SWINE HEALTH MANAGEMENT

Handbook on swine health field surveillance

Volume 1

RAP PUBLICATION 2012/27

Swine health management

Volume 1

Handbook on swine health field surveillance

Food and Agriculture Organization of the United Nations
Regional Office for Asia and the Pacific
Bangkok, 2012

ISBN 978-92-5-107477-0

Cover photographs:
Top left: © FAO/Pius Ekpei – A young sow nursing her litter of piglets (FAO Project UTF/NIR/047/NIR)
Top right: © FAO/J. Koelen – Improved pig-raising, using antibiotic treatment (FAO Special Programme for Food Security: SPFS/CMB/6701)
Bottom left: © Bureau of Animal Industry, Philippines/Imelda J. Santos – Blood collection activity in the Philippines
Bottom right: © FAO/K. Pratt – French white pigs cross bred with local Beninese variety for better meat and natural resistance to disease
Cover design:
Veerawatchara Suksantinunt

For copies please write to:
Carolyn Benigno
Animal Health Officer
FAO Regional Office for Asia and the Pacific
Maliwan Mansion, 39 Phra Atit Road
Bangkok 10200, Thailand
Tel. (+66) 2-697-4000
Fax. (+66) 2-697-4445
Email: FAO-RAP@fao.org

Foreword

With the increase in worldwide demand for meat, fast-growing species with efficient feed conversion rates – such as pigs – are likely to account for a major share in the growth of the livestock sector. The increase in animal numbers is not spread evenly round the globe: Asia leads the increase, whereas pig numbers in North America and Europe are increasing more slowly or holding steady. In Africa, pig numbers have recently grown more rapidly, reflecting increased adoption of pig husbandry in a continent where "livestock" has traditionally been taken to mean "ruminants".

Commercial pig production has intensified significantly in recent decades. More pigs of the same few breeds are kept on fewer farms, with increased output of animal products. Large-scale production systems have achieved a high level of uniformity because they are based on the same genetic material and therefore provide similar feed and infrastructure for the animals.

In developing countries, half of the current pig population is still kept in traditional small-scale, subsistence-driven production systems in which pigs provide much more than meat. Pigs in such low-input systems provide value-added for farmers by consuming feed that would otherwise be lost. Hence pork might contribute to food security and provide protein, but the animals might also constitute a financial safety net, fulfill a role in cultural traditions, or provide additional cash for school fees, medical treatment or small investments.

The swine growth trend across Asia is characterized by an increase in production stemming from an increase in herd size. As more and more gilts and young sows populate herds, the risk of disease from these young animals increases. These problems are compounded by the growing movement of animals and the risks of the introduction of new diseases. Hence there are a greater number of reports of swine disease outbreaks such as foot and mouth disease (FMD), porcine reproductive and respiratory syndrome (PRRS) and classical swine fever (CSF). Smallholders and even larger producers face major constraints in actively participating in livestock development opportunities due to the heavy burden imposed by such diseases. The adverse socio-economic impacts of such diseases are significant, particularly in developing countries where the livestock sector shapes prospects for economic growth, poverty alleviation and food security.

This publication is a three-volume set showcasing effective swine disease management in smallholder settings through field surveillance, diagnostic support and the application of good herd health management. This volume – Volume 1: Handbook on swine health field surveillance – aims to guide national animal health frontline staff in conducting field surveillance in swine herds. The second volume – Volume 2: Guide to prevent and control porcine reproductive and respiratory syndrome – provides examples on how to prevent, control and respond to outbreaks of

PRRS, which have been reported in at least six countries in Southeast Asia. The third volume – Volume 3: Frequently asked questions on pig biosecurity and disease reporting – is a compilation of answers to questions raised by pig producers in the course of doing field work on swine health management. These three volumes are an attempt by the Food and Agriculture Organization of the United Nations (FAO), in consultation with other swine health experts, to provide practical information for animal health frontline staff in responding to the needs of smallholder pig producers.

It is hoped that collective action to control and eradicate or manage swine diseases through sharing of information on regional disease control efforts, tools and methods will result in preventing the occurrence and spread of swine diseases in the region.

Hiroyuki Konuma
Assistant Director-General and Regional Representative
FAO Regional Office for Asia and the Pacific
Bangkok, Thailand

Contents

Acknowledgements

The Food and Agriculture Organization of the United Nations is grateful to the contributions made to the three volumes on swine health by the different national focal points of the following countries, namely: Cambodia, Lao People's Democratic Republic, Myanmar, Philippines, Thailand and Viet Nam.

Special thanks to the FAO field team in the Philippines for sharing and demonstrating their field surveillance exercises with the other countries mentioned above and to all the swine farmers who welcomed the field team and national focal points to their homes.

The roles of Carolyn Benigno, Imelda Santos, Sharie Aviso, Chanrit Uawongkun, Leo Loth and Terry Clayton for bringing all the inputs together are much appreciated.

Abbreviations and acronyms

AFSSA	Agence Française de Sécurité Sanitaire des Aliments
AVET	Applied Veterinary Epidemiology Training
BAI	Bureau of Animal Industry
CSF	Classical swine fever
CLSU-CVSM	Central Luzon State University College of Veterinary Science and Medicine
DFA	Direct Fluorescent Antibody test
EDTA	Ethylenediaminetetraacetic acid
ELISA	Enzyme-linked Immunosorbent Assay
FAO	Food and Agriculture Organization of the United Nations
FMD	Foot and mouth disease
IFA	Indirect Fluorescent Antibody test
IPMA	Immunoperoxidase Monolayer Assay
OIE	World Organisation for Animal Health (*formerly Office International des Epizooties*)
PCR	Polymerase Chain Reaction
PRRS	Porcine reproductive and respiratory syndrome
VNT	Virus Neutralization Test

Introduction

Recent disease epidemics in both developing and industrialized countries have once again focused attention on livestock diseases and their potential to harm development. swine diseases, such as foot and mouth disease (FMD), porcine reproductive and respiratory syndrome (PRRS), and classical swine fever (CSF), have negatively affected productivity in many swine production areas, especially in developing countries. In 2009, swine influenza (Pandemic H1N1/2009) triggered worldwide public concern. The occurrence and spread of swine diseases has prompted veterinary authorities from different countries to impose stringent trade barriers, which have significant economic and social implications in trading countries.

The key to success in handling animal disease epidemics is early detection. If a disease can be detected early, there is a better possibility it can be arrested and eliminated before it causes widespread harm. Early detection presupposes there is a surveillance system in place that will detect infection. The country's veterinary authorities are then in a position to manage the problem before it becomes uncontrollable, thus protecting the local livestock industry and ensuring food security for those dependent on livestock (FAO, 1999).

Surveillance is defined as the systematic routine collection, collation, and analysis of data related to animal health and the timely dissemination of information to those who need to know so that action can be taken (OIE, 2009). With surveillance, early detection of emerging diseases or monitoring of any change in the status of existing diseases can be achieved by closely investigating an animal population. Furthermore, knowledge on the sources of disease and the risk of disease transmission can be determined so that effective disease control strategies can be implemented.

Field veterinary staff play an important role in effective and efficient disease surveillance. Field veterinary investigators must be proficient in recognizing and distinguishing swine diseases and in conducting in-depth investigations using standardized methods.

This handbook is aimed at providing practical information for field veterinary staff in preparing and conducting surveillance of swine.

The handbook is divided into four parts: preparing for field surveillance, conducting active surveillance of swine diseases, passive surveillance at the community level, and data analysis and information dissemination.

Preparing for active surveillance of swine diseases field surveillance

A management plan must be drawn up and adhered to. The plan defines priorities, targets, responsibilities, resource allocation and responsibilities. The elements included in such a plan are outlined below.

Objectives of the field surveillance

The first step is to know the rationale and specific objectives of the surveillance. It must be clear why the surveillance is being done. The aim of surveillance could be: to detect disease, prove that a zone or country is free from a disease, describe disease distribution, or assess progress of disease control programs. Objectives must state which disease (if known) will be investigated, for what reason, and where the disease will be investigated. It is also important to define the animal population.

The expected outputs to be delivered by the surveillance program must be determined. What are the results, decisions and actions to be brought about by the surveillance? What useful information derived from the surveillance might aid decision-making regarding animal and public health issues?

How will disease information be obtained?

Decide on the type of surveillance to be employed. Surveillance may be: active, passive, risk based (targeted), a serological survey, or a combination of these four types of surveillance. If animal health data is already available, determine the source, quality and reliability. Verification of available data may be necessary. Depending on the type of surveillance, specimen collection or interviews with farmers and local animal health workers may be necessary.

Standard case definitions

Case definitions are essential in disease investigations. At the start of a survey the disease must first be defined or described for a field investigator to measure disease occurrence accurately.

The case definition should include the field observations or clinical criteria or laboratory criteria. The OIE description of animal diseases can be used in developing standard case definitions. Remember that case definitions can vary between and within countries. When using standard case definitions, ensure that animals or outbreaks counted as cases are identified uniformly (FAO, 2010).

Time and target area

Surveillance planning will include deciding on how many staff members will be allocated to surveillance duties, the frequency of visits, distances to be travelled, and transport requirements. Planning the schedule of field visits and surveys will help cut costs in transportation and other expenses and will allow adequate time for laboratory tests to be conducted. Depending on the objective of the survey:

- Draft a protocol outlining the duration and the target start and end dates of the surveillance.
- Decide on the frequency of field surveys in an area.
- Carefully plan a schedule for every activity for the duration of the surveillance. On the surveillance calendar, program the following:
    - what farms to visit
    - how many farms to visit
    - when to visit each farm

Biosecurity

Veterinarians, field surveillance officers, community animal health workers and agribusiness representatives may visit many farms in one day and travel sometimes considerable distances between farms. They are potential carriers of many animal diseases and should adhere to a strict biosecurity protocol of cleaning and disinfection:

- In an ideal situation, farmers should refuse visitors to the farm unless they undergo a cleaning and disinfection regime before entering.
- The surveyor (field surveillance officers) should clean and disinfect when leaving the farm.
- Contact with animals should be minimized (for instance, interviews can be conducted outside the farm).

Materials and supplies

Before conducting a surveillance, ensure the availability of materials and supplies necessary for the activity. Make an inventory of all the materials needed.

Checklist of basic materials and instruments for field surveillance:

- scrub suit (coverall) and boots
- restraint aids (e.g. pig snares, ropes, nose tongs)
- disposable gloves
- specimen collection kits
- blood collection equipment

- cool boxes/ice chest/coolants
- soap and disinfectants
- necropsy kit
- office supplies (e.g. marker pens, ink, tapes and notebook)
- questionnaire/sample submission forms
- transport/vehicle
- camera
- maps or GPS device
- computer hardware and software
- leaflets or posters on the disease
- telephone and other communications equipment

Field team

- Determine the number of field surveillance officers or people who will collect samples and conduct follow up investigations.
- Ensure the technical competency of field surveillance officers in general swine health, clinical diagnosis of the targeted disease, and a number of other diseases (to determine a differential diagnosis if necessary).
- Ensure field surveillance officers have skills in sample collection and in conducting standard questionnaire interviews.
- Make a work plan and define the responsibilities for each member of the team.
- Ensure field surveillance officers have been trained in biosecurity and are equipped with cleaning equipment and disinfectants. Field surveillance officers should disinfect after every farm visit.

Permits and notices to prepare for a field survey

Obtain from national, regional and local authorities the necessary permits and notices to conduct the field activities. These include:

- Permits or notices for conducting sampling and other field activities in the area or locality.
- Permits for shipment or transportation of biological specimens.

Participation of pig owners

- Develop communication channels with pig owners, animal health workers and community leaders.

- Explain fully the purpose and importance of the surveillance activities to get their cooperation and support.
- Obtain their consent regarding the procedures conducted on their pigs such as sample collection and testing.
- If their services or help are needed, explain to pig farmers and animal health workers what needs to be done and their responsibilities.
- Discuss with the pig farmers and animal health workers the case definition for the disease under investigation, emphasizing that all cases that meet the case definition should be documented and reported promptly.

Survey of pig farmers

Possible risk factors of disease and other relevant information can be obtained from farmers through the use of survey methods. When conducting an interview using a questionnaire:

- Decide on the design and method of administration of the questionnaires before conducting the field work.
- Decide whether a new questionnaire needs to be drafted for the interview or a standard questionnaire prescribed by the national veterinary services or higher authorities will be used.

Specimen collection

- Determine the type of diagnostic specimen. Selecting the type of specimen depends on the disease under investigation and the diagnostic tests to be used.
- Know the protocols provided by the laboratory regarding the collection and handling of specimens. Follow these protocols closely.
- Know the protocols provided by the laboratory regarding packaging and storage. Follow these protocols closely.
- Be familiar with marking tools and identification procedures for specimens.
- Be familiar with the shipment requirements and procedures.

Laboratory analysis

Depending on the capabilities of the laboratory and the disease and the animal species to be investigated:

- Check for available rapid test kits in the market and their suppliers. Make sure these tests are of satisfactory standard; seek advice from the laboratory or the national veterinary service. Purchase adequate numbers for the surveillance activity.

- Find out from the laboratory or the state veterinary service the required confirmatory diagnostic methods.
- Check the availability of diagnostic tests in your area for a particular disease and the protocols the laboratory implements regarding the performance of these tests.
- Check the technical capability of the national veterinary services and regional or provincial laboratories in testing the samples, protocols used in sample submission, testing, and release of results.
- In close consultation with the national veterinary service: identify other available laboratories capable of performing the required test for the samples. These may include:
    - private laboratories
    - reference laboratories
    - veterinary school and/or state university-based laboratories
- In close consultation with the national veterinary service: secure agreement or understanding with the institutions or laboratories that will be used to analyze the specimens.
- Formalize agreements regarding the release of laboratory results.

Data management and processing

Identify and consult veterinary epidemiologists to determine the methods for data entry and processing and methods for the centralization and collation of data. Data entry may be done by:

- manual coding on spreadsheets or tables (paper-based)
- recording in a notebook (paper-based)
- use of a computer database program
- use of laptops or handheld electronic devices
- data transmission by mobile phone (e.g. SMS Gateway)

Several computer programs such as MS Excel and different versions of Epi-Info database management program can be used for this purpose.

Data analysis

Consult veterinary epidemiologists to determine how data from reports and data gathered during the field and laboratory investigation will be analyzed. Data can be analyzed by tabulating farmer reports manually and making a summary report using epidemiological analytical methods with the use of appropriate database and statistical programs.

Data circulation

- Determine and put in place a mechanism or system of reporting.
- Develop a system that facilitates information transfer or feedback mechanisms so that a rapid response can be made.
- Work with the national/central veterinary services, public health officers, national veterinary medical associations or animal industry associations to educate animal health professionals and other stakeholders and encourage participation.

Conducting active surveillance of swine diseases

Active surveillance of swine diseases is a comprehensive search for evidence of a disease or for confirmation that a population is free from a disease. It may involve actively communicating with veterinary officers, farmers, community animal health workers, laboratories, auxiliaries and others. Performance, production and health records may need to be obtained and farms may need to be visited to examine the livestock for evidence of disease.

Active surveillance may include any or all of the following:

- clinical surveillance,
- collection of diagnostic specimens,
- laboratory analysis, and
- farmers' interviews.

Clinical surveillance of diseases present in a herd

- Initial diagnosis of a disease is made by physical examination or clinical observation of the animals (FAO, 1999).
- Check pigs manifesting clinical signs and lesions symptomatic to the disease of interest as described in the case definition. Look for signs suggestive of the disease of concern. Carefully inspect the body parts for lesions.
- Consider differential diagnosis of the lesions and clinical signs found. A differential diagnosis is used to identify the presence of a disease where alternatives are possible, for instance vesicular lesions on pigs could be caused by swine vesicular disease, Foot and Mouth Disease, vesicular stomatitis, vesicular exanthema of swine, and chemical or thermal burns.

Figure 1 Directly observe pigs for signs of disease or abnormalities
Photo courtesy of CLSU-CVSM. Philippines

- Pigs manifesting signs of a disease will be considered suspect or clinical cases depending on the case definition and the objectives of the surveillance. For example, pigs having vesicular lesions in the mouth and tongue and between the coronary band and hoof, which are highly suggestive of Foot and Mouth Disease, could be considered as cases depending on the case definition.

Figure 2 The first step by the field investigator is direct observation of abnormalities like the skin lesions on this pig
Photo courtesy of Janice C. Sabagay, FAO

- Gather and record information if there are unusual animal deaths. “Unusual” should be defined in the case definition.
- Direct evaluation of the pigs and the environment should be undertaken to determine the occurrence of disease and the factors that may be associated with a disease event. Observable risk factors must be always noted and recorded.
- Interview farmers using a standard questionnaire (Annex 6) about the clinical signs or abnormalities they have previously seen in their pigs. Describe and record the unusual signs or lesions they have observed and what parts of the body were affected. Collect and record information about the health issues of their animals.

Figure 3 Pigs and their environment must be directly observed to determine disease occurrence and associated factors
Photo courtesy of CLSU-CVSM, Philippines

- Farmers have constant access and contact with their animals and routinely check for signs of disease or abnormalities and can give valuable information regarding changes in health or disease status. Follow a standard questionnaire (Annex 6) and record changes in reproductive rates, fertility rates, food and water intake.

- When there is evidence of disease through visual inspection, depending on the case definition and the objectives of the surveillance, further investigation may be needed to confirm the presence of the disease.

Figure 4 Reliable information regarding clinical signs and abnormal conditions of animals should be gathered through interviews with farmers (indirect surveillance)
Photo courtesy of AVET, 2011

- Intervention measures may be put in place by the veterinary officer in charge when a disease is clinically detected. This can be done even before laboratory tests confirm the disease or findings and recommendations of the surveillance are released.
- Depending on the case definition and protocols, specimens from suspected and clinical cases in the herd could be collected and submitted to a laboratory for diagnosis.
- Accurate recording of all findings as per standardized questionnaire and investigation forms are essential. All fields on the forms have to be filled in.
- Modern technology can greatly aid data information collection and recording. Take photographs or record a video film of the findings. Use mobile phones to take photographs and transmit these immediately to the veterinary service in charge. Use voice recording devices during farmer interviews.

Collection of diagnostic specimens

Confirmation of a disease or exposure to a disease or vaccine is done by taking specimens from the target animals and subjecting these specimens to diagnostic methods.

Logistics needed

- Determine the number of field staff to be deployed for each survey schedule. Designate how many field staff will cover a particular area and how many animals or farms will be handled by each team/staff member.
- Purchase in advance all necessary supplies (e.g. specimen collection containers, needles and syringes). Purchase additional specimen containers and needles so extra materials are available in case of breakage or contamination in the field.
- Provide the field team with the needed office supplies such as pens, sample record forms/questionnaires, and marker pens for sample tubes.
- Provide packaging materials (boxes, gel coolants/ice packs/ice chests) for the diagnostic specimens. Ensure a cold chain from farm to laboratory; this may include refrigerators and freezers for overnight storage.
- Arrange for specimen transport to the designated laboratory. Inform the laboratory in advance of the delivery, how many specimens will be tested and when the specimens will arrive.
- The surveillance team must have transportation to the field and access to public or private laboratory facilities. Ensure that extra supplies for vehicles such as spare tires and other important motor parts, engine oil, gas, etc. are available (FAO, 1999).

- Ensure that provisions (food, water, first aid kits, sleeping materials etc.) for field personnel are prepared in case they need to stay on site longer than originally planned (FAO, 1999).
- Double-check the availability of specific materials and equipment for specimen collection.
- A standard specimen collection kit should contain:

A. Serology

Blood collection tubes (vacutainer or test tube)
Syringes (10 ml) for blood collection
Needles for vacutainer tubes
Needle holders
Vacutainer holders
Microcentrifuge tubes (serum vials)

B. Antigen detection/virus isolation

For samples other than blood:
Scissors and forceps
Small and large syringes
Bottles of transport/culture media
Swabbing materials

Calculating a sampling frame (selection of farms: herd level)

The epidemiology department of the national veterinary services will provide a sampling frame (the number of farms, their location and the number of animals to be sampled on selected farms). To calculate this sampling frame the following observations and data need to be considered:

- Determine the scope of observation or the population coverage, i.e. whether only a certain proportion of the population or the whole population will be included. The proportion of the population to be examined may be a representative sample.
- Consider the representativeness of the samples in selecting, i.e. if the samples have the same characteristics as those of the population from which inferences can be made.
- Draw up a sampling frame or a list of all the units in the population from which you will choose your sample. This can be a list of all the towns, villages, households, pig owners and every animal in the study area, i.e. the number of pigs in a village or town.

- Building the sampling frame can be done by: i) getting the list of communities, pig owners and their animals from the veterinary/local agricultural or extension offices; ii) visiting all households in the area and recording the number of pigs (census) or; iii) conducting a meeting with farmers in the village.
- When getting a list from veterinary or agricultural offices, ensure that the list is updated to ensure that all units are included in the sampling frame.
- If records are unavailable or not updated, a new sampling frame may be constructed. Visiting all households in the village can be done with the help of community animal health workers who can act as service providers or enumerators. Village officials may act as guides for the surveillance officer in locating the selected farmers during the fieldwork or they may also be tapped as enumerators.
- During the visit, use a serological survey form (Annex 1) in recording the names of the farmers and specify the number of their pigs.
- When no one is home, ask neighbors if those households have pigs and if there are, include them in the list.
- The list of pig farmers and the number of their pigs recorded by the village officials or enumerators should be consolidated. This will be the final sampling frame from which samples will be selected.
- Another method of drawing up a sampling frame is through conducting a farmers' meeting. Convene the farmers at a time and place convenient to them. Ask them their names and number of animals. Ask about pigs owned by farmers who are not at the meeting.
- Compute for the sample size. Determine the confidence level and the prevalence as these provide a basis for establishing the sample size for the survey. The sample size should be a representative of the population so that inferences can be made regarding the true disease status. Several computer programs, such as Epi-Info and Survey Toolbox are available to make a sampling frame. Determine the sample size and select the samples (Cameron, A. R., 1999).

Figure 5 A sampling frame can be made by a census of farmers and the number of their pigs (A) or by getting a list of pig owners and their pigs from municipal/village veterinary or agricultural officers (B) Photo courtesy of AVET, 2011

Calculating a sampling frame (selection of pigs at farm level)

The epidemiology department of the national veterinary service will provide a sampling frame (the number of animals to be sampled on the selected farms). To calculate this sampling frame the following observations and data need to be considered:

- To minimize the sampling error, choose samples in an unbiased way. Probability sampling or random sampling techniques ensure each individual animal has an equal chance of being selected.
- Simple random sampling can be done by drawing lots. Write the number (assigned or based on ear tag) of each animal in the sampling frame in a piece of paper, and then place the papers in a container. You then draw out the numbers at random. The number of papers to be drawn will depend on your identified sample size.
- When conducting surveillance for large numbers of animals, stratification or breaking the population into subgroups is necessary. Stratification may be done according to the management system, age groups or by herd size.
- Methods of probability sampling when using large sampling frames include:
    - Cluster sampling (one-stage, two-stage or multistage)
    - Stratified random sampling (random sampling within subgroups or strata)
- Sampling with large frames is done in two or more stages (FAO, 1999). For example, you can list the communities with swine herds, then randomly choose from the list the communities to be sampled. From the chosen communities, make a list of the herds and then randomly choose from the list the herds to be sampled. From the herds selected, make a list of the number of pigs. Compute for the cumulative total by adding the number of pigs starting from the first herd/location selected up to the last.
- Randomly select animals using the random number table from a statistics textbook or with the aid of a calculator or a computer (random number generator).
- The number of animals selected should be marked on the serological survey form (Annex 1).

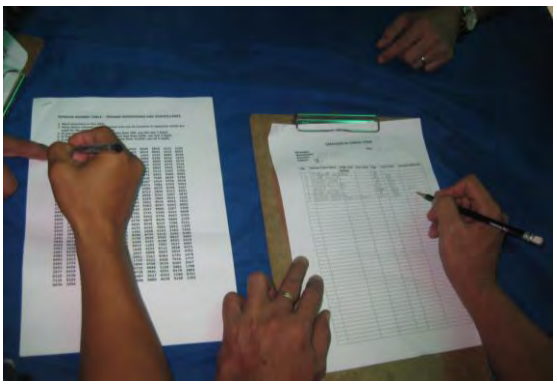

Figure 6 Do random sampling using the random number table
Photo courtesy of AVET, 2011

Farmer compliance

- Trust must be established with selected communities.
- Explain fully the participation and responsibilities of farmers and the community.
- Give assurance to the owners that no harm will be done to their animals.
- After the pigs are chosen on the form, explain the selection procedure to the farmers to discount suspicions or negative ideas about the reason why they were chosen.
- Obtain informed consent from farmers regarding the procedures that need to be undertaken within the village or farm such as collection of samples from their swine herd and laboratory testing.
- Discuss the details about why and how the procedures will be performed.
- Explain the expected duration of activities.

Specimen collection

Marking and recording

- Identify the number of animals to be sampled per farm.
- Identify animals that have been selected through statistically-valid methods of sampling.
- Immediately after identifying the desired animal, mark the body of the animal (using Gentian violet, etc.) for easy identification. Repeat this procedure until all the animals for sampling are identified.

Figure 7 Randomly identify pigs by counting loudly while pointing to each animal.
The identified pig is marked with Gentian violet
Photo courtesy of AVET, 2011

- If pigs are individually identified with an ear tag or ear notch, you may use the identification number instead of the random identification number.
- Record individual data of the selected animals on the sample recording sheet (Annex 4). The information sheet serves as reference data and should contain the following:
    - Name of farm owner
    - Date and time of specimen collection
    - Address of farm (village, town or province)
    - Farm population
    - Production system
    - Species of animal
    - Type of specimen
    - Animal specimen identification
    - Age of animal
    - Sex of animal
    - Pregnancy status
    - History, clinical signs, morbidity, mortality and post-mortem findings
    - Vaccine received and date of vaccination

Figure 8 A selected animal is marked for easy identification
Photo courtesy of AVET, 2011

- Make sure each animal's identification number/code designated during selection is the same as the one written on the sample recording sheet.

- Proper restraint of pigs should be done during examination and collection of specimens. The restraint procedure used depends upon the age and size of the pig:
    - Small pigs and piglets may be physically restrained by simply holding them (Cameron, A.R., 1999) or letting the pigs lie between the restrainer's thighs or in a trough while handling the head and legs. They may also be immobilized with the use of a pig restrainer or nose tongs.
    - Large pigs can be restrained using snares or snout ropes.

- Correct handling and restraint will reduce stress, prevent injury to the person conducting the examination or collection, and allows accurate and fast execution of the procedure.

Figure 9 A small pig can be restrained by holding the head and the legs when collecting blood
Photo courtesy of CLSU-CVSM, Philippines

Figure 10 Larger pigs can be restrained using snares. The snare loop is placed in the mouth and over the top jaw and snout of the pig, with the snare handle held vertically in the other hand
Photo courtesy of AFSSA

Type of specimen

Various specimens may be collected in swine disease surveys. These include blood, body fluids, tissue and organ samples or biopsies, swabs and feces. The OIE Terrestrial Manual (2008) describes different diagnostic specimens for collection in pigs. Different methods of collection, handling, packaging, preservation and transport of specimens are also discussed.

- Blood can be tested either for antigens or antibodies. Whole blood, plasma or serum samples can be assayed to detect the presence of specific antibodies against diseases and antibodies formed due to vaccination.
- Paired serum samples are collected from acute and convalescent cases to confirm many important swine diseases.
- Vesicular epithelium and vesicular fluid from un-ruptured (intact) and ruptured vesicles are suitable samples for FMD virus isolation (BAI, 2002).
- Other organs and tissues can be collected based on the purpose of the survey and the diagnostic test to be performed. Table 1 lists several specimens for various swine diseases.

Table 1. Diagnostic specimens for selected swine diseases

Swine disease	Diagnostic specimen
porcine reproductive and respiratory syndrome	whole blood, serum and meat juice samples (antigen and antibody detection) boar semen, lung tissue, tonsils, lymph nodes (antigen detection)
foot and mouth disease	vesicular fluid or epithelium, whole blood, serum (antibody detection)
porcine pseudorabies virus **Aujeszky's disease**	serum (antibody detection), tonsils, lungs (virus isolation)
classical swine fever **African swine fever**	blood, tonsil, spleen, kidney or lymph nodes (antigen detection), serum (antibody detection)
porcine circovirus-2	serum, lymph nodes (antibody, antigen detection)
atrophic rhinitis	nasal or tonsillar swabs, tonsil (agent identification)
pandemic H1N1 **2009 Influenza**	nasopharyngeal swabs, respiratory specimens
enteric microbes **(e.g. salmonella sp.)** **parasites**	fecal samples (agent identification)

Figure 11 Vesicular epithelium from vesicles for foot and mouth disease diagnosis
Photo courtesy of NFMDTF, Philippines

Collection

- Specimen collection should be done in teams with the assistance of the pig farmer.
- The number of teams may depend on the proximity of one farm or household to another and the number of animals to be sampled.
- Follow standard protocols and procedures in specimen collection.
- Follow principles of asepsis to ensure collection of quality samples. Contaminated samples due to improper handling may give unreliable results.
- Sites for blood collection in pigs include the anterior vena cava, jugular vein and ear vein. The anterior vena cava or the jugular vein is the preferred site in collecting large amounts, especially in adults, while the ear veins are used when collecting small amounts of blood. The marginal ear veins are readily visible in all sizes of pigs, hence are commonly used in collection (Framstad T., Sjaastad Ø. and Aass, R.A, 2004).
- Blood collection can be done by phlebotomy techniques: venipuncture or drip method (BAI, 2002).
- Venipuncture is done with the use of a syringe and needle or needle and sterile vacuum (vacutainer) tubes.
- Five milliliter (ml) of blood to be collected per animal is ideal for serological test. A considerable amount of serum (about 2 ml) can be extracted from this amount of blood (BAI, 2002).
- The drip method can be done when collection tubes or syringes are not available. This is done by angling a test tube against the flow of blood from the severed blood vessel (BAI, 2002).
- Collect blood and serum samples in clean, sterile tubes.
- When whole blood or plasma is needed for testing, use a suitable anticoagulant. Heparin or EDTA can be used.

- Blood samples should be processed immediately after collection. Whole blood should be stored cold. Serum should be separated by centrifuge after clotting and also stored cold.
- Do not send hemolysed or contaminated blood to the laboratory.
- Collection of organ and tissue samples requires more specialized techniques, equipment and transport media (Cameron, A.R., 1999).
- Collection techniques depend on the type of samples needed, the purpose and the requirements of the diagnostic test to be used.

Figure 12 Blood collection in small pigs
Photo courtesy of CLSU-CVSM, Philippines

Figure 13 Blood collection in large pigs
Photo courtesy of Sharie R. Aviso, FAO

Handling, packaging and labeling

Handle all specimens carefully in a bio-secure and bio-safe manner treating them as if they harbor infectious or zoonotic disease agents. Observe safety precautions in handling specimens as they may carry microbiological hazards:

- Use protective gloves when handling diagnostic specimens.
- Close specimen collection tubes tightly with plastic screw caps after collection, especially if the specimens are fluids (vesicular fluid/blood/sera).
- Place the tubes in a holder in an upright position after collection.
- Mark all sampling tubes/vials with appropriate labels and codes. Codes may be developed for village, herds and individual animals. Label the tubes and vials so that the diagnostic specimen matches the sampled animal.
- Label the body of the container containing the tubes with the diagnostic specimen – not the lid – to avoid loss of identification if a lid is lost or replaced during handling or processing. Use permanent/indelible ink that will not be washed off or smear if the tube or vial gets wet.

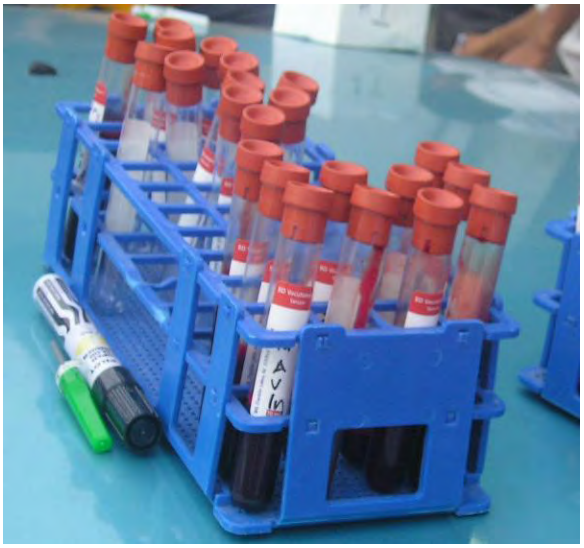

Figure 14 Tubes must be immediately labeled and placed in an upright position after collection. Use water-resistant permanent markers
Photo courtesy of Sharie R. Aviso, FAO

- Use standardized labels such as animal identification (ear notch, ear tag, etc.) when marking tubes and vials. Unique herd codes are usually used to provide basic herd information for diagnostic investigation.
- The labels must be consistent with the records on the information sheet and on the requisition form that accompanies each diagnostic specimen submitted to the laboratory.
- Diagnostic specimens not immediately sent to the laboratory should be refrigerated to prevent deterioration.

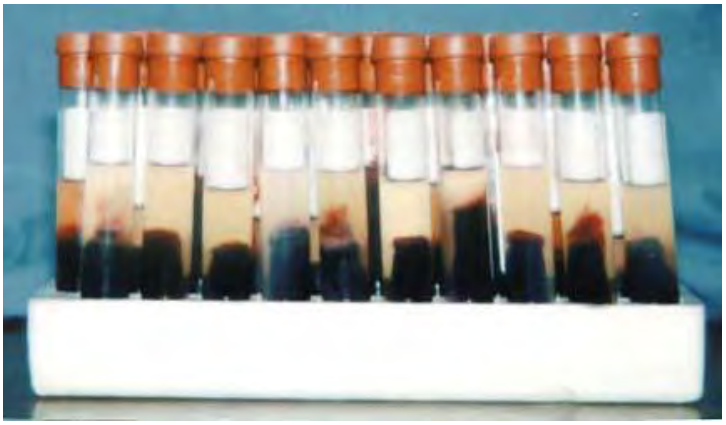

Figure 15 Test tube holders can be used to securely hold together the blood samples
Photo courtesy of Imelda J. Santos, FAO

- Use suitable specimen collection packages to transport specimens safely to the laboratory.
- Ensure that caps of tubes and vials are closed and taped securely so that no leakage will occur during shipment.
- Place vials and collection tubes in transport containers or cool boxes with gel coolants or ice packs or keep them refrigerated while being transported to the laboratory.

Figure 16 Transport samples in cool boxes with gel coolants or ice packs
Photo courtesy of RADDL IV, Philippines

- Label the boxes containing specimens with the name and addresses of the sender and the laboratory and write clearly "Biological Specimens" and the storage requirements (BAI, 2002).
- For specific details for transport requirements, contact the laboratory where specimens will be submitted.
- Make sure the laboratory is contacted before submission. Laboratories must be informed about the expected date and time of delivery, number of specimens, and contact information of the sender.

Operating procedures

- Before the actual fieldwork, conduct a thorough briefing of all field veterinary staff regarding the protocols to be followed.
- Never compromise on the safety or well being of staff. Make sure work conditions are such that health is not compromised.
- If the field surveillance officers divide into groups, the individual farm or village must be identified and designated to each group.
- Advise each group regarding the number of animals to sample at each site.
- Issue equipment, materials and instruments listed on the checklist to each of the staff or groups.
- Follow strict biosecurity measures to prevent the spread of infectious diseases during the surveillance farm visits. If available, use the farm foot baths. Disinfect vehicles by using the wheel baths, change clothes and wash before entering and leaving the farm premises.

Figure 17 Follow biosecurity measures like the use of a foot bath
Photo courtesy of AVET, 2011

- When conducting a series of survey activities from village to village or farm to farm, follow all biosecurity measures strictly to prevent disease spread. In addition to cleaning and disinfecting between farms, for highly contagious diseases there is also the required "downtime' after each visit. For example, depending on the case definition and protocols, officers are not allowed to visit any farm after detection of FMD virus for 24 hours.

- Wear protective gear (scrub suits/coveralls, rubber boots, gloves, etc.) and clean clothing when conducting fieldwork. These must be disinfected before leaving the investigation site.
- A container containing appropriate disinfectants must be made available for the pig restrainer and personnel involved in sampling.
- Materials used for specimen collection need to be cleaned and disinfected before leaving the premises.
- Follow standard laboratory procedures in diagnostic specimen collection, transporting and processing of specimens.
- Forms and questionnaires should be readily available. Forms and questionnaires (see Annexes 2-5) are essential when conducting sero-surveillance. These data recording sheets are used and kept as references during the analysis of diagnostic specimens. Necessary forms include:
    - Investigation report forms
    - Individual data recording sheets
    - Sample recording sheets
    - Sample submission forms
- Practice good hygienic measures on the premises:
    - Wash hands thoroughly after collection of samples. Use soap, rinse well and dry hands with a clean towel.
    - Sterilize all equipment and materials after use.
    - Decontaminate and dispose of used containers and diagnostic test kits.
    - Apply disinfectants to areas that were contaminated by reagents, microbiological materials or specimens.
    - Discard needles and tubes, especially damaged or broken, into a disposal unit or bio-safe container immediately after use.

Figure 18 Wear proper attire and carry a disinfectant when doing field surveys
Photo courtesy of Janice C. Sabagay, FAO

Laboratory analysis of specimens

- Laboratory testing of specimens confirms diagnosis of a disease, determines the prevalence of a subclinical disease, provides evidence of past exposure of animals to a disease, or determines the vaccination status of an animal or herd.
- Once specimens have been received at the laboratory they should be treated promptly to appropriate laboratory methods for analysis.
- Some diagnostic tests can be done by field investigators on site with screening tests with minimal requirements for technology. Commercial rapid test kits for various diseases, like FMD, PRRS, CSF, PRV and PCV-2, are now available. Depending on the case definition and the objective of the surveillance, virological, serological and molecular assays should be conducted by a competent laboratory to validate the screening test results.
- It is important to establish links with local, national or international laboratories able to analyze the diagnostic specimens. If areas are remote and laboratories are not easily accessible, special arrangements will have to be made to transport specimens to the nearest competent laboratory.
- A variety of laboratory tests (Table 2) are available for different swine diseases. One or more of these methods may be used to confirm clinical or serological surveillance.
- The sensitivity and specificity of a test should be determined and documented to serve as a basis for the interpretation of the data.
- The OIE Manual of Standards for Diagnostic Tests describes in detail the instructions for laboratory diagnostic procedures for different swine diseases.
- The laboratory should release test results promptly so that reports can be generated as soon as possible. Reports are used to:
    - Notify the state veterinary services to implement effective and efficient disease control strategies if disease is detected or confirmed as required by the objective of the surveillance.
    - Notify the farmer (by the veterinary authorities).

Table 2. Various diagnostic tests for selected swine diseases

Disease	Diagnostic test
FMD	ELISA, VNT, virus isolation, PCR
PRRS	Serological test: ELISA,PCR, IFAT and VNT, IPMA
	Antigen detection: DFAT, Immunohistochemistry, virus isolation
PRV	ELISA, VNT, virus isolation, DFAT
PCV-2	ELISA, PCR, virus isolation
CSF/ASF	Antigen/virus detection: PCR, DFAT
	Antibody detection: ELISA, IFAT
Swine Vesicular Disease	ELISA, VNT, virus isolation and growth

Farmer interviews

It is important that other data be collected to support the clinical and laboratory diagnosis (Annex 6). This is crucial when doing an outbreak investigation. Pig farmers can give detailed and important information regarding the husbandry of their animals, which is important to a comprehensive investigation. Field visits to communities to conduct farmer interviews regarding the health or disease status of their animals are important.

- An interview using a structured questionnaire (such as Annex 6) is best employed.
- An interactive dialogue or informal interview may be done with individual pig farmers or group/village discussions and consultations with other key informants.
- For informal interviews, use either semi-structured or unstructured interviews. In semi-structured interviews, ask the questions listed but you can deviate from the topic and formulate other relevant questions as need arises. For unstructured interviews, you can discuss freely with farmers without structured questions or a preset sequence of topics.

With farmer interviews, you must be able to do the following:

Identify cases, deaths and population at risk

- Record herd health and compare past and present productivity.
- Obtain an inventory of the total swine population as well as the total population per age group (Annex 6).
- Make a record or list of the number of sick and dead pigs and the number of susceptible animals in each farm (Annex 4).
- Record the age groups affected (Annex 6).

Describe chronology of disease events

A chronology is best done using a structured questionnaire like the one shown in Annex 6. If disease is suspected or detected in an area, conduct an investigation tracing back the source of infection. This is a critical step in assessing the spread of a disease or infection, especially in outbreak investigations:

- Record disease events according to date of occurrence:
    - Ask the farm owner or manager about the first case to determine when the disease started.
    - Note subsequent cases.
- Indicate farms or areas affected.
- Trace stock movements on and off the property to obtain information about the possible sources of infection and where the infection has possibly spread. Know the origin of pigs newly introduced to the farm.
- Trace the movement of feeds, animal products and other materials transported onto and off the farm.
- Evaluate farm records to validate data gathered through farmer interviews.

Figure 19 Review farm records to trace animal movements and introduction of feeds from outside sources
Photo courtesy of Janice C. Sabagay, FAO

Identify the possible source of infection

- Identify the source of infection for this property. The "index case" can be traced back from the very first farm affected.
- Knowing the source of infection will explain how the area had an incursion or outbreak. From the source of infection, forward tracing can be conducted and so other infected farms and areas can be identified.

Figure 20 Get information regarding feed and animal movements for tracing purposes
Photo courtesy of CLSU-CVSM, Philippines

Gather information regarding possible risk factors

A risk factor is a variable associated with an increased risk of disease or infection.

- Document all related information through history and background data gathering on the geographical location and environmental data.
- Review and collect farm records (production records, vaccination records, etc.).
- Document information regarding animal health programs.

Figure 21 Geographical location of the farm and environmental data should be noted by the investigator
Photo courtesy of CLSU-CVSM, Philippines

Figure 22 Review pertinent records on animals
Photo courtesy of Janice C. Sabagay, FAO

Figure 23 Vaccination and production records must be reviewed
Photo courtesy of CLSU-CVSM

- Examine the feeding, breeding and waste management employed on the farm.

Figure 24 Examine waste disposal management
Photo courtesy of CLSU-CVSM, Philippines

- Pay close attention and listen to the details of the farmer's description of events.
- Always validate the results of the discussion through direct observation of the animals, farms or villages or by specimen collection and submission for laboratory analysis.
- When an unstructured interview has been completed, structure all the data gathered from informants to facilitate computer entry and data analysis.

The survey questionnaire

The outputs of the surveillance system will be based on the inputs. It is therefore of utmost importance that data collected from the field is adequate and accurate. This can be achieved through the use of a survey questionnaire.

Designing the survey questionnaires

A questionnaire or a survey is used to obtain the data needed to answer the objective of the surveillance. The structure and flow of topics, sequencing of questions, and the style of the questionnaire should be user-friendly. This will aid in collecting reliable and accurate information. If questions are framed well, the main aim of the survey will be satisfactorily achieved. Good investigations depend on good questions.

The following steps should be considered when developing the questionnaire:

Determine the objectives of survey questions

- Questions must answer the main goal (objective) of the surveillance. They should provide answers to what you need to know.

Decide on the items to be included

- Decide what information you want to gather from the survey. Identify the content of the questionnaire. Measurable items or variables (rates and proportions) are important to facilitate analysis. Depending on the surveillance objectives, the questionnaire can be customized to a specific disease.

Determine the type of questions

There are two types of questions based on response: closed and open-ended. Structured or semi-structured surveys may make use of one or both.

- Closed questions provide respondents with a set of choices from which they select their answer. Answers to closed questions are easy to encode and analyze, but there can be bias due to limited response ranges.
- Open-ended questions allow respondents to formulate their own answers based on their own knowledge or judgment. Open-ended formulations are recommended for questions regarding clinical signs and post-mortem lesions. Farmers should be encouraged to narrate exactly what they observed in their own words. With narrative responses, there is no bias due to limited response range. Thus, a more comprehensive description of what really happened is obtained.

Determine the number of questions and items

The number of items or number of questions depends on the target output (the objective) of the surveillance system or on the design of the information system in place (FAO, 2011). Forms must be concise. A simple questionnaire will reduce the time it takes to complete the questionnaire (FAO, 2011).

Avoid collecting data that will not be analyzed or interpreted (Dufour and Hendrikx, 2007). A long and complicated questionnaire will tend to rush the investigator and the farmer during the interview and often leads to errors or incomplete data.

Determine the sequence of items

Structure the survey so the questions follow a logical sequence. Questions should be grouped by topical or thematic category (Dufour and Hendrikx, 2007). Good sequencing will allow the investigator to follow the flow of the questionnaires more easily and more easily trace the course of the interview when encoding.

Develop the questionnaire

Questions must be precise, clear and simple. Use of simple words, phrases and sentences makes the questionnaire easy to understand for anyone, especially the respondents. Terms used should be clearly defined and fully understandable. Technical jargon or formal versions of words (e.g. "obtain" verus "get") should be avoided as these may confuse or annoy the respondent and result in wrong or misleading answers. Do not assume farmers should understand scientific terms. Translate technical and scientific words into the local language whenever possible to encourage people to talk. Avoid using leading questions as these may generate false positive responses. Inaccurate and unreliable answers which enter the database will invalidate the results of the investigation.

Conduct a pilot survey (testing)

Test the questionnaire in the field to ensure farmers understand it. Pilot testing the questionnaires and techniques for conducting the interview will identify gaps or problems which can be addressed before collecting data. Testing is also a way of training the field team to use the questionnaire and conduct the interview.

Administer the questionnaire

Questionnaires can be used in a number of ways.

- *Unstructured interviews* can be used where there is a free flow of discussion and no structured questionnaire. The information supplied by informants is recorded as notes which then must be analyzed using a structured framework (e.g. assigning keywords to topics then counting the frequency of topics mentioned).
- *Semi-structured surveys* list major points or topics as a guide to discussion. You may alter or make new questions as relevant topics arise during the

interview. This can reveal important information not covered in a structured questionnaire.

- *Structured interview*s list a sequence of specific questions that need to be asked. The questionnaire is used directly during a formal interview and its structure strictly followed point for point. By following the structure, all questions will be answered during the interview, no questions will be left unanswered.

A sample questionnaire is illustrated in Annex 6.

Questions to ask in the survey questionnaire (see Annex 8 and 9)

- **Identifying information**
  - Source of the data (village/farm/herd)
  - Name of the farm
  - Complete address of the farm/specific location (include coordinates if available)
  - Name of the farm owner and the contact details (telephone number or email address)
  - Animal identification per house/pen
  - Animal Information (age, sex, breed)
- **Farm information/history**
  - Farm layout
  - Type of production system
  - Type of housing, facilities and structures
  - Biosecurity
  - Record-keeping and feed inventory
  - Population inventory (number of animals), inventory per pen or housing or age group (Annex 1, 3 and 4)

Figure 25 Knowing the farm layout and type of housing is essential in investigation
Photo courtesy of CLSU-CVSM, Philippines

Figure 26 Get the population per pen or housing unit to determine the population at risk
Photo courtesy of CLSU-CVSM, Philippines

- **Clinical information**
  - Health problems of animals
  - Occurrence of diseases
  - Dates of detection of unusual events or disease
  - Herd history including vaccination history
  - Chronology of events, particularly the number of sick and dead animals according to date of occurrence
  - Groups affected (age, sex, size)
  - Number of animals affected and number of animals on the premises to determine the numbers at risk
  - Post-mortem lesions if necropsy is performed
  - Morbidity and mortality of the farm
  - Tissues or samples submitted to laboratory
  - Diagnostic test results
  - Health problems on nearby farms

Figure 27 Gather evidence of disease such as stillbirths and mummified fetuses
Photo courtesy of CLSU-CVSM, Philippines

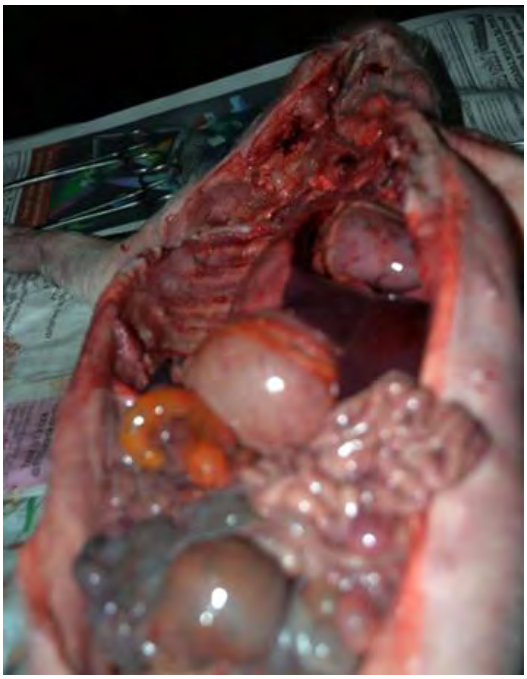

Figure 28 Postmortem examinations can serve as bases for diagnosis of a disease
Photo courtesy of CLSU-CVSM, Philippines.

- **Risk factor information**
  - Proximity to other farms/livestock premises
  - Sources of stock
  - Feed and water sources

Figure 29 Gather data on feed and water sources
Photo courtesy of CLSU-CVSM, Philippines

- Transportation procedures
- Breeding system/methods
- Protocol for purchased or delivered semen

Figure 30 Note if the farm uses artificial insemination or other breeding methods
Photo courtesy of CLSU-CVSM, Philippines

- Vaccination history (vaccination program, date of last vaccination, vaccine used, etc.)
- Behavior of farm workers and other people entering the farm
- Presence of other animals, pests and wild animals, e.g. stray dogs, cats, bats, rodents
- Forward and backward tracing of risk factors

Figure 31 Gather information on the presence of other animals such as pets, fowl and other livestock within the farm premises
Photo courtesy of CLSU-CVSM, Philippines

Passive surveillance in pigs at the community level

Passive disease surveillance is the routine gathering of information on disease incidents from sources such as routine disease reports, reports from animal health workers, field veterinary officers and livestock officers, submission of diagnostic specimens to laboratories and the results of laboratory investigations, requests for assistance from farmers, abattoirs and livestock markets.

Passive surveillance has several advantages. Aside from being cost-effective, it facilitates a continuous communication between veterinary officers, farmers and other key data sources. However, it should be recognized that complete reliance on passive surveillance usually leads to significant under-reporting of diseases. Identification of a disease requires clinical skills. Hence, educating farmers so they can identify symptoms and motivating them to report through well-established communication channels are tasks posing considerable challenges. It is essential that passive surveillance be supplemented by a strong system of active disease surveillance, particularly for emergency animal diseases.

Negative reporting

- *Negative reporting* is a type of passive surveillance system wherein animals are found and reported to be healthy by farmers or veterinary officers conducting regular field visits.
- When no cases are seen, negative or "zero reporting" is used. These are recorded and included in the database. An example of a negative reporting form is shown in Annex 7.
- The limitation of negative reporting is that it is applicable only to certain diseases with obvious clinical signs.
- Negative monitoring activities from the field support surveillance data, provide evidence of freedom from a disease in a particular geographical location.
- Negative reporting from farm owners, farm personnel and community animal health workers must always be encouraged to maintain a continuous inflow of information into the surveillance system.

Data analysis and information dissemination

After all data are gathered from different sources, it must be collated and analyzed. Epidemiologists and statistical and epidemiological programs can aid a field investigator in the analysis and interpretation of survey results. FreeCalc is a free software package that assists in the analysis of surveys to detect disease or prove freedom from disease (Cameron and Baldock, 1998 in Salman, M.D. 2003).

A Geographic Information System (GIS) can be used as a spatial tool in analyzing and interpreting data in disease investigations. It can be used in:

- illustrating spatial distribution of diseases,
- mapping locations of disease outbreaks and spread,
- determining buffer zones, and
- identifying high risk areas and threatened zones for priority control activities.

Results of the investigation and recommendations must be provided to all who will benefit. A comprehensive report and documentation of the findings will help stakeholders in the surveillance initiative:

- *National/central/provincial veterinary services* for documenting occurrence, incursion or eradication of a disease in the country and specific location, and submission of these documents to OIE or FAO for international recognition of disease status or freedom from disease and for trade purposes.
- *Field veterinarians/community animal health workers* for provision and implementation of effective disease control, prevention and eradication procedures.
- F*armers* for implementing disease control, prevention and eradication procedures.
- *Members of the public* for promotion of awareness and vigilance to zoonotic diseases.

Recommendations on making a surveillance report

- Prepare a comprehensive report with complete documentation of the investigation (See Annex 9).
- Describe the sampling techniques, tests and testing procedures in detail.
- If known, include the sensitivity and specificity of the tests performed.
- Develop recommendations on effective disease control strategies based on the findings.
- Immediately report to higher authorities when a new disease or outbreak is detected. Annexes 8 and 9 show examples of investigation report outlines for submission to higher authorities.
- Completed and approved reports can be sent verbally or by electronic means: telephone, email, or facsimile.
- Veterinarians and animal health workers may be informed through their organizations or associations.
- Depending on the findings and on the objective of the surveillance, inform the public through public awareness campaigns using mass media, newsletters or bulletins. Public awareness campaigns are particular important when a disease outbreak of public health importance occurs.

Caution should be exercised when reporting to the public, public officials or the media to avoid unnecessary alarm or panic.

- Fast dissemination of findings and recommended actions to farmers and local and provincial veterinary officers will encourage continuous reporting and monitoring of animal health and disease status of swine herds.

ANNEXES

Annex 1 Serological survey form

Name of Farm: Date:
Village:
Municipality:
Province:
Region:

Location/ Age Group	Pigs	Cumulative Total	Selected Pigs

Adapted from Bureau of Animal Industry, Philippines, 2002

Annex 2 FMD investigation report

1. Date of visit : _____
2. Visit number : _____
3. Name of investigator : _____
4. Place affected : _____
   (Village or Municipality)
   : _____
   (Province)
5. Date the outbreak started : _____
6. Type of farm : ☐ Commercial Farm ☐ Backyard Farm
   ☐ Slaughterhouse ☐ Auction Market
   ☐ Others
7. Details of the outbreak

Name of Farmer/Owner	No. of Sick	No. of Dead	Population	FMD Vaccination History	No. of Condemned	Remarks

8. Description of lesions

9. Movement of animals off the premises: (Destination)

10. Movement of animals to the premises: (Origin)

11. Movement of people to the premises:

12. Estimated number of susceptible animals within 5 km radius (population of animals in village)

Susceptible Species	Population
Pig	
Carabao	
Cattle	
Sheep/Goat	

13. Laboratory specimen(s) submitted: ☐ Yes

Epithelium ☐ Serum ☐

14. Probable origin of outbreak:

_____

Signature over Printed Name

Source: Bureau of Animal Industry, Philippines, 2002

Annex 3 Individual data recording sheet

Owner: _____

Date: _____

Village: _____ Municipality: _____ Province: _____

Animal Identification	Age	Sex	Last Vaccination (date/brand)		2nd to last vaccination (date/brand)		3rd to last vaccination (date/brand)		Remarks

Source: Bureau of Animal Industry, Philippines, 2002

Annex 4 Sample recording sheet

Date:
Village:
Municipality:
Province:
Region:

No.	Animal ID	Owner	Age	Sex	Pregnancy Status	General Health Condition	Disease & Vaccination History	Remarks

Source: Bureau of Animal Industry, Philippines, 2002

Annex 5 Sample submission form

Region: _____

Name of Province: _____

Name of Municipality/City :_____

Farmer/Owner Profile:

Name: _____
Address/Location of the Farm: _____
Contact Number: _____
Type of Farm: ____ Commercial
____ Backyard
____ Other (Please specify)
Animal Population: _____

Disease History:

Clinical History/Signs or Symptoms Observed:

_____
_____

Date Observed: _____
Vaccinations: _____
No. of Sick (Morbidity): _____
No. of Dead (Mortality): _____
Tentative Diagnosis: _____
Tests Requested: _____

Laboratory Samples Collected:

Sample ID	Species	Age	Sex	Samples Submitted*	Remarks

*Indicate whether serum, swab or organ (e.g. brain, tonsils, lungs, kidney, spleen, intestine)

Date and Time of Collection: _____
Date and Time Sample was Submitted: _____

Sender Details:

Name and Signature of Sample Collector: _____

Agency/Office: _____

Office Address: _____

Position: _____

Contact Number: _____

Email (if any): _____

Adapted from AVET Instruments, 2009

Annex 6 Sample questionnaire for outbreak/ disease investigation on pig farm

1. Date of Investigation _____

2. Identifying Information

1.1 Name of the Farm_____

1.2 Complete Address of the Farm

_____ _____ _____

Village *Municipality/District/City* *Province*

1.3 Name of Owner/Head of Family _____

1.4 Contact Number of Owner_____

1.5 GPS Coordinates : Latitude_____ Longitude_____

3. Farm Information

- What is the current animal population inventory in the farm? Please provide the data per age, group, housing or pen.
- Pig keeping system:

  Penned_____ Free-range_____ Penned + free-range_____

4. Clinical Information

Have there been cases of sick or dead pigs in the past several months? [ ] Yes [ ] No

If yes, when did you observe the occurrence of the disease? _____

When was the first case? _____

What were the clinical signs of the affected pigs? _____

What groups were affected? Provide the information in the table below.

Age Group	Total Number	Number			
		Sick	Dead	Destroyed	Slaughtered

Are there still sick or dying pigs? [ ] Yes [ ] No

If none, when was the last case? _____

List the chronology of events, particularly the number of sick and dead animals according to date of occurrence (for construction of epidemic curve)

Date	Total Number	
	Sick	Dead

Was this health problem seen also in other villages or farms in the area before the first case of outbreak? [ ] Yes [ ] No

Was necropsy conducted? [ ] Yes [ ] No

Where specimen samples submitted to an animal diagnostic laboratory?

[ ] Yes [ ] No

What samples and how many were submitted? _____

What diagnostic tests were performed? _____

- How many tested negative/positive? _____

5. Risk Factor Information

Proximity to Other Farms/Livestock Premises

- Number of Neighboring Farms _____
- Distance of Farm to the Neighboring Farms

Name of Neighboring Farm	Direction (N,S,E,W)	<1 km	1-3 km	3-5 km	>5 km

- Indicate where the nearest farm is located.
- What is the population of the nearest farm?
- Is there a recorded case in the nearest farm similar to those seen in your farm?

Sources and Movement of Stock

- Do you purchase animals/breeders? [ ] Yes [ ] No
  *If yes, w*here is your source? _____
  (Please indicate name of farm source including complete address)

- When was the last time you purchased new stock? _____
  [ ] Last 3 days [ ] Last week [ ] Last month
  [ ] Other (please specify) _____

- Were pigs brought from other villages to your property/farm before the first case of outbreak? [ ] Yes [ ] No

- If yes, where did they come from?
  (Please indicate name of source including complete address)
  _____

- Were there pigs that became sick or died in that area? [ ] Yes [ ] No

- Breeding method in your farm:
  [ ] Artificial insemination [ ] Natural breeding

- If practicing artificial insemination, where is the semen collected?_____

- If using natural breeding, what is the place of origin of the boars?
  _____

Annex 6 (Continued)

- Did pig traders come to buy pigs from your property/farm before the first case of outbreak? [ ] Yes [ ] No

- Did meat traders carry animal meat or meat by-products, especially pork, to sell in your household/farm before the first case of outbreak?
  [ ] Yes [ ] No [ ] Don't know

Medication History

- Were sick pigs treated with medicine? [ ] Yes [ ] No
- If yes, what medicines were given? _____
- Did the animals recover after medication? [ ] Yes [ ] No
- Have you changed the medication? [ ] Yes [ ] No

Feed and Water Source

- What types of feed do you use?_____
  [ ] Swill [ ] Commercial Feeds
  [ ] Other (Please specify) _____

- Where do you get your feeds? _____
- What is your water source? _____

Vaccination History

- Do you vaccinate your animals? [ ] Yes [ ] No
  Please list your vaccination program (use the table below)

Vaccinated Against	Name of Vaccine Given	Age at Vaccination	Date of Last Vaccination

People Entering the Farm

- Who takes care of the animals in the farm? _____

- Does the animal caretaker stay within or outside the farm premises?
  _____

- How often do you have visitors in the farm?
  [ ] Everyday [ ] Weekly [ ] Once or twice a month [ ] Other_____

- Do you have any local veterinarian visiting the farm regularly? [ ] Yes [ ] No

- Frequency of veterinarian visit
  [ ] Once a month [ ] Twice a month [ ] Other_____

Other Biosecurity Measures

- Do you have an isolation area for sick animals? [ ] Yes [ ] No
- How large is the isolation area? _____
- Do you have a quarantine area for new animals? [ ] Yes [ ] No
- Do you treat sick animals? [ ] Yes [ ] No
- What method do you employ in the disposal of dead pigs?
  [ ] Burying without disinfection [ ] Burying after disinfection
  [ ] Burning
  [ ] Other (Please specify) _____
- Is wildlife present in the area? [ ] Yes[ ] No
- If yes, what are the vectors/wildlife present in the farm? _____
- Are there other animals present within the farm premises? [ ] Yes [ ] No
- If yes, what other animals? _____
- What methods do you employ to control pests, wildlife and stray dogs and cats?
  _____
  _____
  - Does the farm have: foot baths [ ] Yes [ ] No wheel baths [ ] Yes [ ] No

Other hygienic practices/disinfection methods_____

Farmer's Knowledge, Attitudes and Practices

- What is the length (in years) of experience in pig raising?
  _____

- When you encounter dead animals or disease in your farm, to whom do you report the incidence?

  [ ] Village head [ ] Livestock technician [ ] Neighbor

  [ ] Agricultural officer [ ] Local veterinarian [ ] Do not report

- If you encounter sick animals in your farm, do you

  [ ] Slaughter [ ] Treat by yourself

  [ ] Sell [ ] Seek veterinary assistance

- What other health management practices do you regularly carry out?

  [ ] Disinfection (how often) _____

  [ ] Deworming (how often)_____

  [ ] Other (Please specify)_____

Adapted from AVET Instruments, 2011

Annex 7 Negative monitoring report

Province_____ **Municipality**_____

During the period from _____to _____
I visited the following villages, spoke to farmers and examined livestock:

Date: **Village:**

There was NO evidence or suspicion of __(disease under investigation) _____ in any village visited.

_____ _____ _____

Signature over Printed Name Position Date

Source: Bureau of Animal Industry, Philippines, 2002

Annex 8 Outline of an outbreak investigation report

1. **Title**
2. **Disease Background**

   Location (Province, Municipality, Village)
   Date of onset of outbreak; Date of visit
   Species affected (including total number of animals in the farm, number affected/dead)
   Results of any laboratory tests or analysis
3. **Method of Investigation**

   Describe how the outbreak was investigated (interview of key informants, veterinary officers, farmer, etc.).
4. **Results of the Investigation**

   Describe the outbreak in terms of time, animals affected and place and how the outbreak spread through the village (transmission pathway).

   Present the results of the analysis and the working hypotheses formulated, the risk factors involved, and the follow up investigations conducted.
5. **Financial Impact** (where appropriate)
6. **Control Strategies**

   Describe the emergency control measures and biosecurity measures implemented.
7. **Recommendations**

   Describe future actions to fully control the outbreak and prevent future recurrence.
8. **Appendices containing laboratory reports, etc.**
9. **Reports**

- The outbreak report should be completed as soon as possible after the initial investigation to keep all levels of veterinary services well-informed
- Follow up reports should be made when new information becomes available, such as:
  - Laboratory results
  - Alteration of control measures
  - Further spread of outbreak identified
  - Improvement in the health status of the animals

Source: AVET Instruments, 2011

Annex 9 Outline of a surveillance report

1. Title
2. Subject of Surveillance
    a. Disease Background
    b. Geographical Coverage
3. Objectives of the Study
4. Case Definition
5. Scope of Observation
    a. Target and Study (Monitored) Population
6. Methodology
    a. Duration of Survey
    b. Survey Design
    c. Survey Activities
7. Sampling Strategy
8. Sample Size Calculation
9. Collection of Samples
10. Type of Samples Collected
11. Diagnostic Methods/Laboratory Tests
12. Survey/Data Collection
13. Data Management and Processing
14. Data Analysis and Interpretation

Source: AVET Instruments, 2011

References

Bureau of Animal Industry. 2002. Foot *and Mouth Disease Handbook for Field Officers*. DA-BAI: Quezon City.

Cameron, A. R. 1999. *Survey Toolbox for Livestock Disease: A Practical Manual and Software Package for Active Surveillance in Developing Countries*. ACIAR Monograph No. 54. Retrieved from aciar.gov.au/.../MN54-Part%201%20Background%20to%20Disease%20Survey.pdf

Cameron A.R., Baldock F.C. 1998. *A new probability formula for surveys to substantiate freedom from disease*. Prev. Vet. Med 34:1-17. In M.D. Salman. 2003. Ed. Disease Surveillance and Survey Systems-Methods and Applications. Blackwell Publishing. Online version: http://www.scribd.com/doc/35174117/Animal-Disease-Surveillance-and-Survey-Systems-Methods-and-Applications.

Christensen, J. 2001. *Epidemiological Concepts Regarding Disease Monitoring and Surveillance*. Acta vet. scand. 2001, *Suppl. 94,* 11-16. Retrieved from http://www.biomedcentral.com/content/pdf/1751-0147-42-s1-s11.pdf

Department of Agriculture and Food. 2007. *Animal health disease surveillance and control*. Retrieved from http://www.agric. wa. gov. au/ PC_92813.html?s=0

Dufour, B. & Hendrikx, P. 2009. 2nd ed. *Epidemiological Surveillance in Animal Health*. CIRAD, FAO, OIE and AEEMA.

FAO. 2010. *Applied Veterinary Epidemiology Training Surveillance Workbook*. TCP/RAS/3215.

FAO. 1999. *Manual on Livestock Disease Surveillance and Information Systems*. Retrieved from http://www.fao.org/DOCREP/004/X3331E/X3331E00.htm

FAO. 2011. *Preparing for TADs: EW: Disease surveillance*. Retrieved from http://www.fao.org/ag/againfo/programmes/en/empres/GEMP/empres/emp1/1210-dis-surv.html

Dauphin, G., Domenech, J., Dietze, K., Ferrari, G., Honhold N., Kim, M., Lubroth, J. Pinto, J. & Zingeser, J. 2009. *FAO guidelines for surveillance of pandemic H1N1/2009 and other Influenza viruses in swine populations*. FAO

Konradsson, K., Lium, B., Mortensen, S., Rautiainen, E. & P. Wallgren. 2001. *Disease Surveillance Strategies in Swine*. Acta vet. scand. 2001, Suppl. 94, 31-42. Retrieved from http://www.biomedcentral.com/content/pdf/1751-0147-42-S1-S31.pdf

OIE. 2010. *Terrestrial Animal Health Code-Animal Health Surveillance*. OIE, Paris, France. www.oie.int.

OIE. 2010. *Terrestrial Manual*. OIE, Paris, France. Retrieved from http://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/1.1.01_ COLLECTION.pdf

Paskin, R. 2011. M*anual on Livestock Disease Surveillance and Information Systems*. Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/ ag/againfo/programmes/en/empres/GEMP/resources/prnt-surveillance-cp-surveill.htm

Framstad T., Sjaastad Ø. & Aass, R.A. 2004. *Bleeding and intravenous techniques in pigs*. The Norwegian School of Veterinary Science . Retrieved from http://oslovet. norecopa.no/teaching/pig/pigbleed/

Salman, M. D. 2003. Ed. *Animal Disease Surveillance and Survey Systems-Methods and Applications*. Blackwell Publishing. Online version: http://www.scribd.com/doc/35174117/Animal-Disease-Surveillance-and-Survey-Systems-Methods-and-Applications.

Sherman, D. 2011. *Livestock Disease Surveillance*. Retrieved from: http://www.ahdp.net/reports/livestock%20disease%20surveillance.pdf