
Food and Agriculture Organization of the United Nations

# Disease reporting:

## notes for private veterinarians in Myanmar

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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# Abbreviations

| | |
|---|---|
| **AHD Law** | animal health and development law |
| **AHS** | African horse sickness |
| **ASF** | African swine fever |
| **ASFV** | African swine fever virus |
| **BQ** | black quarter |
| **BSE** | bovine spongiform encephalopathy |
| **CAHW** | community-based animal health worker |
| **CL** | cloacal |
| **CSF** | classical swine fever |
| **DBS** | dried blood spot |
| **EDTA** | ethylenediaminetetraacetic acid |
| **ELISA** | enzyme-linked immunosorbent assay |
| **EuFMD** | European Commission for the control of foot-and-mouth disease |
| **FAO** | Food and Agriculture Organization of the United Nations |
| **FMD** | foot-and-mouth disease |
| **GLEWS** | global early warning and response system |
| **H** | hemagglutinin |
| **HPAI** | highly pathogenic avian influenza |
| **HS** | haemorrhagic septicaemia |
| **IB** | infectious bronchitis |
| **IBD** | infectious bursal disease |
| **LBVD** | Livestock Breeding and Veterinary Department |
| **LPAI** | low pathogenic avian influenza |
| **LSD** | Lumpy skin disease |
| **LSDV** | Lumpy skin disease virus |
| **MD** | Marek's disease |
| **MOALI** | Ministry of Agriculture, Livestock and Irrigation |
| **MOLF** | Ministry of Livestock and Fisheries |
| **ND** | Newcastle disease |
| **N** | neuraminidase |
| **PCP-FMD** | progressive control pathway for foot and mouth disease control |
| **PCR** | polymerase chain reaction |
| **PD** | Pullorum disease |
| **PPR** | *Peste des Petits Ruminants* |
| **PRRS** | porcine reproductive and respiratory syndrome |
| **SDGs** | Sustainable Development Goals |
| **TB** | Tuberculosis |
| **TR/OP** | tracheal/oropharyngeal |
| **WAHIS** | World Animal Health Information System |
| **WOAH** | World Organisation for Animal Health |

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# Introduction

An animal disease **early warning system** is essential for the timely detection, reporting and communication of occurrence, incursion or emergence of diseases, infections or infestations in a country, zone, province or region. It is an integral component of emergency preparedness.

The key to success in handling animal disease epidemics is **early detection.** If a disease can be detected early in the phase of epidemic development, the possibility exists that it can be arrested and eliminated before it inflicts much damage.

Early detection presupposes that there is a surveillance system in place that will bring infection to light when it is first seen. Then the country's veterinary authorities can manage the problem before it becomes uncontrollable. In this way, they protect the local livestock industry and ensure food security for those closely dependent upon livestock. Early detection enables early warning and an early reaction, and surveillance is the primary key to effective disease management. Private veterinarians play a vital role in early disease detection.

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Chapter 1

# Notifiable animal diseases in Myanmar

## 1.1 Legal reporting responsibility for owner, livestock keeper or veterinarian

**The Animal Health and Development Law** (AHD Law) was enacted by State Law and Order Restoration Council on 25 November 1993. The Ministry of Livestock and Fisheries (MOLF) [now the Ministry of Agriculture, Livestock and Irrigation – MOALI], in the exercise of the powers conferred on it under the AHD law, named eight **List A** contagious animal diseases and nine **List B** contagious animal diseases by notification no. 44/99 on 5 August 1999.

In clause 3 of this notification, it states that,

The owner or a person in possession of the animal shall:

(a) inform promptly to an official of the Livestock Breeding and Veterinary Department (LBVD), in charge of the respective township or village tract or to a person designated for this purpose by the MOLF, when he knows the occurrence of any contagious disease in List A in his animals or if he finds the symptoms of any contagious disease in List A in the dead animal and shall also comply with the directives of such official or person in respect of the prevention and control of contagious disease.

(b) submit to inspection of the responsible official of LBVD in respect of the occurrence of any contagious disease in List B and comply with the directives of such official for the prevention and control of contagious disease.

## 1.2 List A and list B contagious diseases in Myanmar

**As of 31 December 2020**, the Ministry of Agriculture, Livestock and Irrigation listed 12 List A and 12 List B contagious animal diseases shown in Table 1 and Table 2.

**Table 1.** List A diseases

| No. | Name of disease | Affected animals |
|---|---|---|
| 1 | Foot-and-mouth disease (FMD) | Buffalo, cattle, sheep, goat, pig and elephant |
| 2 | Anthrax | Buffalo, cattle, sheep, goat, pig, elephant, horse, ass, mule and dog |
| 3 | Haemorrhagic septicaemia (HS) | Buffalo, cattle, pig and elephant |
| 4 | Black Quarter (BQ) | Buffalo, cattle, sheep and goat |

Notification number 44/99 (5-8-1999) and other notifications that notified the disease infected in animal as contagious animal disease by the Ministry of Agriculture, Livestock and Irrigation

**Table 1.** List A diseases (continued)

| No. | Name of disease | Affected animals |
|---|---|---|
| 5 | Classical swine fever (CSF) | Pig |
| 6 | Newcastle disease (ND) | Fowl, turkey and quail |
| 7 | Infectious bursal disease (IBD) | Fowl |
| 8 | Rabies | Dog, cat, buffalo, cattle, sheep, goat, horse, ass, mule and elephant |
| 9 | Highly pathogenic avian influenza (HPAI) | Poultry and wild birds |
| 10 | Porcine reproductive and respiratory syndromes (PRRS) | Pig |
| 11 | African swine fever (ASF) | Pig |
| 12 | Lumpy skin disease (LSD) | Cattle and buffalo |

**Table 2.** List B diseases

| No. | Name of disease | Affected animals |
|---|---|---|
| 1 | Brucellosis | Buffalo, cattle, sheep, goat, pig, horse, ass and mule |
| 2 | Tuberculosis (TB) | Buffalo, cattle, sheep, goat, pig, elephant and horse |
| 3 | Surra | Horse, ass, mule, buffalo, cattle and elephant |
| 4 | Glanders | Horse, ass and mule |
| 5 | Avian pasteurellosis (Fowl cholera) | Fowl, duck, turkey and quail |
| 6 | Infectious bronchitis (IB) | Fowl |
| 7 | Pullorum disease (PD) | Fowl, turkey and quail |
| 8 | Marek's disease (MD) | Fowl |
| 9 | Duck viral enteritis (Duck plague) | Duck |
| 10 | Bovine spongiform encephalopathy (BSE) | Cattle |
| 11 | *Peste des Petits Ruminants (PPR)* | Sheep and goat |
| 12 | African horse sickness (AHS) | Horse |

Chapter 2

# Selected notifiable diseases

All **List A** diseases are important and categorized as notifiable diseases. Myanmar veterinarians are familiar with most of them. In this chapter, some of the important diseases are selected that may have emerged in Myanmar after Myanmar veterinary graduates finished their training. These diseases may have significance due to trading importance, zoonosis, the liability of economic loss and significant impact on the health of wildlife.

## 2.1 Foot-and-mouth disease

Foot-and-mouth disease (FMD) is a highly contagious viral disease.

### Disease agent:

The disease is caused by a virus of which there are seven types or serotypes, each producing similar symptoms. Immunity to one type does not necessarily protect an animal against other types. This complicates FMD vaccination.

### Susceptible animals:

Cattle, sheep, goat, other cloven-hoofed ruminants, swine and elephant

### Zoonosis:

FMD is not recognized as a zoonotic disease. Humans are very rarely affected.

### Clinical signs:

**Cattle**: Under natural conditions, the average incubation time is three to six days. Fever, blisters (vesicles) in the mouth with quivering lips, drooling saliva and frothing of the mouth. Blisters on feet and lameness. Cows may develop blisters on their teats. Drop in milk production, weight loss and loss of appetite. The blisters rupture after some days, producing painful ulcers on the tongue and skin. Sudden death may occur in calves due to heart lesions.

**Pigs and small ruminants**: Lameness may be the main clinical sign observed.



Figure 1. Ruptured vesicles (blister) and ulceration in tongue and gum.

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Figure 2. Increased salivation.

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Figure 3. Lesions in the interdigital space and erosion in the hoof.

## Epidemiology of FMD:

The virus survives in lymph nodes and bone marrow at neutral pH but is destroyed in muscle when pH is less than 6.0, that is, after rigor mortis.

The disease can be spread by people, vehicles and other objects (fomites) contaminated by the virus. Airborne spread is possible because the virus is so infectious.

FMD is endemic in most of Southeast Asia and remains a major animal health problem within the region. Myanmar is an FMD-endemic country. Serotype 'O', 'A' and 'Asia 1' (WOAH/LBVD FMD Control Project in Sagaing and Mandalay Region). The table below shows the FMD serotype that occurred in Myanmar by decade.

**Table 3.** FMD serotypes that occurred in Myanmar

| FMD Type | 1950–1960 | 1961–1970 | 1971–1980 | 1981–1990 | 1991–2000 | 2001–2010 | 2011–2020 |
|---|---|---|---|---|---|---|---|
| O | 1956, 1958 | - | 1971, 1977, 1978 | 1982, 1989 | 1996, 1998, 1999, 2000 | 2001–2010 | 2011, 2015–2017 |
| A | - | - | 1971,1978 | - | - | 2010 | 2015 |
| Asia 1 | 1958 | - | 1971, 1977–1978 | 1982, 1989 | 1991, 1997, 2000 | 2001, 2005 | 2017 |

## Prevention and control

Outbreaks have been linked to the importation of infected meat and meat products. FMD is one of the most difficult animal infections to control. In endemic areas, culling may not be justified. Strict animal movement control is needed in addition to controlling the movement of equipment, vehicles and people. The livestock market is one of the disease-spreading areas, so vets should pay attention to biosecurity and recent disease information in the area.

Movement control is complemented by vaccination for susceptible livestock. Vaccines must protect against the particular virus strain prevalent in the area.

## Samples for laboratory confirmation:

Tissue from vesicles, scabs from abrasions and erosions in virus transport media (VTM) for antigen detection and virus gene sequencing. Serum samples for detection of antibody and virus typing. Please contact the veterinary diagnostic laboratory for biosecure sample collection and transport instructions.

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

FMD is one of the most important contagious diseases in trading cloven-hoofed animals. To promote the cattle trade, it is necessary to get a better status in Progressive Control Pathway for Foot and Mouth Disease Control (PCP-FMD). The PCP-FMD is developed by FAO and the European Commission for the Control of Foot-and-Mouth Disease (EuFMD), endorsed by WOAH, to guide the countries in improving the management of FMD risks. The PCP-FMD: Principles, Stage Descriptions and Standards (Edition 2018) is shown in Annex 3: Global disease early warning systems.

## 2.2 Lumpy skin disease

Lumpy skin disease (LSD) is an infectious disease of cattle and buffalo characterized by skin nodules. It spreads locally through insect and tick bites.

It causes significant morbidity in cattle. The morbidity rate is 20 to 45 percent, and the mortality rate is up to 10 percent. Although the mortality rate is generally low, significant economic losses result from loss of condition, decreased milk production, abortions, infertility and damaged hides. It has a negative impact on the cattle export trade.

### Disease agent:

LSD is a pox virus disease, related antigenically to sheep pox virus and goat pox virus.

### Susceptible animals:

Cattle and buffalo. The primary host of the virus is cattle (Bos taurus and Bos indicus) and buffalo (Bubalus bubalis).

A research found that cross-bred cattle were more susceptible to LSD than indigenous cattle.

### Zoonosis:

There is no evidence that LSD can infect humans.

### Clinical signs:

LSD is characterized by nodules in the skin. The incubation period of the disease is between 4 and 14 days.

The affected animal's skin becomes uneven or lumpy, and the virus is found in higher amounts in the nodules, scabs and lesions about 35 days after infection. Subclinical infections are common.  Around half of all infected animals develop characteristic, irregular, firm skin nodules 10 to 50 mm in diameter. The nodules can be generalized, and scars may persist for months. Skin lesions usually change over time, as shown in Table 4.

**Table 4.** Development of skin lesions during symptomatic illness

| Time since the first signs | Lesion appearance |
|---|---|
| 1–2 days | The first skin nodules start to appear |
| 4 days | The infected animal may show multiple nodules, but the centre of the lesions has not started to slough off |
| At least 7 days | A clear circle around the lesions and the scabs are starting to lose. It may be not easy to see the ring without shaving the hair |
| At least 2 weeks | Scabs have formed on top of the skin lesions |
| 2–3 weeks | Scabs begin coming off, leaving a raw ulcer |
| 3+ weeks | The ulcers dry after the scabs come off and swiftly start healing by scarring |

**Other signs are:**

- enlargement of superficial lymph nodes;
- high fever with temperature up to 41 °C;
- development of large firm nodules in the skin and diameter of the nodule up to 5 cm;
- potential formation of nodules in the whole body but mostly in the head, neck, dewlap, limbs and perineum areas;
- nodules become necrotic, painful, and discharge pus and fluids;
- potential development of Vesicles, erosions, and necrotic ulcers in severe cases in the mouth, udder and mucus membrane;
- Oedema in the dewlap, limbs, brisket and genitalia;
- pregnant cows may abort and become anestrus for several months;
- other non-specific signs are anorexia, dullness, conjunctivitis, rhinitis, excessive salivation and sudden decrease in milk production.

After recovery from the disease, the affected animal becomes emaciated. Secondary diseases such as pneumonia, mastitis and necrotic skin diseases may develop.

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Figure 4. Mild case of LSD showing characteristic skin lesions (full body).



Figure 5. Severely affected cow with multiple skin lesions.



Figure 6. Severe case of LSD with skin nodules covering the udder and teats.

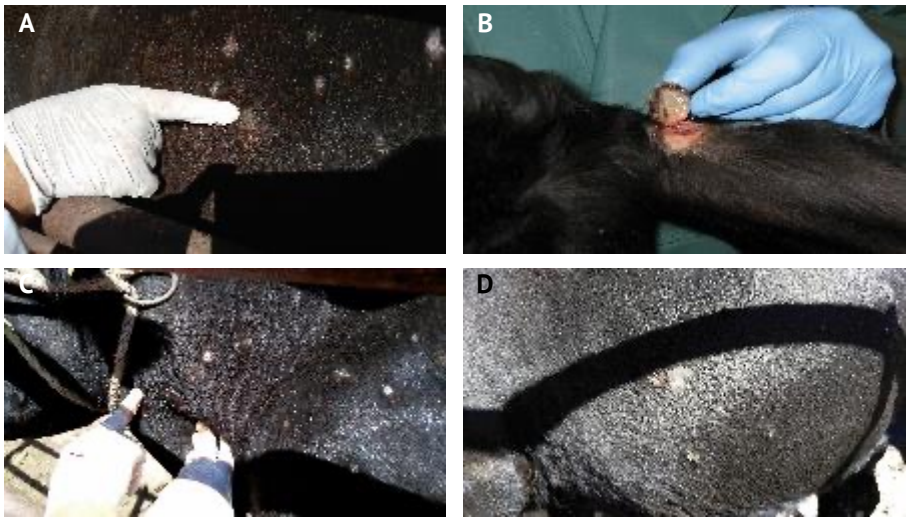





Figure 7. Skin lesions with scabs, ulcers and scars A–C–D.

## Epidemiology of LSD:

Moving cattle between farms or between countries usually causes the first case.

The main virus transmission route between cattle and buffaloes is mechanical transmission via biting flies, such as stable flies (*Stomoxys* spp.) and mosquitoes and ticks. Insect-associated transmission is generally over shorter distances (< 20 km), though long-distance transmission can occur when insects are transported in vehicles, or occasionally, on the wind in suitable weather conditions. Re-used syringe needles can also spread the virus.

LSD may be transmitted by a wide variety of blood-feeding vectors such as insects and ticks. This transmission is mechanical. The virus does not replicate in insects. The transmission of the virus through a seminal fluid is not established. The transmission of LSD virus over short and longer distances is illustrated in **Figure 8** below.

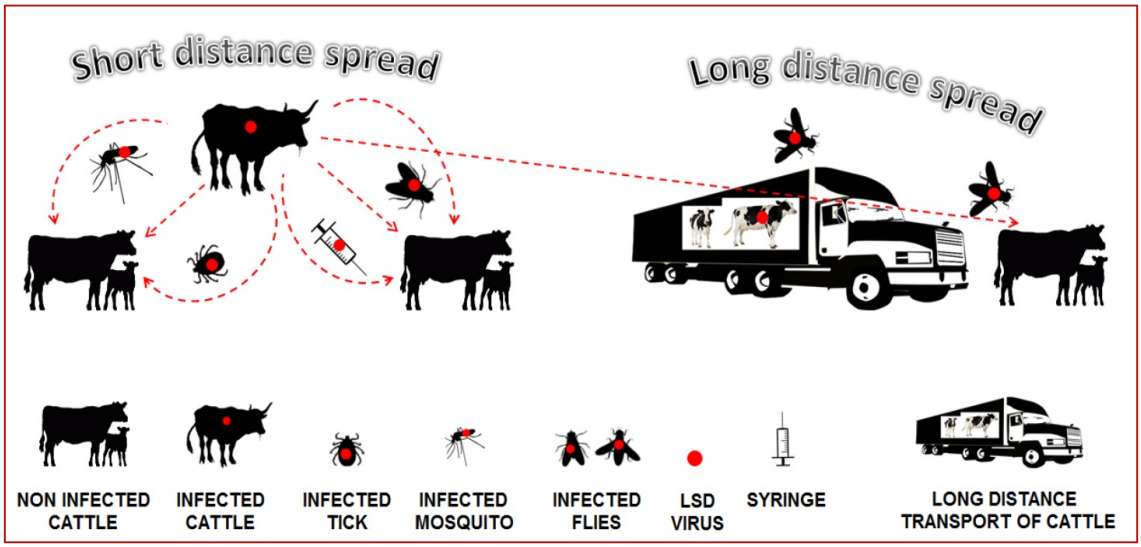



Figure 8. Schematic illustration of the spread of LSDV (LSD virus is indicated as red dot).
Source: Lumpy skin disease field manual – A manual for veterinarians (2017)

The disease was first diagnosed in Zambia, Africa, in 1929. Since the 2000s, LSDV has spread from Africa to several countries in the Near East, Europe, Asia, and more recently, in several Southeast Asian countries. In 2019, LSD occurred in neighbouring countries of Myanmar. In Myanmar, LBVD reported to WOAH the first LSD case in Tabayin Township, Sagaing Region, in November 2020.

Recently reported LSD outbreaks in other countries in our region include:

- Bangladesh (July 2019)
- India (August 2019)
- China (August 2019)
- Taiwan Province of China (July 2020)
- Bhutan (November 2020)
- Viet Nam (November 2020)
- Thailand (March 2021)

## Prevention and control:

The prevention of the disease depends on vaccination.  Disease control is mainly based on the rapid diagnosis and isolation of affected animals. The causative virus is mainly spread by blood-feeding insects, such as certain flies and mosquitoes or ticks. Vector control, for example, with smokey fires, may help, but it is difficult to completely stop these parasites from infesting cattle and buffaloes.

Vaccination with live modified LSD vaccine (Neethling strain) is effective when the vaccine is matched to the circulating virus. Sometimes high-dose of goat pox vaccine is used, but this is less effective.

Infected farms should be thoroughly disinfected. Pox virus can survive a long time in scabs.

## Sample for laboratory confirmation:

The early skin lesions contain large numbers of virus particles. Fresh skin biopsies or scabs in virus transport medium, both kept on ice, are preferred samples for molecular studies and virus isolation. Oral and nasal swabs can also be taken for PCR or virus isolation.

Sera should be collected for serum neutralization testing (the current gold standard assays) and enzyme-linked immunosorbent assay (ELISA) two to three weeks after the first appearance of skin lesions.

## 2.3 Porcine reproductive and respiratory syndrome (PRRS)

This disease was first recognized in the United States of America in the mid-1980s. PRRS is also known as blue ear disease.

### Disease agent:

It is caused by the porcine reproductive and respiratory syndrome virus, PRRSV, a single-strand RNA-enveloped virus. Differences in virulence are detected through variations in the structural genes. The causal virus was first isolated in the Netherlands in 1991. PRRSV is classified in the order Nidovirales, family Arteriviridae, genus Arterivirus.

### Susceptible animals:

Pigs of any age can be infected. PRRSV is highly host-restricted.

### Zoonosis:

PRRS does not infect humans.

### Clinical signs:

The clinical presentation and clinical signs of PRRS vary greatly between herds. Infection with PRRSV shows two different sets of clinical signs: reproductive and respiratory. Reproductive symptoms are influenced by herd factors such as immune status and host susceptibility. PRRS causes an increased incidence of late-term abortions and stillbirths, reduced farrowing rates and weak piglets, and increased mortality in pre- and post-weaned pigs.

PRRS virus infection has also been shown to increase the morbidity associated with *Haemophilus parasuis* and *Streptococcus* suis infections. Anorexia, lethargy and fever may be observed in breeding and finisher animals, along with cyanosis (blueing) of the ears, vulva, tail, abdomen or snout.

Suckling and recently weaned piglets exhibit respiratory problems or ‘thumping’ and show increased susceptibility to other endemic diseases.

### Epidemiology of PRRS:

In Myanmar, it was first detected in 2011 in Mandalay. Within 3 months, PRRS spread to at least 34 townships throughout the country. The virus was isolated in Mandalay and Yangon Veterinary Diagnostic Laboratories. The detected virus strain was the North American Asia strain.

Swill feeding is the most common cause of disease spread. Low bio-secured pig husbandry practices in Myanmar, such as boar sharing between farms, favour the introduction and spread of PRRS.

## Prevention and control:

PRRS is extremely difficult to control under the usual conditions of commercial pig production. The design of effective strategies to control and/or eliminate the PRRS virus depends on an accurate and comprehensive understanding of virus transmission. The immune response to either infection or vaccination with the PRRS virus is unusually complicated.

The following activities should be done for disease control and prevention:

- educate backyard farmers, commercial farmers, live pig dealers, pig licensees and pig processors;
- improve internal biosecurity to reduce the virus spreading within farms (intra-farm transmission);
- improve external biosecurity to reduce the viral load in the community or among farms (inter-farm transmission);
- vaccination is challenging and requires matching with field virus strain; and
- supportive treatment for PRRS (there is no effective treatment for PRRS in the presence).

Recovered pigs left from the outbreaks are immune to the PRRS and will not get sick again. Offspring will be acclimatized to the virus while having a maternally derived antibody. Restocking from other sources will create an opportunity for the existing virus to continue its chain of infection

## Samples for laboratory confirmation:

Tissue sample from dead carcass kept in the cold chain is submitted to the laboratory as soon as possible. It is for virus detection using the molecular technique when PRRS outbreak or suspect case occurs. For disease monitoring, serum sample for detection of antibodies using ELISA technique. The antibody could be detected after 14 days of infection.

## 2.4 African swine fever

African swine fever (ASF) causes incurable and often lethal hemorrhagic fever in domestic pigs and wild boars. The mortality rate is very high, and there is no effective treatment. The disease was first detected in Kenya, Africa, in 1907. In August 2018, China was the first Asian country affected. ASF has spread widely in Asia since then. In 2020, ASF presented an acute and global animal health emergency that has the potential to devastate entire national economies.

### Causal agent:

ASF is a deadly viral disease affecting both domestic and wild pigs of all ages. Although signs of ASF and classical swine fever (CSF) may be similar, the ASF virus is unrelated to the CSF virus. The causative agent of ASF is the African swine fever virus (ASFV), a large double-stranded DNA virus of the genus *Asfivirus* within the *Asfarviridae* family (Alonso *et al.*, 2018).

### Zoonosis:

ASF does not threaten human health and cannot be transmitted from pigs to humans. It is not a food safety issue.

### Clinical symptoms:

Clinical signs and mortality rates can vary according to the virulence of the virus and the type/species of pig. All ages of pigs can be infected.
Acute forms of ASF are characterized by:

- high fever, depression, anorexia and loss of appetite;
- haemorrhages in the skin (redness of skin on ears, abdomen and legs);
- abortion in pregnant sows;
- cyanosis;
- vomiting;
- diarrhea;
- death within 6 to 13 days (or up to 20 days). Mortality rates may be as high as 100 percent.

Sub-acute and chronic forms are caused by moderately or low virulent viruses, which produce less intense clinical signs that can be expressed for much longer periods. Mortality rates are lower but can still range from 30 to 70 percent.

Chronic disease symptoms include loss of weight, intermittent fever, respiratory signs, chronic skin ulcers and arthritis.

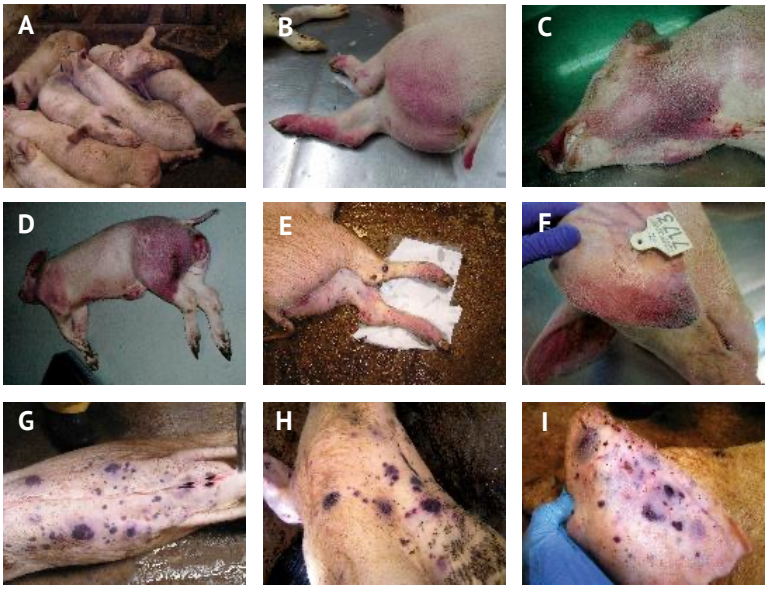
Different types of pigs have varying susceptibility to ASF virus infection. African wild suids, like warthogs, may be infected without showing clinical signs allowing them to act as reservoirs.

## Epidemiology of ASF:

The epidemiology is complex and varies depending on the environment, types of pig production systems, the presence/absence of competent tick vectors, human behaviour and the presence/absence of wild pigs. Routes of transmission include direct contact with infected domestic or wild pigs, indirect contact through ingestion of contaminated material (e.g. food waste, feed, or garbage), contaminated fomites, or biological vectors (soft ticks of the genus Ornithodoros) were present. The role of soft ticks in Asia is not well understood.

In Myanmar, since the Ministry of Agriculture, Livestock and Irrigation confirmed the first ASF outbreak in August 2019, 11 outbreaks had been reported. These were in Shan State (7), Kachin State (1), Kayah State (1), and Sagaing Region (2).

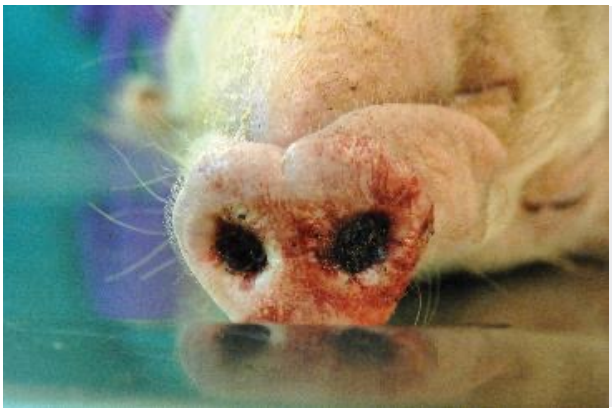
Various control measures have been implemented, including movement control, surveillance, official disposal of carcasses etc., and raised awareness of good animal husbandry practices.






- pigs are visibly weak with fever and huddle to stay warm;
- B-E. bloody diarrhoea and distinct hyperaemic (red) areas on neck, chest and extremities;
- F. cyanosis (bluing) at the tips of ears;
- G-I. necrotic lesions on skin of the abdomen, neck and ears.

Figure 9. Clinical signs of acute African swine fever.





Bloody froth may also be present in the trachea, mouth and nose. Differential diagnoses need with classical swine fever, PRRS (blue ear), swine erysipelas, pasteurellosis, salmonellosis and porcine circovirus. The figures below show some of the diseases that can look somewhat similar.

Figure 10. Further lesions of acute ASF.

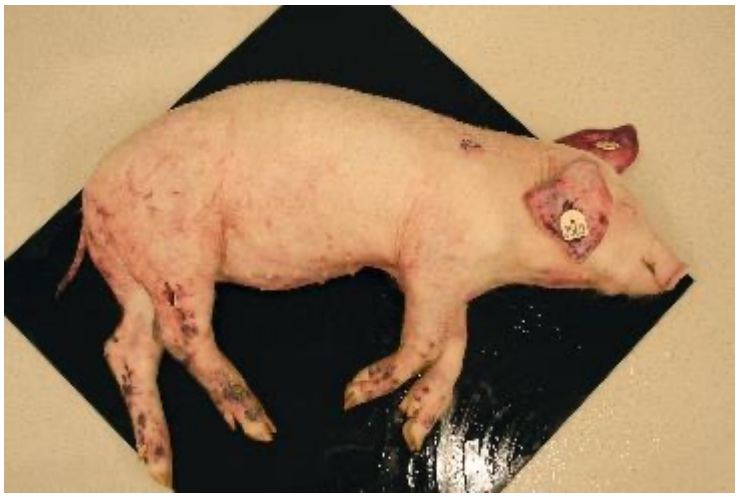




Figure 11. Haemorrhages in a pig with CSF.

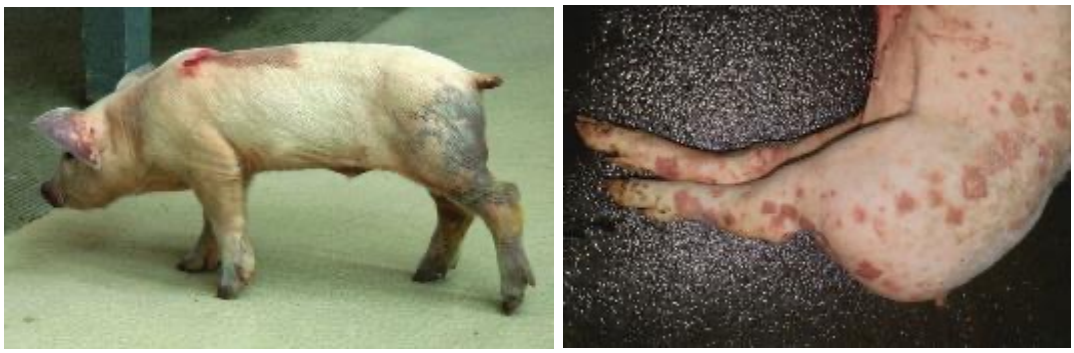




Figure 12. Characteristic diamond-shaped skin lesions caused by erysipelas (CSF)



Figure 13. Piglet neurological issues due to Aujeszky's disease.

## Prevention and control:

Currently, no authorized ASF vaccine is available globally with proven efficacy and safety-approved vaccine for ASF. Prevention in countries free of the disease depends on implementing appropriate import policies and biosecurity measures. The aim is to ensure that neither infected live pigs nor pork products are introduced into areas free of ASF. This includes ensuring proper disposal of waste food from aircraft, ships or vehicles from affected countries and policing illegal imports of live pigs and pork products from affected countries.

During outbreaks and in affected countries, control is difficult. It must be adapted to the specific epidemiological situation. Classic sanitary measures may be employed, including early detection and humane killing of animals with proper disposal of carcasses and waste. This is combined with thorough cleansing and disinfection, zoning/compartmentalization and movement controls, surveillance and detailed epidemiological investigation, and strict biosecurity measures on farms.

In some regions of Asia, ASF transmission seems to depend largely on the wild boar population density and their interaction with low-biosecurity pig production systems. Good knowledge and management of the wild boar population and good coordination among the veterinary services, wildlife and forestry authorities are required to prevent and control ASF successfully.

According to FAO headquarters biweekly ASF Update for Asia and the Pacific Region, 4 August 2022, actions taken by Myanmar included:

- movement control of live pigs;
- surveillance within containment and/or protection zone;
- official disposal of carcasses, by-products and waste;
- disinfection when an ASF outbreak was detected; and,
- awareness raising on good animal husbandry practices and biosecurity.

### Sample for laboratory confirmation:

Collect whole blood using sterile tubes (vacutainers) with anticoagulant (EDTA purple stopper). Blood is collected from the jugular vein, the inferior vena cava, or the auricular vein. Blood can be taken from the heart where the animal is already dead, but it must be done immediately. Blood is used for virus detection by PCR and virus isolation.

Dried blood spot (DBS) samples are collected by applying a few drops of blood drawn by lancet, or using a sterile syringe needle, from the vein or skin, onto specially manufactured absorbent filter paper. The blood is allowed to saturate the paper thoroughly and is air-dried for several hours. Samples are stored in low-gas-permeability plastic bags with desiccant added to reduce humidity. Like this, samples may be kept at ambient temperature, even in tropical climates. These cards are useful in remote locations or when a cold chain is unavailable, such as in hunting conditions and rural areas in the tropics.

Organs and tissues can be used to isolate the ASF virus. The target organs are the spleen, lymph nodes, liver, tonsil, heart, lung and kidney. Of these, the spleen and lymph nodes are the most important as they usually contain the highest amounts of virus. Samples required are organs without formalin, with the minimum recommended amount of 5 g, securely packed, including double bags.

## 2.5 Avian influenza

Avian influenza or bird flu varies in pathogenicity for poultry. It is often categorized as either highly pathogenic avian influenza (HPAI) or low pathogenic avian influenza (LPAI). The designation of "low pathogenic" or "highly pathogenic" does not refer to how pathogenic the viruses are to humans, other mammals, or other birds.

Most strains of avian influenza are not highly pathogenic. However, some low-pathogenic strains in poultry can mutate into highly pathogenic avian influenza strains that cause a contagious and severe illness among poultry and sometimes wild birds, and often death.

HPAI viruses of the H5Nx subtype viruses in the Goose/Guangdong/1/96-lineage (Gs/GD/96-lineage) emerged in China in 1996. Viruses in this lineage are zoonotic pathogens with pandemic potential and have caused severe outbreaks of disease in poultry, including multi-continent epizootics since 2005. Most countries have eliminated these viruses from poultry following incursions, but in some places, strains of virus within this lineage remain endemic.

### Disease agent:

Avian influenza is caused by influenza A viruses adapted to birds. There are four types of influenza viruses: A, B, C and D. Human influenza A and B viruses cause seasonal human flu epidemics.

Influenza A viruses are divided into subtypes according to proteins on the surface of the virus, hemagglutinin (H) and neuraminidase (N). There are 16 H subtypes (H1–H16) and 9 N subtypes (N1–N9). A well-known HPAI subtype is H5N1, while a common LPAI subtype is H9N2. H5 and H7 LPAI viruses have the potential to mutate or evolve into HPAI viruses and are closely monitored by human and animal health officials.

Influenza viruses have a lipid (fatty) envelope surrounding the virus particle. This makes them sensitive to detergent and soap.

### Susceptible animals:

All types of poultry, including quails and wild birds, are susceptible. Some influenza A poultry-adapted viruses affect mammal species as well. Some waterfowl species are asymptomatic and can be infected without showing clinical signs. It depends on the virus strain.

### Zoonosis:

Some subtypes are highly zoonotic

## Clinical signs:

The clinical signs are variable. The outcome of infection is influenced by virus strain virulence, the species affected, age, concurrent bacterial disease and environmental factors such as weather and ventilation.

During the HPAI H5N1 outbreak in Myanmar, the following signs were reported in chickens:

- sudden death;
- drowsiness and lie down;
- nasal and mouth discharge;
- difficulty in breathing;
- head swelling; and,
- wattle and comb cyanosis.

LPAI shows no distinct clinical symptoms. Weight gain decrease in broilers and egg drop -in-layer chickens commonly occurs with LPAI infections.

Figure 14

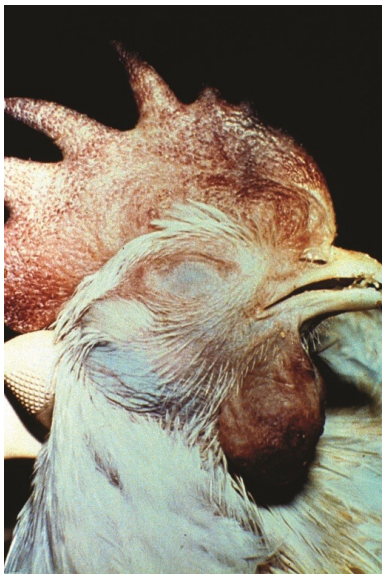




Figure 15

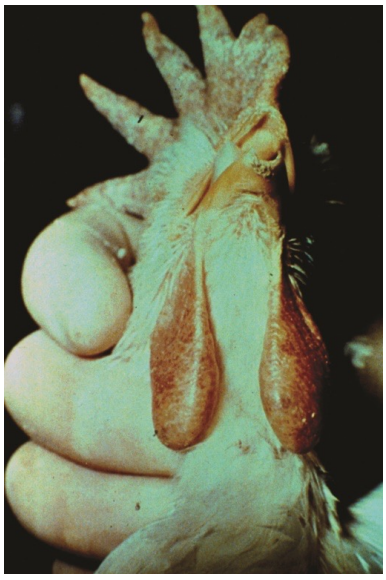


Figure 14: Oedematous cyanotic comb and wattle of a chicken with highly pathogenic avian influenza.
Figure 15: Oedematous wattles.

**Table 5.** H5N1 outbreaks in Myanmar reported to WOAH from 2006 to 2017

| Year | Location (State/ Region) |
|---|---|
| 2006 | Sagaing and Mandalay Regions |
| 2007 | Yangon Region, Mon State, Bago Region and Shan State |
| 2010 | Yangon Region and Sagaing Region |
| 2011 | Sagaing Region and Rakhine State |
| 2012 | Sagaing and Bago Regions |
| 2015 | Sagaing Region |
| 2016 | Sagaing Region |
| 2017 | Thanitharyi and Yangon Regions |

## Epidemiology of AI:

In Myanmar, the first HPAI **H5N1** outbreak occurred in 2006. Outbreaks reported to WOAH are summarized in the table above.

In 2014, **H5N6** was detected in the LBVD-FAO risk-based virus surveillance from live chicken illegally imported from China and environment samples.

LBVD-FAO surveillance also detected **H9N2** (LPAI), from many collected and tested samples. H9N2 affects chickens without a distinct clinical sign, but production losses are significant for economic impact. H9N2 can infect humans but has mild symptoms.

The **H7N9** virus was not detected, but an H7 antibody was detected in border areas before the H7N9 vaccination plan started in China. Even though H7N9 is LPAI, it can cause human death. Later, H7N9 LPAI mutated to HPAI, showing clear clinical signs in chickens. By 2019, the H7N9 subtype had caused hundreds of human deaths in China. The vaccination programme appears to have controlled this subtype.

The table below provides a summary of avian influenza virus subtypes.

**Table 6.** Global AI virus subtype update

| Subtype | Epidemiological situation overview |
|---|---|
| H5N1 HPAI (1997) | • The *classic bird flu* is a highly pathogenic AI virus that can occasionally infect humans;<br>• endemic in several countries in Africa and Asia;<br>• new introduction in West Africa in December 2014;<br>• different clades reassortments;<br>• October 2020: one new influenza A(H5N1) case in Lao People's Democratic Republic in a one-year-old female that was exposed to backyard poultry. Since 2003, 862 cases of influenza A(H5N1) human infection have been reported worldwide. |

**Table 6.** Global AI virus subtype update (continued)

| Subtype | Epidemiological situation overview |
|---|---|
| H5N8 HPAI (2014) | • New strain spread from the Far East to Central Asia, Near East, Western Europe and Africa in June 2016;<br>• September 2018: 52 countries were affected;<br>• Since December 2019, upsurge in Europe, Central and East Asia, and the Near East. H5N1 and H5N5 HPAI viruses have emerged from reassortments between clade 2.3.4.4b H5N8 HPAI viruses and other LPAI viruses found in wild bird reservoirs;<br>• Since October 2020, new H5Nx reassortants emerged in Europe from the H5N8 HPAI clade 2.3.4.4b and Eurasian LPAI viruses. Several subtypes were detected, including H5N1, H5N2, H5N3, H5N4, and H5N5. H5N1 HPAI virus clade 2.3.4.4b was also seen in Africa and Asia and was introduced to North America near the end of 2021;<br>• Algeria, Senegal, Lesotho, Mauritania and Mali reported H5 HPAI for the first time from January to February 2021; and,<br>• Seven human infections caused by influenza A(H5N8) were reported in the Russian Federation, all cases were asymptomatic, and no sustained human-to-human transmission was observed. One mild human infection caused by an H5N1 clade 2.3.4.4b virus was reported by the United Kingdom in December 2021. |
| H5N6 HPAI (2014) | • 1 human case with 'H5N8-like' H5;<br>• To date, 79 human cases of influenza A(H5N6) have been reported, 78 occurring in China and one in Lao People's Democratic Republic;<br>• H5N6 in 2017 in the Netherlands was not zoonotic and genetically different;<br>• Detection of an H5N6 HPAI virus in June 2019 in Nigeria marked the first ever report of this subtype on the African continent; and,<br>• Outbreaks in wild birds in Western China, in domestic poultry in Viet Nam, and a new introduction reported by the Philippines in the first quarter of 2020. |
| H5N2 HPAI | • A sub-type widespread in its LPAI form can cause local epizootics in its HPAI form;<br>• Major epizootics occurred in the United States of America and France in 2015;<br>• enzootic in Taiwan Province of China; and,<br>• occasional sporadic reassortments were detected in Europe. |
| H5N5 HPAI | • Enzootic in Taiwan Province of China was first detected in September 2019. |
| H7N9 LPAI (2013) and HPAI (2017) | • Reported only in China's recent HPAI mutation (observed end of 2016);<br>• Most human cases were exposed in live bird markets;<br>• Period 5 from October 2016 to September 2017, significant in case numbers and geographic expansion increased;<br>• Nation-wide vaccination campaign since September 2017, drop in animal outbreaks and human cases as well as detections; and,<br>• See monthly FAO H7N9 situation update. |
| H7N3 HPAI (2020) | • The United States of America reported an outbreak of H7N3 HPAI on a turkey farm in South Carolina. It was noted this new HPAI virus emerged from spontaneous mutation of an H7N3 LPAI virus that has been circulating in the country since March 2020 and was reported on the same premise. |

**Table 6.** Global AI virus subtype update (continued)

| Subtype | Epidemiological situation overview |
|---|---|
| H7N4 LPAI (December 2017) | • Found only in China and Cambodia through live bird market surveillance; and,<br>• one human case in China with reported exposure to poultry. |
| H9N2 LPAI | • To date, around 90 influenza A(H9N2) human cases have been diagnosed worldwide, with at least 70 cases occurring in China since December 2015;<br>• cause of significant production losses and mortalities in poultry production systems; and,<br>• Endemic in several countries in Africa and Asia. |
| H10N3 LPAI | • On 31 May 2021, the National Health Commission of China reported the first influenza A(H10N3) human infection. This was the first human case reported globally. |

## Prevention and control:

HPAI vaccination is strictly prohibited in Myanmar. With some restrictions, LBVD permits the poultry industry to vaccinate for LPAI H9N2.
For HPAI, strict biosecurity measures and good hygiene are essential to protect against disease outbreaks. These include:

- Keep poultry away from areas frequented by wildfowl;
- do not keep materials on the premises that may attract wild birds, including poultry feed products placed outside the building;
- maintain strict control over access to flocks by vehicles, people and equipment;
- ensure the sanitation of property, poultry houses and equipment;
- avoid the introduction of birds of unknown disease status into the flock;
- report any bird illnesses and deaths to the veterinary services; and,
- ensure appropriate disposal of manure, litter and dead poultry.

Many countries, including Myanmar, have a 'stamping out' policy to maintain disease freedom.

## Sample for laboratory confirmation:

Based on the experience of the AI outbreak in Myanmar, the whole dead chicken carcass in a double-wrapped, tight container with ice is preferable. Submit to the laboratory as soon as possible (within 24 hours is more suitable for a laboratory test). If the dead carcass is not convenient for transport, internal organs are placed in a tight container kept in an ice box. Do not pool the sample from different sources together.

From live birds, tracheal/oropharyngeal (TR/OP) or cloacal (CL) swabs from live poultry are kept in virus transport media in an ice box and sent to the laboratory. Do not send in dry swabs for testing because AI viruses are easily inactivated on dry swabs. Dry swabs may not be tested by the laboratory.

Sera sample from live poultry is for disease surveillance and monitoring. Antibodies can also be extracted from eggs for serology

## 2.6 Prominent clinical signs to report to Livestock breeding and veterinary department

Prominent clinical signs to report to LBVD (veterinary passive surveillance) shown in the table are attached as **Annex 1**.

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Chapter 3

# Disease surveillance and information flow

## 3.1 Surveillance

### Introduction

Surveillance has its primary purpose as early detection of disease. The sooner a disease is found before it makes progress along the epidemic curve, the better. Many examples of devastating livestock production and severe economic losses incurred by having found out too late. When the perceived threat of livestock epidemics recedes into the background and there are spending cuts to be made, official Veterinary Services are usually the first to suffer, with a concomitant loss of ability to detect disease.

### Early detection

The key to success in handling animal disease epidemics is early detection. If a disease can be detected very early in the phase of epidemic development, the possibility exists that it can be arrested and eliminated before it inflicts damage. Early detection presupposes that there is a surveillance system in place that will bring infection to light when it is first seen. The country's veterinary authorities are then placed in the position of managing the problem before it becomes uncontrollable, thus protecting the local livestock industry and ensuring food security for those closely dependent upon livestock. Early detection enables early warning and an early reaction. Surveillance is the primary key to effective disease management.

**Veterinary surveillance** is essential for the early detection of unusual, infectious, rare or emerging disease events or changes in existing ease patterns. Veterinarians have a key role in the ongoing and timely collection, analysis and monitoring of information related to animal health. In their work, private veterinarians may learn first from producers about disease outbreaks. Veterinarians can inform government agencies to help those making decisions for animal health management.

**The disease information that veterinarians report promptly to the veterinary authority can protect our animals, people and the environment.**

## Definition

Two definitions of surveillance are:

- "all regular activities aimed at ascertaining the health status of a given population with the aim of early detection and control of animal diseases of importance to national economies, food security and trade (FAO, 1999).";
- a "systematic ongoing collection, collation, and analysis of information related to animal health and the timely dissemination of information so that action can be taken (WOAH, 2021)."

## Objectives

The objective of surveillance depends on the situation in the country and the risk. Objectives may change or overlap, depending on the epidemiological situation, and should be revised periodically. Surveillance can focus on one or a combination of several diseases (RiskSur, 2015). For example, for lumpy skin disease (LSD), there are four main objectives of surveillance, as shown in the table below.

**Table 7.** Four objectives of LSD surveillance

| Objective | Description |
|---|---|
| Early detection | In a previously LSD-free country, it is essential to detect the first incursion of the disease as soon as possible. In regions that are already affected, it is also vital that new LSD outbreaks are detected without delay. |
| Evaluate the presence or distribution of LSD | If the disease is present, it is crucial to monitor its prevalence, incidence and distribution of the disease. |
| Post-vaccination surveillance | If vaccination is used to control LSD, surveillance is vital to monitor the effectiveness of the vaccination campaign. |
| Demonstrate the absence of LSD | The disease may never have been present or have been eradicated recently. To maintain or resume international trade in live cattle or cattle products, it is necessary to prove freedom from the disease. |

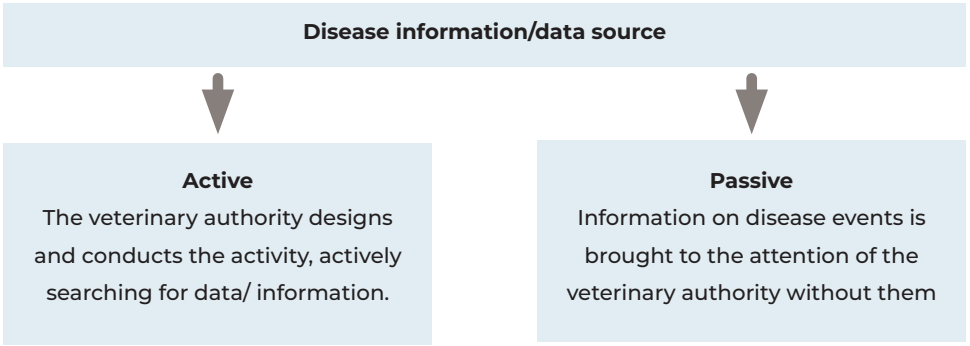
**Surveillance in support of disease control programmes:** Surveillance is an essential component in disease control programmes and can be used to determine the distribution and occurrence of infection, infestation or other relevant health-related events. It can be used to assess progress and aid decision-making in controlling or eradicating selected infections or infestations

## Types of surveillance

Surveillance may be classified in several different ways, including by:

1. **origin of the data** used/collected during a surveillance activity;
2. **disease focus** of surveillance;
3. whether surveillance is based on a **sample** of the population or the whole population; and
4. how often a particular surveillance activity is conducted, **frequency**, i.e. whether it is continuous or occurs periodically.

Another classification is active or passive surveillance. The differences are shown in the diagram below. This document concerns passive surveillance. The notes aim to enhance the sensitivity of passive surveillance by encouraging disease suspicion reporting.




Both active and passive surveillance have important roles in disease surveillance.

## Active surveillance

**Active surveillance** relies on information gathered by the veterinary authorities. It involves active monitoring for the typical clinical signs in animal and/or laboratory diagnostic testing.

**Who provides the information?**
Official veterinarians carry out data collection or private veterinarians contracted by veterinary authorities.

**Target population and timing**

- Active surveillance should be risk-based to maximize resources, e.g. only certain high-risk districts, production systems, or months are selected;
- the target should be a well-defined animal population with a random selection of individuals in statically valid numbers; and,
- active surveillance is carried out within a defined timeframe. It may be carried out together with other compulsory animal health monitoring programmes.

## Passive surveillance

**Passive surveillance** relies on animal owners or others notifying the veterinary authorities of suspected cases. It is sometimes known as reactive surveillance. If positive cases are found after notification, veterinary services are responsible for official investigations and control measures.

Passive surveillance is potentially very powerful since it can occur whenever animals are handled. It can cover the entire country and animal population. However, the effectiveness relies on the capability of stakeholders to recognize the characteristic clinical signs and their willingness to report them. Passive surveillance is much less expensive than active surveillance.

**Who provides the information?**
Data providers can be official or private veterinarians, farmers and other animal farming stakeholders, e.g. middlemen, animal transport vehicle drivers, artificial insemination technicians, abattoir workers and meat inspectors. All stakeholders need to be aware of the clinical signs of disease, how to report and the importance of reporting. The veterinary authorities should provide disease-relevant communication messages, so stakeholders know what and how to report

**Target population and timing**

- Passive surveillance includes the total target population at risk;
- passive surveillance usually occurs all year round and is useful for long-term trend analysis;
- passive surveillance requires sufficient epidemiological capacity for outbreak investigation and laboratory capacity to test reported and suspected cases; and,
- passive surveillance is enhanced where there is a robust farm registration system with updated animal identification, including vaccination data and movement records.

A common example of a passive surveillance system is a farmer disease reporting system in which farmers report daily/weekly/monthly or even zero cases to the veterinary authority. Another example of passive surveillance is the system of officially notifiable diseases routinely reported. Other examples are reports of laboratory diagnosis, routine meat inspection findings, and statutory notification of disease.

**Uses of passive surveillance**

- rapid detection of disease outbreaks;
- early identification of disease problems (endemic and non-endemic diseases);
- assessment of health status of a defined population;
- definition of priorities for disease control and prevention;
- identification of new and emerging diseases;
- evaluation of disease control programmes;
- provision of information to plan and conduct research; and,
- confirmation of options for a specific disease.

### Benefits and disadvantages of active and passive surveillance

The table below shows the benefits and disadvantages of active and passive surveillance.

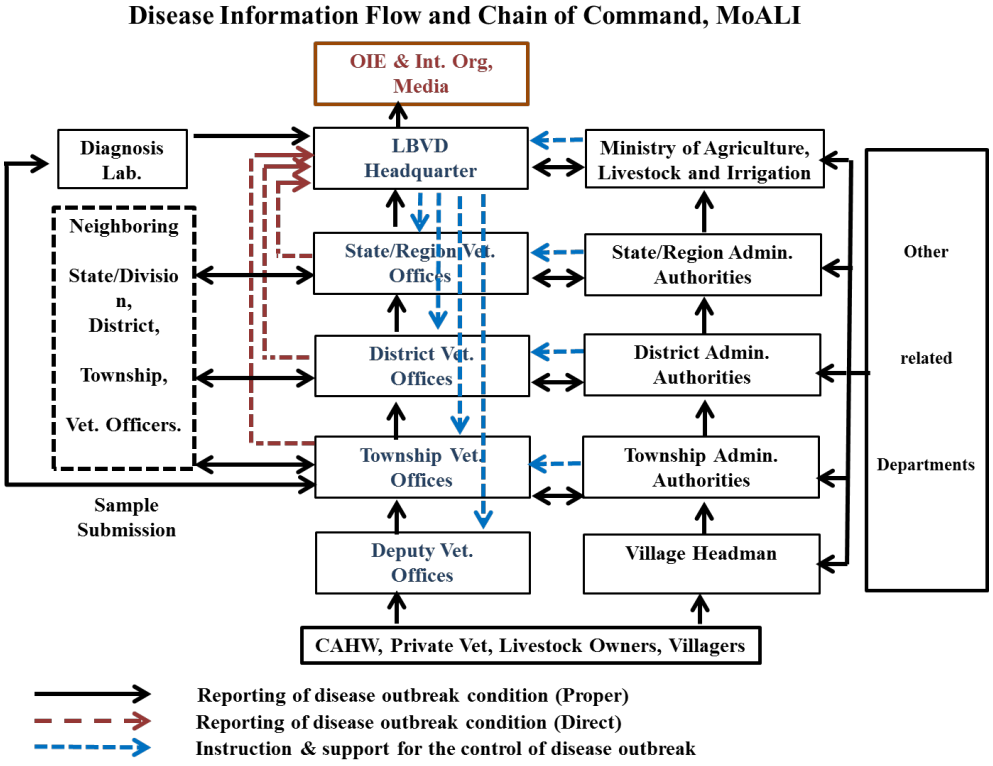
**Table 8.** Benefits and disadvantages

| Active/passive | Benefits | Disadvantages |
|---|---|---|
| Active surveillance | • an effective method of determining the infectious status of a farm or region with certainty; and,<br>• allows detection of disease when owners are not aware or willing to report. | • narrow geographic and population coverage;<br>• it is carried out only at specific times; and,<br>• costly. |
| Passive surveillance | • wide geographic and population coverage;<br>• is carried out all the time; and,<br>• relatively inexpensive. | • highly dependent on the knowledge, ability and willingness of animal keepers; and,<br>• possibly dependent on the involvement of the private veterinarians. |

## 3.2 Myanmar disease information flow and chain of command

The diagram in **Figure 16** shows disease information flow and chain of command in Myanmar.

Figure 16: Disease Information Flow and Chain of Command, MoALI




Source: National One Health Strategic Framework and Action Plan of Myanmar (2019–2023)

## 3.3 Animal health and livestock development law (2020)

The Pyidaungsu Hluttaw enacted the **Animal Health and Livestock Development Law** on 26 August 2020 and repealed the Animal Health and Development Law (1993). The sections related to reporting disease information enacted in Myanmar Animal Health and Livestock Development Law (2020) in Burmese is attached as **Annex 2**.

## 3.4 Global disease early warning systems

The Global disease early warning systems, including the following systems and pathways, are attached in **Annex 3**.

- WOAH-World Animal Health Information System (WOAH-WAHIS);
- FAO-WOAH-WHO Global Early Warning and Response System (GLEWS);
- The Progressive Control Pathway for Foot and Mouth Disease Control (PCP-FMD): Principles, Stage Descriptions and Standards.

# References


**Beltrán-Alcrudo, D., Arias, M., Gallardo, C., Kramer, S. & Penrith, M.L.** 2017. *African swine fever: detection and diagnosis – A manual for veterinarians*. FAO Animal Production and Health Manual No. 19. Rome. Food and Agriculture Organization of the United Nations (FAO). 88 pages.

**Blacksell SD, SiengsananLamont J, Kamolsiripichaiporn S, Gleeson LJ, Windsor PA.** 2019. *A history of FMD research and control programmes in Southeast Asia: lessons from the past informing the future*. Epidemiology and Infection 147, e171, 1–13. (available at https://doi.org/10.1017/ S0950268819000578).

**Farm health online.com.** *Porcine reproductive and respiratory syndrome* (PRRS) (also available at https://www. farmhealthonline.com/disease-management/pig-diseases/prrs/)

**FAO.** 1999. *Manual on Livestock Disease Surveillance and Information Systems*. (available at https://www.fao.org/3/x3331e/ x3331e00.htm).

**FAO.** 2014. *Risk-based disease surveillance – A manual for veterinarians on the design and analysis of surveillance for demonstration of freedom from disease*. FAO Animal Production and Health Manual No. 17. Rome, Italy. (available at https://www.fao.org/3/i4205e/i4205e.pdf).

**FAO.** 2022. *African swine fever situation in Asia and Pacific update,* 28 April 2022

**FAO.** 2022 *Global Avian influenza viruses with Zoonotic Potential situation update,* 25 May 2022. (available at https://www.fao. org/ag/againfo/programmes/en/empres/ Global_AIV_Zoonotic_Update/situation_update.html).

**FAO.** 2022. *African swine fever situation in Asia and Pacific update*, 26 May 2022, e-cards on biosecurity: There is no ASF vaccine yet.

**FAO.** 2022. *African swine fever situation in Asia and Pacific update*, 4 August 2022. (available at https://www.fao.org/ animal-health/situation-updates/asf-in-asia-pacific).

**FAO.** 2020 *Online training course on LSD preparedness, Module 5* (Surveillance), 7 July – 21 August 2020

**FAO/EuFMD.** 2020. *Online Training Course on Lumpy skin disease (LSD) Preparedness 9 July – 21 August 2020*, Module Five: Surveillance.

**FAO-WOAH-WHO**. 2006. *Global Early Warning and Response System for Major Animal Diseases, including Zoonoses* (GLEWS). (available at https://www.woah.org/app/uploads/2021/03/glews-tripartite-finalversion010206.pdf).

**WOAH**. 2018. *Manual 5, Surveillance and epidemiology.* (available at https://rr-asia.woah.org/wp-content/uploads/2019/09/ seacfmd-manual-5.pdf).

**WOAH**. 2021. *Terrestrial Animal Health Code, Chapter 1.4. Animal health surveillance*. (available at https:// www.woah.org/en/ what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_surveillance_ general.htm).

**WOAH**. 2021. *Terrestrial Animal Health Code, Chapter 7.6. Killing of animals for disease control purpose.* (available at https:// www.woah.org/fileadmin/Home/eng/Health_standards/ tahc/current/chapitre_aw_killing.pdf).

**The Ministry of Agriculture, Livestock and Irrigation**. *Notification number 44/99* (5-8-1999) and other notifications that notified the disease infected in animal as contagious animal disease.

**The Ministry of Agriculture, Livestock and Irrigation, the Ministry of Health and Sports, and the Ministry of Natural Resources and Environmental Conservation.** 2019. *National one health strategic framework and action plan of Myanmar* (2019-2023).

**The Republic of the Union of Myanmar.** 2020. *The Pyidaungsu Hluttaw Law No. 13*, 2020, Animal Health and Livestock Development Law (26-8-2020). (available at https://www.mlis.gov.mm/ lsScPop.do?lawordSn=14600)

**Tuppurainen, E., Alexandrov, T. & Beltrán-Alcrudo, D.** 2017. *Lumpy skin disease field manual – A manual for veterinarians.* FAO Animal Production and Health Manual No. 20. Rome. Food and Agriculture Organization of the United Nations (FAO). 60 pages. (available at https://www.fao. org/3/i7330e/i7330e.pdf).

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Annex 1

# Prominent clinical signs to report to livestock breeding and veterinary department
## (veterinarian passive surveillance)

- A veterinarian should report promptly to the nearest LBVD office or relevant township, ward or village tract administrator if he or she finds that the animal, he or she treats is suspected of suffering from a contagious disease. If the disease may be zoonotic, should inform the health authority, too;
- A veterinarian should share the disease information, including List A and List B contagious diseases and some endemic diseases (e.g. liver fluke) to LBVD and other private veterinarians; and,
- The veterinarian should report and collect a sample when prominent clinical signs of disease are observed in the following table.

**Table A1.1.** Prominent signs to report and lab samples

| Prominent signs | Species affected | Disease suspected | Sample to be submitted to lab | Remarks |
|---|---|---|---|---|
| Fever, blisters in the mouth and on feet, drop in milk production, weight loss, loss of appetite, quivering lips and frothing of mouth, distinct lameness, and cows may develop blisters on teats.<br><br>After recovery, animals are easily exhausted. | Cattle, swine, sheep, goat, deer, other cloven-hooved ruminants and elephants. | Foot-and-mouth disease (FMD) | **Cattle & other ruminants** - Sera for antibody detection, Tongue epithelium unruptured or freshly ruptured vesicles about 0.5-1 ml usually from the tongue, buccal mucosa or feet for virus detection.<br><br>**Pig** - Sera for antibody detection, Vesicle fluid and skin lesions of snout, teat and foot areas.<br>Virus samples should be kept in FMD preservative bottles.<br>Sera samples should be kept in an ice pack is better | Not a zoonotic disease<br><br>Immunity to one type does not protect an animal against other types.<br><br>Serotypes “O”, “A” and “Asia 1” are detected in Myanmar. |

**Table A1.1.** Prominent signs to report and lab samples (continued)

| Prominent signs | Species affected | Disease suspected | Sample to be submitted to lab | Remarks |
|---|---|---|---|---|
| High fever, large firm nodules in the skin and diameter of the nodule up to 5 cm, the nodules may form in the whole body but mostly in the head, neck, dewlap, limbs and perineum areas.<br><br>Nodules become necrotic and painful, and discharge pus and fluids.<br><br>Morbidity is 20 to 45 percent and mortality is very low.<br><br>Not more than 10 percent. After recovery, animals become emaciated and secondary diseases such as pneumonia, mastitis and other skin diseases can be occurred. | Cattle and buffalo | Lumpy skin disease (LSD) | Skin nodules, scabs and crusts contain relatively high amounts of LSDV. Viruses can be isolated from this material for up to 35 days and likely for longer.<br>Fresh skin biopsies or scabs in virus transport medium, both kept on ice.<br><br>Blood in EDTA (a minimum of 4 ml of vacutainer EDTA) for PCR & in Heparin for virus isolation. The best time to collect is in early stage of infection when they are pyrexia.<br>Oral and nasal swabs can also be taken for PCR or virus isolation.<br><br>Serum for anti-body ELISA is to be collected 1 to 2 weeks after appearance of clinical signs.<br>For skin samples, 10 to 20 percent glycerol in PBS buffer or tris-buffered tryptose broth at pH 7.6 is suitable for isolation and PCR.<br><br>Blood, saliva swabs and tissue samples should be kept at 2 to 6 °C and submitted to the lab within 48 hours.<br>All samples should be submitted to the lab within 48 hours. | Not a zoonotic disease.<br><br>It is spread by blood-feeding insects.<br><br>Viruses are found in higher amounts in the nodules, scabs, and lesions of the skin up to 35 days after infection.<br><br>Swampy and blood insect-abundant areas should be paid attention to LSD.<br><br>In Myanmar, LSD was confirmed in November 2020. |

**Table A1.1.** Prominent signs to report and lab samples (continued)

| Prominent signs | Species affected | Disease suspected | Sample to be submitted to lab | Remarks |
|---|---|---|---|---|
| Sudden onset to death, dead carcass no rigor mortis, the abdomen becomes enlarged, tarry blood oozes out from orifices, not clot.<br><br>Most animals are simply found dead.<br>Some animals may have illness signs, e.g. high temperature, shivering or twitching, harsh dry cough, blood in dung or nostrils, decrease or complete loss of milk, fits bright staring eyes, colicky pains and dejection and loss of appetite | All mammals including human | Anthrax | Collect 0.5 to 1 ml postmortem blood sample from the peripheral vein<br><br>A plain dry swab of haemorrhagic exudate.<br>As an alternative to a blood sample, thin blood smears can be collected from periphera blood vessels and air dried the blood smears. One end of the slide must be left clean.<br><br>Where blood or other body fluids cannot be collected, a 2 $cm^2$ portion of the ear tip is taken within 48 hours after death and air dried. | It is a zoonotic disease.<br><br>The important thing is if suspected Anthrax, the dead carcass should not be opened. |

**Table A1.1.** Prominent signs to report and lab samples (continued)

| Prominent signs | Species affected | Disease suspected | Sample to be submitted to lab | Remarks |
|---|---|---|---|---|
| **Clinical signs vary greatly** between herds.<br>Two different sets of clinical signs are reproductive and respiratory.<br><br>Late-term abortions and stillbirths reduced farrowing rates and weak piglets and increased mortality in pre- and post-weaned pigs.<br>Anorexia, lethargy and fever may be observed in breeding and finisher animals, along with cyanosis (blueing) of the ears, vulva, tail, abdomen or snout.<br><br>Suckling and recently weaned piglets exhibit respiratory problems or 'thumping'.<br><br>Virulence of disease is related to secondary bacterial infection. | Only pig (species-specific) | Porcine Reproductive and Respiratory Syndrome (PRRS) | For virus isolation, lung, lymph nodes, spleen and tonsils are the specimens of choice.<br><br>For RT-PCR, whole blood (EDTA), lung, lymph nodes, spleen and tonsils, samples from mummified or aborted litters are unlikely to yield virus, but can still be useful for RT-PCR.<br><br>Sera from a recovered animal for antibody detection. The sample should be in an ice pack and submitted to the laboratory within 48 hours. | Not a zoonotic disease.<br><br>Currently, there is no effective direct treatment for the PRRS but supportive treatment can be applied.<br><br>Restocking from other sources will create an opportunity for the existing virus to continue its chain of infection.<br><br>The first outbreak occurred in 2011 in Mandalay Region and spread to the whole country.<br><br>Vaccination with products approved by LBVD is permitted when used in strict combination with biosecurity measures. |

**Table A1.1.** Prominent signs to report and lab samples (continued)

| Prominent signs | Species affected | Disease suspected | Sample to be submitted to lab | Remarks |
|---|---|---|---|---|
| Acute form: high fever, depression, anorexia and loss of appetite, haemorrhages in the skin (redness of skin on ears, abdomen and legs), abortion in pregnant sows, cyanosis, vomiting, diarrhoea and death within 6 to 13 days (or up to 20 days).<br>Mortality rates may be as high as 100%.<br><br>Sub-acute and chronic form: less intense clinical signs that can be expressed for much longer periods, loss of weight, intermittent fever, respiratory signs, chronic skin ulcers and arthritis.<br>Mortality rates are lower between 30 to 70 percent. | Pigs and wild boar | African swine fever (ASF) | Blood is a target sample for virus detection.<br>Whole blood with anticoagulant (EDTA tubes) (2 to 14 days post-infection) for PCR.<br><br>A nasal swab from infected pigs and, saliva from sick or recently dead animals.<br><br>Organs and tissues (targeted organs spleen, lymph nodes, liver, tonsil, heart, lung and kidney.<br><br>Spleen and lymph nodes are the most important as they usually contain the highest amounts of virus.<br><br>Serum for serology after 7 days post-infection.<br><br>All collected samples must be kept at 4 °C and sent to the relevant laboratory within 48 hours. | Not a zoonotic disease.<br>Similar to classical swine fever.<br><br>Myanmar confirmed the first ASF outbreak on 1 August 2019, a total of seven outbreaks were reported in Shan State, two in Sagaing Region and one each in Kachin and Kayah States, a total of 11 outbreaks.<br><br>In 2020, ASF presents an acute and global animal health emergency that has the potential to affect entire national economies as effective vaccines or antiviral drugs are not currently available. |

**Table A1.1.** Prominent signs to report and lab samples (continued)

| Prominent signs | Species affected | Disease suspected | Sample to be submitted to lab | Remarks |
|---|---|---|---|---|
| **The clinical signs are variable and influenced greatly** by the virulence of the viruses.<br><br>Sudden onset of death, drowsiness, head swelling, nasal and mouth discharge, difficulty in breathing, lying down, wattle and comb become cyanosis. HPAI case definition in Myanmar is as follows:<br><br>- Mortality in commercial farms: 1 percent in 2 consecutive days.<br>- Mortality in backyard farm: 5 percent in 2 consecutive days.<br>- Drop in egg production.<br>- Drop in feed intake with or without other clinical signs. | All types of poultry and wild birds | Avian influenza | Dead chicken carcass in a strict container (tight container) with ice.<br><br>Internal organs are placed in a tight container and kept in an ice box if the dead carcass is not convenient for transport.<br><br>Do not pool the sample from different sources together.<br><br>From live chicken both oropharyngeal and cloacal swabs, fresh faeces may serve as an alternative. Similar swab samples can be pooled and most commonly pooling of five samples, kept on ice.<br>All samples should be submitted to the lab within 48 hours. | Highly zoonotic disease.<br>HPAI viruses cause high mortality in poultry.<br><br>LPAI viruses can cause a variety of outcomes in poultry ranging from no apparent clinical signs to moderate death rates. |

**Table A1.1.** Prominent signs to report and lab samples (continued)

| Prominent signs | Species affected | Disease suspected | Sample to be submitted to lab | Remarks |
|---|---|---|---|---|
| Extreme behavioural changes such as restlessness become irritable biting or snapping at any form of stimulus, and attacking other animals, humans and even inanimate objects.<br><br>Most rabid dog has saliva foam in their mouth, but in the dumb paralytic type, there is no saliva foam in the mouth. | All mammals | Rabies | The rabid dog, head or brain.<br><br>Brain samples in 10 percent formalin for immunohistochemistry or histopathology | It is a zoonotic disease.<br><br>Lab confirmation is important.<br><br>Precaution should be done when sample is collected. |

Annex 2

# Myanmar animal health and livestock development Law (2020)

The text below shows the sections that relate to reporting of disease information that are enacted in Myanmar law.

## Chapter I Title and Definitions

1. This Law shall be called the Animal Health and Livestock Development Law.
2. The following expressions in this Law shall have the meanings given below:
   (a) Animal means terrestrial animals, aquatic animals or amphibians. This expression also includes semen, ova and embryos of any of the said animals and creatures specified as animals in the notification issued by the Ministry from time to time;
   (b) Livestock production means breeding of animals by means of any method for breeding and production of animal products except fisheries and fishery products. Such expression also includes the small scale livestock farming and commercial livestock farming;
   (c) to (h)
   (i) Infectious disease means any disease transmits among animals or from animal to human or from human to animal. Such expression also include any animal diseases specified as an infectious animal disease in the notification issued by the Ministry from time to time;
   (j) to (l)
   (m) Farmer means the person who is operating small-scale livestock farming or commercial livestock farming. Such expression also includes the owner of animals or the person who is in possession of animals;
   (n) to (q)
   (r) Veterinary service means animal health service related to veterinary public health, animal health care, infectious animal disease prevention and control, animal sheltering and keeping, grooming and spa, training for animal and laboratory and its related services;
   (s) -
   (t) Permit means the certificate issued for domestic production, processing or distribution of animals, animal products, genetically modified organisms, animal feed, animal equipment or veterinary medicinal products, veterinary service, livestock production, establishment of slaughterhouse or slaughtering after being examined by the Department;
   (u) to (cc)
   (dd) Ministry means the Ministry of Agriculture, Livestock and Irrigation, the Union Government;
   (ee) -
   (ff) Department means the Livestock Breeding and Veterinary Department;

## Chapter VIII Veterinary Services

16. A person or an organization that wants to provide any veterinary service shall apply for a permit to the respective Township Veterinary Officer in accordance with the stipulations.
18. The permit holder for providing veterinary service shall:
    (a) comply with the terms and conditions of the permit;
    (b) accept the inspection of the Department;
    (c) inform promptly the Department of the occurrence of suspicious infectious animal disease in the worksite, if it is found;
    (d) strictly comply with the instructions of the Department after informing under subsection (c).

## Chapter IX Livestock Production

19. Any person or organization that wants to operate commercial livestock farming, except for small-scale livestock farming shall apply for a permit to the respective Township Veterinary Officer in accordance with the stipulations.
21. A Farmer shall:
    (a) comply with the terms and conditions of the permit, if he or she is a permit holder;
    (b) accept the inspection of the Department;
    (c) inform promptly to the Department and the Administrator of the relevant Township, Ward or Village Tract, of the occurrence of infectious animal disease in his or her livestock, if it occurs.
    (d) strictly comply with the instructions of the Department after informing under subsection (c);
    (e) to (g)
    (h) follow this Law and rules, orders, directives and procedures issued under this Law in relation to livestock production.

## Chapter XII Prevention and Control of Infectious Animal Diseases

34. The farmer shall promptly report to the Township Veterinary Office and relevant Administrator of Township, Ward or Village Tract, if he or she suspects that his or her livestock are infected with, or die due to any infectious animal disease.
35. The veterinarian shall immediately report to the nearest Veterinary Office, if any animal under his or her treatment is suspected of having an infectious animal disease.

## Chapter XV Prohibitions and Penalties

42. Any person without a permit or recommendation certificate shall not:
    (a) operate commercial livestock farming;
    (b) provide any veterinary services;
    (c) to (f)

45. Any farmer or veterinary service provider or community animal health worker shall not:
(a) fail again to comply with the orders and directives issued by the Department in relation to prevention or control of infectious animal disease;
(b) fail to report promptly to the Department, relevant government department and organization, if he suspects that infectious animal disease is occurred;
(c) fail to report to the Veterinary Office and relevant Administrator of Township, Ward or Village Tract, if the signs of infectious animal disease are found in the dead animal.

47. Whoever:
(a) violates the prohibition of subsection (a) of section 42 shall, on conviction, be punished with a fine from a minimum of one million kyats to a maximum of two million kyats.
(b) violates the prohibition of subsection (b) of section 42 shall, on conviction, be punished with a fine from a minimum five hundred thousand kyats to a maximum of two million and five hundred thousand kyats. If that person violates such prohibition again, he or she shall, on conviction, be punished with imprisonment for a term not exceeding two months and shall also be liable to a fine from a minimum of one million kyats to a maximum of five million kyats;
(c) to (d)

50. Any famer or veterinary service provider or community animal health worker violates any prohibition of section 45 shall, on conviction, be punished with a fine from a minimum of five hundred thousand kyats, to maximum of five million kyats. If that person violates such prohibition again, he or she shall, on conviction, be punished with imprisonment for a term not exceeding three months and shall also be liable to a fine from a minimum of one million kyats to a maximum of ten million kyats.

I hereby sign under the Constitution of the Republic of the Union of Myanmar.

(Sd.) Win Myint
President
Republic of the Union of Myanmar

Source: https://www.moali.gov.mm/en/law?page=0)

Annex 3

# Global disease early warning systems

WOAH-World Animal Health Information System (WOAH-WAHIS)

The World Organisation for Animal Health's (WOAH) World Animal Health Information System is known as WAHIS[1]. It is an internet-based computer system that processes data on animal diseases in real-time and then informs the international community. Access to this secure site is only available to authorised users, namely the Delegates of WOAH Member Countries and their authorised representatives, who use WOAH-WAHIS to notify the WOAH of relevant animal disease information. The WOAH early warning system is illustrated in the figure below.

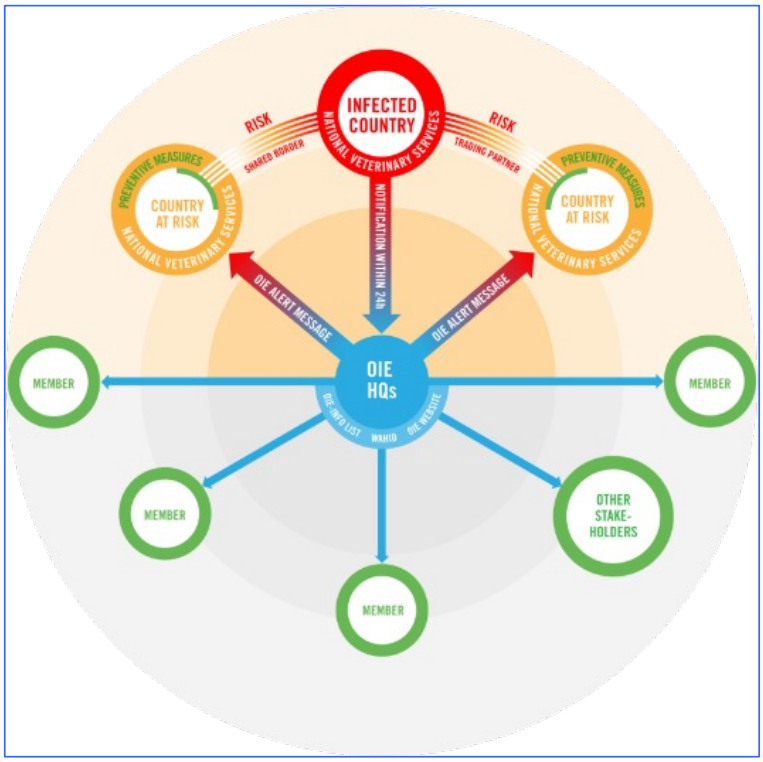


Figure A3.1. WOAH-World Animal Health Information System (WOAH-WAHIS)[2]

The system consists of two components:

1. Early warning system to inform the international community, by means of "alert messages", of epidemiological events that occurred in WOAH Member Countries, and
2. Monitoring system to monitor WOAH Listed diseases (presence or absence) over time.

1 See: https://wahis.woah.int/ accessed May 2022.
2 Source: https://www.woah.int/fileadmin/Home/eng/Animal_Health_in_the_World/img/graph_active_search/WEB_GRAPHICS_EARLY-WARNING-EN.png

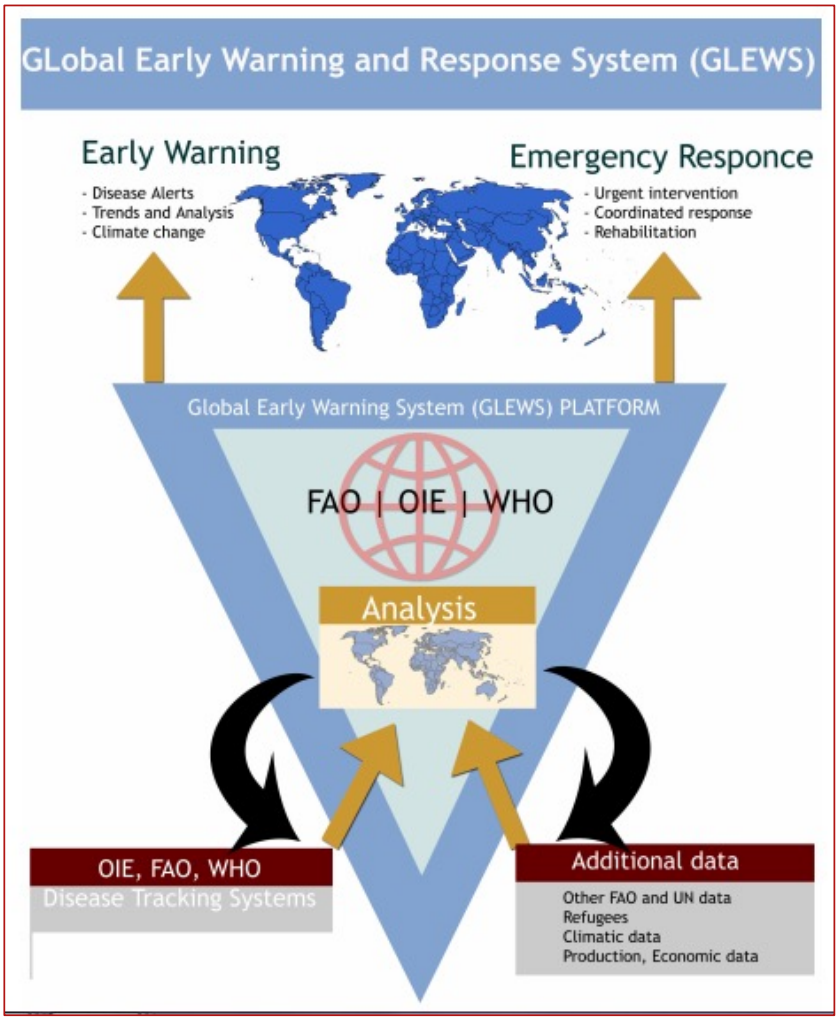


Figure A3.2. FAO-WOAH-WHO GLEWS flow of information
source: www.woah.org/app/uploads/2021/03/glews-tripartite-finalversion010206.pdf

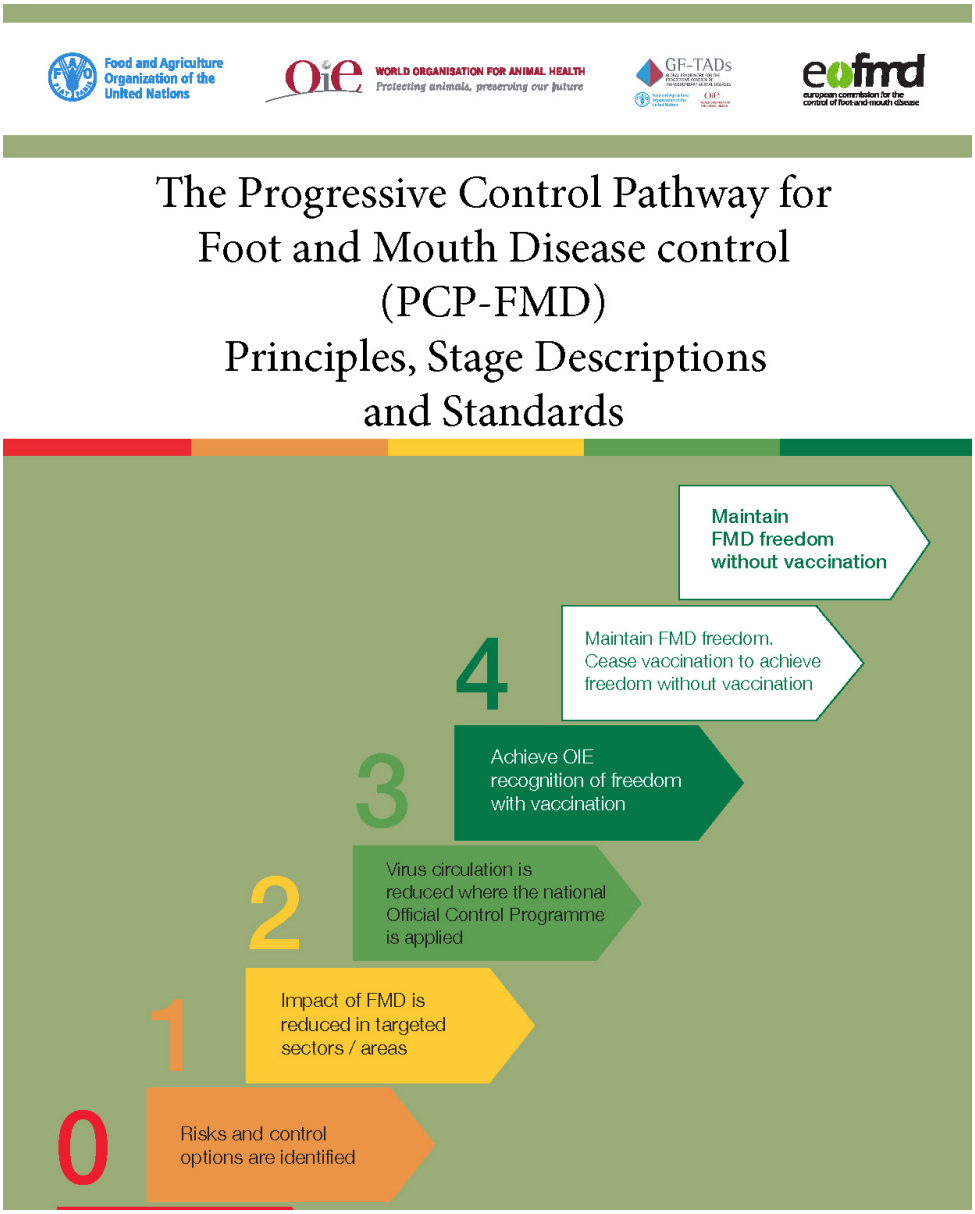


Figure A3.3. The Progressive Control Pathway for Foot and Mouth Disease Control (PCP-FMD)

source: http://www.fao.org/3/CA1331EN/ca1331en.pdf

Annex 4

# Reporting Forms

## Contagious Disease Reporting Form – LBVD AHD/PC (14)

**မွေးမြူရေးနှင့်ကုသရေးဦးစီးဌာန၊ ညွှန်ကြားရေးမှူးချုပ်ရုံးက ၁၀-၈-၁၉၉၉ ရက်စွဲဖြင့်ထုတ်ပြန်သည့် ညွှန်ကြားချက်အမှတ် ၁/၉၉ "တိရစ္ဆာန်ကူးစက်ရောဂါကာကွယ်ရေးနှင့် ထိန်းချုပ်ရေးဆောင်ရွက်ရန်ကိစ္စ" တွင် ပူးတွဲဖော်ပြထားသည့် "ကူးစက်ရောဂါဖြစ်ပွားကြောင်း သတင်းပေးတိုင်ကြားခြင်းပုံစံ"**

**မွေးမြူရေးနှင့်ကုသရေးဦးစီးဌာန**

**ကူးစက်ရောဂါဖြစ်ပွားကြောင်း သတင်းပေးတိုင်ကြားခြင်းပုံစံ**

တိရစ္ဆာန်ပိုင်ရှင်/လက်ဝယ်ရှိသူအမည် .....

ဖြစ်ပွားသည့် နေရာဒေသ အမှတ် ..... လမ်း .....

ရပ်ကွက်/ကျေးရွာ ..... မြို့နယ် .....

စတင်ဖြစ်ပွားသည့် ရက်စွဲ ..... ကောင်ရေ .....

သေဆုံးကောင်ရေ ..... ယင်းဒေသရှိကောင်ရေ .....

ရောဂါလက္ခဏာများ .....

ရောဂါကူးစက်ပျံ့နှံ့မှုအခြေအနေ .....

တိုင်ကြားသည့် နည်းလမ်း .....

| **တိုင်ကြားသူ** | | **သတင်းလက်ခံသူ** | |
|---|---|---|---|
| လက်မှတ် | ..... | လက်မှတ် | ..... |
| အမည် | ..... | အမည် | ..... |
| နိုင်ငံသားစိစစ်ရေးကတ်ပြားအမှတ် | ..... | ရာထူး | ..... |
| လိပ်စာ | ..... | လိပ်စာ | ..... |
| ဖုန်းနံပါတ် | ..... | ဖုန်းနံပါတ် | ..... |

ယင်းညွှန်ကြားချက် အပိုဒ် ၁၇ တွင် အောက်ပါအတိုင်း ဖော်ပြထားပါသည်-

"၁၇။ ဦးစီးဌာန ဒု-ဦးစီးမှူးသည် မိမိတာဝန်ယူရသည့် ဒေသအတွင်း တိရစ္ဆာန်ကူးစက်ရောဂါဖြစ်ပွားကြောင်း သတင်းပေးတိုင်ကြားချက် ရရှိသည့်အခါ-

(က) လူကိုယ်တိုင် လာရောက်တိုင်ကြားခြင်းဖြစ်ပါက ကူးစက်ရောဂါဖြစ်ပွားကြောင်း တိုင်ကြားခြင်းပုံစံ *AHD/PC (14)* တွင် ရေးသွင်း၍ ယင်းပုံစံမူရင်းကို တိုင်ကြားသူအားပေးအပ်ရမည်။

(ခ) အခြားနည်းလမ်းဖြင့် တိုင်ကြားခြင်းဖြစ်ပါက ရရှိသည့်သတင်းအချက်အလက်ကို ကူးစက်ရောဂါဖြစ်ပွားကြောင်း တိုင်ကြားခြင်း ပုံစံ *AHD/PC (14)* တွင် ရေးသွင်း၍ ယင်းပုံစံမူရင်းကို တိုင်ကြားသူ သို့မဟုတ် သတင်းပေးတိုင်ကြားချက်ပါ ကူးစက်ရောဂါဖြစ်ပွားသောဒေသ၏ အာဏာပိုင်အဖွဲ့အစည်းအား ပေးအပ်ရမည်။

(ဂ) ကူးစက်ရောဂါဖြစ်ပွားမှုမှတ်ပုံတင်စာအုပ် *AHD/PC (15)* တွင်ရေးသွင်းရမည်။

(ဃ) ကူးစက်ရောဂါဖြစ်ပွားကြောင်း ဆောလျင်စွာအစီရင်ခံစာပုံစံ *AHD/PC (16)* ဖြင့် ဦးစီးဌာနအထက် ရုံးအဆင့်ဆင့်သို့ အစီရင်ခံတင်ပြရမည်။

(င) **သတင်းပေးတိုင်ကြားချက်ပါ ကူးစက်ရောဂါဖြစ်ပွားသောဒေသသို့ အမြန်ဆုံး သွားရောက်ရမည်။**"

## Disease Reporting Form (Livestock breeding and veterinary department)

Date of Reporting ..... To whom report the events .....

State/Region ..... District .....

Township ..... Village Tract ..... Village .....

Type of Animal .....

Date of Clinical Sign onset .....

Type of Farm .....

Clinical Sign Observed .....

.....

.....

Number of Animal in the herd/ flock .....

Number of Animal Affected .....

Number of Death .....

Date of Mortality onset .....

Medication and Vaccination .....

.....

Other type of Animals nearby .....

What type/number of samples collected .....

Sample collection date .....

Which Lab Sample submitted .....

Lab result/date of result received .....

Name of Farm Owner .....

Farm Add & Owner Add .....

Contact Phone Number (Farmer) .....

Signature .....

Name of Reporting Vet .....

Vet Council Registration No. (TaSaMa) .....

Phone Number .....

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United Nations Building
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Zawana Theidi Quarter, Oattara Thiri Township
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