outlines what a government needs to do before an outbreak of a disease in order to be prepared for it. This includes all things that stakeholders must do e.g. capacity building, equipment procurement, personnel responsibility allocation, and training in all the disciplines that support effective disease control, epidemiology, laboratory and disease management.

5.4.2. Rapid response plan

A pre-programmed government plan detailing what the government will do in the event of an FMD incursion or outbreak from the point when a suspect case is reported. The goal is to eliminate the index case and prevent an epidemic spread. It also refers to a response to an increase in prevalence of an endemic disease situation. The Rapid Response Plan includes three components: the Epidemiology Section for disease investigation; the Laboratory Section for confirmation and sampling; and the Disease Control Section for immediate disease control interventions if need be.

It is important that the epidemiology and disease control sections of veterinary departments be prepared for full cooperation with the disease control programmes in cases of disease outbreak. Pre-planning for index case response is critical so that time is not lost when an index case is reported. The following should be undertaken.

a. Have in place rapid response teams;
b. Prepare kits with all equipment needed for effective rapid response to the index case;
c. Coordinate plans between epi-surveillance, laboratory, and disease control sections;
d. Ensure all needed equipment is identified and ready for action.

5.4.3 Recovery plan

The plan for the safe recovery or restoration of normal activities taking into account modified procedures and practices in light of the experience gained during the outbreak.

5.5 Main Considerations of FMD Control

a. Capacity for detection and taking of laboratory samples for FMD in the animal populations;
b. Capacity of laboratory for rapid identification and characterisation of field viruses collected against the vaccine in use (vaccine matching);
c. Capacity for rapid targeted vaccination based on the current epidemiological situation in any given risk area as determined by the surveillance or intelligence system;
d. Capacity for vaccine procurement that is able to respond to viral serotypes and sub-serotypes variation;
e. Capacity to continuously improve knowledge on livestock keeping systems and movements in the operational area;
f. Coordination, harmonization, complementarity and coherence of actions of veterinary departments at national and regional levels;
g. Good communication at national, regional and international levels with transparency;
h. Good extension outreach at national level;
i. Mitigating the economic impact of FMD for animal trade and animal products trade by introducing Commodity Based Trade (CBT) options to reduce need for elimination of the virus and the enormous costs associated with that approach. Increased use of CBT has potential to produce economic, environmental and ecosystem benefits to countries of the GHoA.

Main Epidemiological considerations for FMD control

Epidemiological investigation must determine the extent of the disease outbreak and delineation of the outbreak area (zonation) based on surveillance and diagnostic information. The epidemiological unit of response can be production system, ecosystem, administrative unit, , or geographic unit that provides a defined area on which response can be based.

Control should take into consideration the following:

a. Stock routes and stock trade routes;
b. Watering points, dipping points and communal pasture;
c. Geographic situation- administrative areas, i.e. districts, counties, regions, states and countries;
d. Production system – pastoralist, agro-pastoralist, sedentary, commercial;
e. Primary, secondary and tertiary market centres, both locally and regionally;
f. Quarantine centres and other export zones;
g. Socio-cultural issues.

Main consideration for movement control and quarantine in pastoral systems

a. The GHOA should take into account that movement control and quarantine is difficult to enforce despite the presence of existing legislations in most of the countries. Low successful prosecutions of its infringements attest to this. However, for effective FMD control, enforcement of controlled livestock movements and control of thefts should be enhanced;
b. The livestock movement control in the GHOA to be strengthened through application of livestock identification and traceability systems (LITS) along the livestock value chains;
c. Deliberate policies need to be put in place to support provision of pastures and watering points, for pastoral communities' utilization.
d. There is also need for governments support in construction of outspans and holding grounds to contain spread of infection particularly during drought.
e. To this end community based cross border meetings are necessary for information sharing and controlling diseases. This includes decisions on sharing of grazing area water points and trade.
f. Monitor livestock movement at check-posts, stock routes and border posts.

Main consideration for movement control and quarantine in closed systems

a. Animals will undergo veterinary inspection that must include mouthing of all the animals to be moved. Animals are only moved by truck direct to the abattoir under veterinary movement approval.
b. Movement restriction for index and contact flocks on an infected farm or one in which the disease is suspected must be put in place. In adjacent farms owned and managed by the same person or entity, even where they are miles apart, where movement of stock, labour or machinery has taken place, then the farm must be regarded as infected and quarantine imposed. An exception can only be made based on absolute certainty that there has been no movement of stock, labour and machinery between the two farms.

c. Settled areas in an administrative geographical unit need to be regarded as one unit unless the settled area is divided by a natural barrier which is likely to stop the spread of disease from one part of settlement to another and no movement of stock, labour and machinery has taken place between the areas. In the clean herd when it is absolutely necessary, animals may be moved for immediate slaughter if vaccinated at least 3 weeks and not more than 2 months earlier.
d. No movement of animals affected by FMD nor hides and skins and manure should be allowed to leave a farm whilst the quarantine is in force.
e. Horses should not normally be allowed to leave an infected farm but may be allowed in special circumstances, provided their feet are disinfected with 5% sodium bicarbonate and thoroughly rinsed with clean water at the boundary of the farm.
f. Unless absolutely unavoidable, only one infected farm or herd should be visited per day. Adequate sanitary and bio-security precautions shall be observed by veterinary staff to avoid the mechanical spread of disease from farm to farm or between herds. After visiting infected farms, all personnel should wash and change clothing, and all vehicles, instruments be thoroughly disinfected.
g. The most effective disinfectant when dealing with FMD is sodium bicarbonate (magadi soda) used as a 5% solution. It can be made up approximately by mixing a handful of sodium bicarbonate with 10 litres of water. Hands, vehicles and clothings should afterwards be rinsed with clean water.
h. Milk from infected farms may be moved out of a dairy or processing plant provided the cans are washed externally with sodium bicarbonate and the milk pasteurized at the farm or point of destination.
i. Inseminations may be done on infected herds as long as proper precautions to stop transmission of the disease are taken into account.
j. Notices of the outbreak must be put at the entry of the farms and road blocks with disinfection of vehicles and pedestrians as necessary.
k. Stop all movement of exposed animals into marketing channels until the outbreak is controlled (a very important consideration for trade negotiations).

Main consideration for FMD control in livestock markets

Animals will undergo veterinary inspection that must include mouthing of all the animals moving into the market.

If a livestock market has been exposed to active FMD, the following actions should be considered:

a. Closure of affected market;
b. Access to market records for establishing what livestock has been exposed ;
c. Launch epidemiological investigation with immediate trace back and trace forward

to determine source of infection and exposed contact animals in market;

d. Undertake other appropriate control measures like disinfection of the contaminated areas with sodium bicarbonate.

Main consideration for FMD control in livestock export quarantines

a. Livestock for export purposes will be held in export quarantine stations and treated according to the requirements of the importing nations;
b. Parameters for such quarantine are under authority and control of the export quarantine station managers and regulated by the Chief Veterinary Officer;
c. These parameters are based on the Standard Methods and Procedures for Quarantines in the IGAD Region;
d. Animals originating from countries in GHOA that have vaccination certificates are exempt from testing and vaccination. Animals from other areas without proof of vaccination are tested and vaccinated depending on the destination market.
e. Animals originating from within country and destined for export are quarantined and vaccinated according to the market destination.

Main consideration for zoning for FMD control

Keeping in mind the progressive implementation of the FAO-OIE PCP-FMD, with adaptations that make the programme fit the context of the GHoA ecosystems, livestock types, management systems and trade patterns, FMD control may be zoned into infected, protection and free zones depending on FMD status and epidemiologic factors at play based on guidelines on zoning from OIE and the OIE/FAO Progressive Control Pathway for FMD.

a. Disease security in the free zones will be maintained by application of natural or physical barriers, surveillance, controls in border posts and quarantine stations, and the use of a protection zone.
b. The protection zones will be upgraded in a structured process to free zones, thereby increasing the areas under free status and reducing the area under infected status. All efforts will be undertaken to harmonize these measures.
c. Activities in infected zones shall include passive and active surveillance to monitor FMD serotypes in circulation in domestic animals and susceptible game.
d. Activities in protection zones shall include syndromic participatory disease search to be conducted every 4 months and vaccination with pre- and post-vaccination sero-monitoring carried out as appropriate.
e. All animals destined for free zones will be quarantined in an approved quarantine camp within the protection zone.
f. All animals in quarantine moving to free zones must be negative for FMDV after 21 days. Strict movement control will also be maintained for products.

g. There will be effective inspection of animals and products along stock routes, markets, dip sites, and entry points to the country and to the free zones.
h. Activities in a free zone will include weekly and monthly veterinary inspections, bi-annual targeted clinical and serological surveillance for detection of evidence of circulating virus using antibody detection tests. Routine vaccination will not be allowed in the free zone.
i. Activities to be carried out in FMD compulsory vaccination areas will include compulsory mass vaccinations using appropriate mixes of serotypes involved as per the instructions of the manufacturers, appropriate identification and pre- and post-vaccination sero-monitoring.

6.0 Reporting and Information Management

Recognizing the need for an early rapid reaction to disease, there is need to ensure timely reporting and rapid response, and sharing of information.

Requirements for reporting and information management are:
a. Capacity building of Information Technology personnel
b. Standard epidemiological data entry forms
c. Information database and management
d. Adoption of common information management system i.e. ARIS-2
e. Use of online livestock movement permit issuance to improve flow of information leading to efficient movement control, collation of data and ease of doing business for livestock keepers and traders
f. Maintenance of rumour registers and zero reports
g. Strengthen feedback mechanisms to stakeholders within countries
h. Information sharing at regional and continental level
i. Reporting to OIE/WAHIS, RECs, AU-IBAR/ARIS-2 and FAO

7.0 FMD and Trade

Foot and Mouth disease is a serious limitation to the export of livestock and livestock products especially the large stock (i.e. cattle). Enhanced control of FMD to meet the importing countries / OIE standards will help enable access this rich market.

Given the status of FMD in GHOA, livestock for export need to pass through export quarantine stations, where all FMD and other disease control requirements for importing nations are met. Protocols for the quarantine stations are well defined and dealt with in the SMP for Quarantines in the IGAD Region.

Livestock moving within the IGAD Regional Economic Community area or leaving the Greater Horn of Africa region for other international destinations will be subject to quarantine and testing requirements of the importing nation. Current import regulations for all importing nations are used by the export quarantines and may change from time to time, so are not included here.

8.0 Risk Analysis and Risk Mapping

The risk analysis (RA) paradigm includes four components – hazard identification, risk assessment, risk management and risk communication. Risk assessment is a scientifically based process of evaluating hazards and the likelihood of exposure to those hazards, and then estimating the resulting impact. The risk management phase involves using all of the information gathered during the assessment to evaluate policy options. Risk communication refers to communicating the results of the risk analysis involving all stakeholders.

It is essential for the countries in the Greater Horn of Africa to better understand the disease situation in order to implement appropriate disease control strategies for progressively controlling FMD. In this regard, risk analysis is required to:

a. Determine the risk of FMD introduction (release, exposure and consequence) to areas of no known disease and to mitigate the risk due to FMD;
b. Assess the progress of intervention in the control of FMD in endemic and epidemic areas;
c. Communicate the results of RA to all the relevant stakeholders to assist in the mitigation of FMD.

8.1 Characterization and Analysis of FMD Risk

a. Determine the risk of FMD introduction to a disease free or controlled area and to mitigate the risk due to FMD, e.g. identify wildlife and domestic reservoirs, movement and interaction of animal populations, etc;
b. Assess the progress of interventions for control of FMD including fencing, routine vaccination, outbreak vaccination programmes, surveillance, movement control, etc;
c. Assess the consequences of FMD including mortality in young animals, reduced productivity, restricted market access, etc;
d. Communicate the results of risk analysis to stakeholders;
e. Risk mapping of FMD;
f. Continuous monitoring of both livestock and buffalo populations in interface areas to identify high-risk areas where close interaction and hence transmission are likely.

8.2 Risk Mapping of FMD

Risk mapping is a tool that can be used to visualize where outbreaks of disease are occurring and to determine the margins of the outbreak, thereby enabling movement control measures to be accurately determined. A good risk map is a valuable tool for trade negotiations when outbreaks happen and can be used to prevent total trade bans due to enhanced ability to control outbreaks and to also prevent exposed animals from entering trade channels.

Risk mapping can utilize various types of response variables e.g. defined syndrome, confirmed infection, or clinical cases. The analysis begins with the determination of the type of response variable to use (syndrome, infection, clinical cases), and the unit of analysis. It is easier to use the lowest administrative zone as the unit of analysis since surveillance data are usually aggregated at this level.

8.2.1 Requirements for risk mapping

a. Data – for the response variable as well as for the risk factors. Knowledge of potential risk factors is required to allow for the collation of all the data required at the same time.
b. Software: for data management (e.g. MS Access), statistical analysis (e.g. ArcGIS, R, STATA, MLwiN, etc.) and GIS mapping (e.g. Quantum GIS, ArcGIS, etc.).
c. Technical expertise to process and analyze data and generate risk maps. Much training on spatial epidemiology has been conducted in the region and it is expected that officers trained would be involved in this work.
d. Backstopping/support – Royal Veterinary College, FAO, ILRI, CIRAD.

8.2.2 Procedure for risk mapping

a. Data cleaning and verification to determine their validity and completeness. Where possible, field surveys can be done to ground-truth some of the data, or collect additional data that are required to commence the analysis.
b. The type of analysis to use depends on the quality of the data obtained. In cases where empirical data is not available, or it is only available for some aspects of the disease, risk mapping can be done using multicriteria decision modelling (MCDM). This approach generates qualitative estimates of risk, based on existing or hypothesized understanding of causal relationships. This requires expert elicitation process to generate perceived knowledge on the disease risk.
c. In cases where data is available only from infected areas, ecological niche modelling should be used. Ecological niche modeling relates to the disease occurrence in relation to environmental and other physical factors, to determine the suitability of an area for occurrence of the disease.

d. In cases where there is good data and so estimates of probability of disease occurrence can be obtained, standard statistical models such as logistic regression modeling can be used. This involves fitting a model to data and using it to predict the risk of the disease once it has been validated. Key considerations that should be made while building the model include the need to capture the hierarchical structure of the data in order to obtain reliable and accurate predictions.

Risk estimates generated from any of the methods described above are mapped using GIS software to obtain a risk map.

African Union – Inter-African Bureau for Animal Resources
(AU-IBAR)
Kenindia Business Park
Museum Hill, Westlands Road
PO Box 30786
00100 Nairobi
Kenya
Tel: +254 (20) 3674 000
Fax: +254 (20) 3674 341 / 3674 342
Email: ibar.office@au-ibar.org
Website: www.au-ibar.org