

AUSVETPLAN Guidance document: Tracing and surveillance

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1 Introduction

1.1 Scope

This document explains some common concepts in the development of tracing and surveillance (TaS) plans. It also details the role of the Investigations and Technical Analysis — Epidemiology functions with regard to TaS. The document is intended as a resource for staff being trained in the following emergency response functions at both state/territory and local levels:

- Operations
 - Investigations
 - Tracing
 - Surveillance
- Planning
 - Technical Analysis — Epidemiology
 - Response Planning
 - Resource Planning.

This document may also contribute to (but has not been designed for):

- compartmentalisation and zoning for trade
- research and development projects.

This document does not cover the detection of the index premises (the first premises the disease is detected on), which will result from general animal disease surveillance conducted during non-outbreak times.

Since jurisdictions will have their own templates and standard operating procedures, this is not an operational document.

1.2 Background

Australia's preferred approach to an emergency animal disease (EAD) outbreak is pre-agreed, before an outbreak, by governments and relevant industries. This approach is captured in the Australian Veterinary Emergency Plan (AUSVETPLAN) Disease Strategies, response policy briefs, operational manuals and guidance documents (see AUSVETPLAN website¹).

AUSVETPLAN Disease Strategies provide information about the nature of the disease, principles of its control and eradication, the preferred initial policy and its rationale, and recommended quarantine and movement controls. They also provide agreed TaS guidance for the specific disease. The tasks associated with emergency response TaS functions are described in the AUSVETPLAN Control Centres Management Manual (Parts 1 and 2).

AUSVETPLAN guidance documents, such as this document, provide overarching principles for control centres to develop, implement and review policy.

¹ www.animalhealthaustralia.com.au/what-we-do/emergency-animal-disease/ausvetplan

Surveillance, in the EAD context, means the systematic ongoing collection, collation and analysis of information, and its timely dissemination, to define the extent of infection in an area, detect new infections, monitor progress against response objectives and demonstrate freedom from disease.

Tracing is the gathering of information on movements during a defined period of animals, commodities and other things capable of spreading the disease agent to and from affected premises, to identify potential spread and a putative source of the outbreak.

Epidemiology is the study of disease causality, host–disease agent interactions, and spread and control of disease, usually with the aim of minimising the number of animals affected during an outbreak.

TaS and epidemiology are interrelated activities. Although TaS is initially based on the existing AUSVETPLAN Disease Strategy, outcomes need to be monitored and refined by epidemiological analysis throughout the response.

Prioritising TaS activities is a two-way process. Timely collection, collation and analysis of TaS data are critical to ensuring that appropriate actions are taken during an EAD response. However, analysis is only useful if required changes are communicated in a timely manner from the Technical Analysis — Epidemiology function to the Investigations function. This is as important as the provision of accurate data from Investigations to Technical Analysis — Epidemiology for analysis.

2 Planning and implementing tracing and surveillance

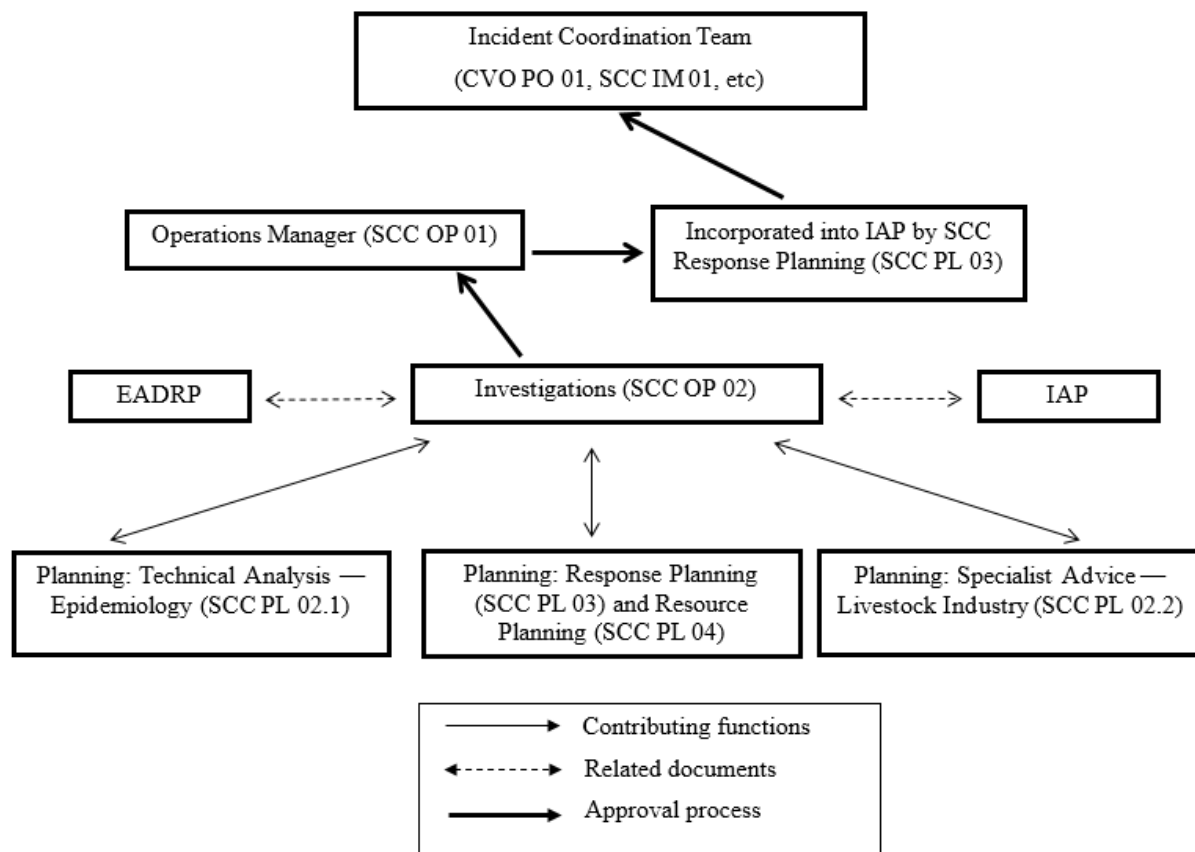
2.1 Responsibilities for developing and implementing tracing and surveillance plans

For the purposes of this document, TaS functions are considered collectively (comprising the Investigations function). Allocation of responsibilities is outlined in the current version of the Control Centres Management Manual, Part 2.

Figure 1 shows the functions involved in development and approval of TaS plans. The State Coordination Centre (SCC) TaS plan is developed in conjunction with the Emergency Animal Disease Response Plan (EADRP), according to the relevant AUSVETPLAN Disease Strategy and supporting documents. From the EADRP, Incident Action Plans (IAPs) are developed. The Investigations function within the SCC Operations Section is responsible for developing and updating the TaS plan, in consultation with SCC Planning, including the Technical Analysis — Epidemiology function.

The SCC TaS plan informs development of Local Control Centre (LCC) TaS plans. These take into account the SCC TaS policy and objectives, and provide priorities to the TaS functions for tactical implementation in the local context. The SCC TaS plan may be appended to the SCC's IAP.

All plans must be approved by the respective function's management before approval by the SCC Coordinator (for the SCC) or LCC Controller (for the LCC) and the Incident Coordination Team.



EADRP = Emergency Animal Disease Response Plan; IAP = Incident Action Plan; SCC = State Coordination Centre

Figure 1 Functions involved in development and approval of tracing and surveillance plans

2.2 Preparing a tracing and surveillance plan

The TaS plan should address:

- a clearly defined population, including any subpopulations that should be targeted to improve the probability of detecting disease
- clustering of disease
- documentation requirements for methodologies used, survey designs and data analysis procedures
- the test or test system being used
- the likelihood of detection (the design prevalence or minimum expected prevalence in the presence of disease)
- sampling approaches, including sample size, selection, collection and despatch to the laboratory
- premises classifications, definitions and criteria for resolution
- quality assurance systems.

The following is a guide to the contents of a TaS plan. This outline assumes that operational procedures, ranging from issuing quarantine notices to extracting reports, will be addressed in

standard operating procedures. Jurisdictional information systems provide field surveillance templates.

2.2.1 Background to the response

The background to the response will be taken from the EADRP and only included in the TaS plan if the TaS Plan is a standalone document. It comprises a brief description of the disease, the industries it is affecting and likely to affect nationally and locally, control measures already implemented, and a timeline.

The TaS plan should be consistent with the relevant AUSVETPLAN Disease Strategy; if it is not, justification should be provided. It should include a TaS plan for each of the defined areas (restricted area — RA, and control area — CA) and premises (infected premises — IP, suspect premises — SP, dangerous contact premises — DCP, trace premises — TP, etc).

2.2.2 Tracing and surveillance aim

The aim is the TaS component of the EADRP issued by the Chief Veterinary Officer that is relevant to the next operational period. For instance, early in the response, the aim will be to define the extent of infection in the jurisdiction and accumulate data to inform risk analyses. Later in the response, the aim will be to demonstrate area freedom from disease.

2.2.3 Tracing and surveillance objectives

The objectives must be specific, measurable, achievable, relevant and time-framed (SMART). They must address what needs to be done for the next operational period, and which defined areas the SCC and LCC are responsible for (eg the CA for the SCC, and the RA for the LCC). The aim of field surveillance is to find where disease exists and does not exist, so that a complete outbreak picture can be generated and disease can be controlled where it is found.

2.2.4 Execution of the tracing and surveillance plan

The ‘execution’ section of the TaS plan will state the current definitions of suspect and confirmed cases, and the criteria for designation of premises (eg TP, DCP, SP, IP).

It will also describe:

- sources of local and regional background information, to provide
 - contact information for key stakeholders and alternatives
 - data validation
 - local knowledge of the distribution of animal populations and routine movements of animals
 - local knowledge of the community, affected industries and appropriate contacts
- timeframe for tracing animals, commodities and fomites (trace-back and trace-forward)
- tracing priorities
 - definition of risk classification for TPs in the RA and CA (eg zero susceptible species premises — ZP, low risk, medium risk, high risk)
 - criteria for prioritisation of risk traces for tracing follow-up and/or referral to Surveillance; for example, will tracing be allocated according to ‘first come, first

traced’ or according to transmission risk? which animal species or commodity will be traced first? how will regions be prioritised?

- allocation of tracing tasks (determined by disease dynamics and transmission routes); for example
 - will a tracer be allocated specific IPs for both trace-forward and trace-back?
 - will the tracer allocated an IP follow all traces from that premises to their ultimate destinations and origins, or will traces be split between commodity tracing ‘specialists’ and regional tracing ‘specialists’?
- surveillance priorities
 - definition of risk premises for surveillance in the RA and CA
 - criteria for prioritisation of premises for surveillance in the RA and CA, including any specific surveillance protocols (eg daily health monitoring for 7 days after the last trace contact for low-risk traces, and 21 days after the last trace contact for high-risk traces)
 - response to disease reports, and traces that have entered the outside area (OA)
- types of surveillance to be applied in the RA and CA
 - active surveillance — type of sampling, epidemiological unit (eg individual or herd), sample size, frequency and period of surveillance, sample and data collection, procedure (eg telephone survey, property visit, visual assessment, testing)
 - passive surveillance — producer awareness, community engagement, communication conduits, documentation (reports, observations), quality assurance for third-party reporters (eg veterinarians)
- types of surveillance to be applied for different premises (IP, DCP, SP, TP, at-risk premises — ARP, premises of relevance — POR); for example
 - on IPs, surveillance in addition to initial diagnostic sampling may not be conducted before destruction. However, additional sampling may be requested by the Technical Analysis — Epidemiology function to assess levels of the disease agent and the extent of spread. The Technical Analysis — Epidemiology function will provide advice on the numbers to sample
 - on SPs and TPs, the type and frequency of sampling, and sample sizes required to resolve the property status should be specified
 - for property proof of freedom, sentinel surveillance and sampling will be conducted. The TaS plan will describe any criteria (eg age) if stock are used as sentinel animals and an overview of restocking options
 - for ARPs, a definition could be included for each category of ARP (commercial versus small landholder), and the type of surveillance that will be undertaken on each, including the criteria for resolution of these premises.
- information management
 - which data collection and management systems will be used, and their needs
 - priority activities at different stages of the response
 - who needs what data and when the data are needed
 - list of databases against response functions responsible for updating them or requiring read-only access
 - description of how the ongoing surveillance history of a premises will be recorded.

The information management system used in the response must be reliable, versatile, comprehensive, and easily accessed for entering and retrieving data. It must also conform to the Australian Government Recordkeeping Metadata Standard. A wide range of data types

will need to be managed (see Appendix 1), with many different uses for the data. Successful surveillance hinges on efficient information flows.

For a more detailed description of the principles of EAD information management, see the AUSVETPLAN Control Centres Management Manual, Part 1.

2.2.5 References

The TaS plan will contain references to documentation and other recording applications (consider appending approved templates and data management flow charts).

2.3 Surveillance enablers

Enablers are management strategies, ancillary services and organisations that promote data quality and efficient collection of data. Most will serve several surveillance purposes. They are summarised below to encourage planners to use a broad perspective when considering how data may be collected.

Surveillance is enabled by:

- responders having a common understanding of the overall response aim and objectives, as well as TaS objectives
- responders maintaining situational awareness
- clear, logical definitions of relevant premises types
- database administrators (eg National Arbovirus Monitoring Program, National Livestock Identification System, GIS)
- a reliable information management system
- administrative and technical support for reporting platforms and communications, including back-up capability
- community engagement from the start of the outbreak
- well-informed observers of livestock who report useful information and act appropriately
- use of local and regional networks (see Sections 2.3.1 and 2.3.2)
- public and producer reporting via multiple avenues that are practical, verifiable and appropriate for the conditions
- availability of compensation for affected parties
- cooperation from diagnostic laboratories, producers, processing sectors, other industry participants, the research sector and the broader community.

Background information is vital to quality intelligence gathering and analysis. During the course of an emergency response, rumours may have inadvertent impacts on response activities and progress. Establishing reliable sources of information early in a response and maintaining them is very important.

2.3.1 Local networks

Efficient TaS relies on high-quality, community-specific information for basic communications, and development of profiles of affected animal populations and their

associated communities. For example, if a tracer is unable to make immediate contact with a landholder to substantiate a high-priority trace, local networks might know where the person is or be able to provide alternative contacts.

An immediate source may be the Specialist Advice — Livestock Industry function in Planning (PL 02.2), or other response personnel who live locally. Other sources include local veterinarians, stock agents, stock transporters, service contractors and local government officers.

2.3.2 Regional networks

Knowledge of regular or seasonal movements within and between regions, such as milk tankers and livestock transporters, can assist allocation of tracing loads on a regional or commodity basis, as well as inform disease risk assessments. Sources of regional information include regional managers of livestock agencies and transport enterprises, industry consultants, and other regional service providers.

3 Surveillance purposes

Surveillance data are needed to ensure that response planners can respond appropriately to competing resource needs during a response. The following interlinked purposes for surveillance should be addressed in EAD surveillance plans:

- describing the extent and characteristics of the disease, including risk factors for transmission and spread
- detecting cases in a timely way
- monitoring progress against response objectives
- demonstrating freedom — property, area (RA and CA) and zone (state and national).

As the response progresses, the emphasis on different surveillance purposes shifts. This subtly affects the type of data required, the source of the data, and enablers supporting data collection.

Table 1 provides a summary of common data types and sources used in EAD responses. Sections 3.1 to 3.4 list types of data required and sources of data.

Response needs for personnel and infrastructure must take precedence over use of these resources for research. Response and research activities may benefit each other if carefully managed during a response — for example, in development of data management tools, modelling capabilities and diagnostic capabilities. Generally, research in the TaS area will take a more prominent role after a response.

Table 1 Summary of data types and sources for tracing and surveillance

Source	Animal population data	Commodity data	Premises status counts	Contextual observation of cases	Clinical observation of cases	Field assignment data	Geospatial and land tenure data	Health and production data	Laboratory data	Legal instruments issued	Meteorological data	Movement data	Timelines	Vector detections
ABS	✓	✓												
ABARES	✓	✓												
Agricultural property databases	✓			✓			✓					✓		
Spatial data custodians (eg GA)						✓	✓							
BoM											✓		✓	
National movement records (NLIS)		✓										✓	✓	
Farm movement records		✓		✓								✓	✓	
Farm health and production records	✓	✓		✓				✓					✓	
Self-reporting	✓	✓	✓	✓	✓	✓		✓					✓	✓
Surveillance visits	✓	✓	✓	✓	✓	✓		✓					✓	
Aggregation surveys			✓		✓	✓							✓	
Laboratory records			✓			✓			✓				✓	
Vector monitoring						✓							✓	✓
Sentinel monitoring			✓			✓							✓	
Industry production monitoring	✓	✓		✓				✓				✓		
Trade records		✓												
Response IMS						✓				✓			✓	
Wildlife population surveys	✓			✓								✓	✓	

ABARES = Australian Bureau of Agricultural and Resource Economics and Sciences; ABS = Australian Bureau of Statistics; BoM = Bureau of Meteorology; GA = Geoscience Australia; IMS = incident management system; NLIS = National Livestock Identification System

3.1 Describing the extent and characteristics of the disease, including risk factors

Where and why are populations at risk, and what is the disease doing to them?

Once an EAD has been detected, it will be assumed that there are potentially IPs other than the index IP. The immediate priorities are to contain the disease on the index IP, and rapidly estimate the extent of spread to define appropriate boundaries for declared areas.

Design of surveillance requires a reasonable knowledge of the size and distribution of susceptible populations, movements of susceptible populations, the location and volume of any associated risk commodities, and the economic and geographic peculiarities of the affected populations (animal and human). Access to good-quality local knowledge and industry background is essential to identifying local risk factors and the populations at risk, and prioritising TaS activities appropriately.

The behaviour of the disease in the local context will influence ongoing response planning. Therefore, TaS will be used to acquire a broad range of quantitative and qualitative information from many different sources.

Tracing movements to and from the index case, and subsequent IPs and DCPs has particular importance for defining the extent of infection early in the response. Initially, the timeframe for tracing will be informed by the relevant AUSVETPLAN Disease Strategy or response policy brief; if these are not available for the specific disease, World Organisation for Animal Health (OIE) standards will be used. Qualitative and quantitative data from further TaS contribute to establishment of a timeline and updating the tracing window to reflect the disease dynamics in the local context — for example, where there is substantiated evidence that the incubation period is different from the anticipated incubation period.

Reassessment of previously susceptible populations may be required where herd immunity might have changed as a result of vaccination or exposure to disease. As the response progresses, formal delimiting surveys contribute to confirming earlier projections, and demonstrating freedom from disease in a broader jurisdictional and national context.

3.1.1 Data types

Early stage of the response:

- Animal population and commodity data (historical and current)
- Geospatial and land tenure data
- Data from surveillance visits (observations and testing)
- Public and producer reporting
- Data on movements from priority risk premises (eg IPs, DCPs, SPs)
- Data from laboratory testing

Middle stage of the response:

- Data from surveillance visits (observations and testing)
- Public and producer reporting

- Health and production data
- Geospatial and land tenure data
- Movement data
- Data from laboratory testing

Later stage of the response:

- Updated animal population and commodity data
- Geospatial and land tenure data
- Data from laboratory testing
- Health and production data
- Data from surveillance visits (observations)
- Public and producer reporting

3.1.2 Data sources

- Jurisdictional agricultural property databases and other regulatory databases
- Geographic information systems (GIS)
- Australian Bureau of Agricultural and Resource Economics and Sciences
- Australian Bureau of Statistics
- Industry processing sector data
- Movement records held on individual premises
- National Livestock Identification System (NLIS)
- Surveillance visits and testing of ARPs
- Public and producer reporting
- Aggregation surveys
- Existing monitoring mechanisms, such as routine vector surveys (eg National Arbovirus Monitoring Program — NAMP)
- Industry production monitoring programs
- Citizen science projects
- Trade records

3.2 Detecting cases in a timely way

Find, contain and eradicate

Detecting cases as early as possible after disease introduction enables control measures to be put in place quickly, thereby reducing the risk of ongoing disease spread and adverse impacts on animal welfare. Early detection is achieved through a combination of understanding the disease and the populations at risk; and implementing tracing, public and self-reporting, and surveillance visits that target areas and populations at risk (risk-based surveillance).

Tracing the movement of animals, commodities and fomites from risk premises, and then prioritising the order in which tracing will be done according to the risk and consequences of transmission are critical to rapid detection, especially of unreported and preclinical cases.

Regular visual observation of populations that are likely to display clinical signs of the disease, and monitoring health and production records are common detection devices. Field surveillance teams play a central role in detection by conducting risk-based surveillance, and encouraging and verifying producer and public reporting. To make best use of surveillance teams, regular self-reporting of both suspect and negative observations by producers should be included. This has most impact on efficiencies in the areas outside, but adjacent to, the RA and CA boundaries because it frees up field teams for confirmatory diagnostic work.

Risk-based surveillance activities are informed by judicious use of epidemiological projections once sufficient data are available. As well as an understanding of the disease agent, projections require a combination of local knowledge of the relevant population, and of geographic, environmental and industry factors affecting transmission and detectability. Examples of such factors are seasonal accessibility of animals for observation, age and sex profiles, and breed.

Laboratory testing is required even in the early stages of an outbreak of a disease that has relatively specific clinical signs and whose incidence is increasing. Testing is designed to provide data on disease prevalence in various areas. It is particularly important to consider including laboratory testing when destruction is the primary control measure on IPs and DCPs, because these populations will not be available for later surveys. Other common triggers for confirmatory testing are when a detection has occurred in a new area or in an animal population previously considered not to be at risk.

Passive reporting systems are generally less costly than other reporting systems, because data collection is not resource intensive; these data may be used to identify trends. Limitations include nonreporting or under-reporting, which can affect representativeness of the data, and thus lead to undetected trends and outbreaks.

3.2.1 Data types

- Data on the population at risk and commodities, including their geographic distribution
- Geospatial and land tenure data
- Health and production data (growth rates, milk yield, egg production, pregnancy rates, mortality rates)
- Observations of clinically susceptible populations for abnormality
- Public and producer reporting
- Movement records of at-risk animals, commodities and fomites

3.2.2 Data sources

- Risk-based surveillance visits and testing
- Public and producer reporting
- Aggregation surveys
- Existing monitoring mechanisms, such as routine vector surveys (eg NAMP)

- Movement records held on individual premises
- Any national databases operating at the time (eg NLIS and sales records)
- GIS

3.3 Monitoring progress against response objectives

Are we there yet?

Response progress is monitored nationally, at the state/territory level and locally. The broad objectives for TaS functions are to provide data that direct other disease control operations; evidence that the overall aim of the response is being achieved; and sufficient, relevant information for planning. TaS data are thus included in reports to the National Coordination Centre and must conform to nationally agreed data standards.

There is a tension between quality and quantity of surveillance data, from the field, laboratory or desk. Data integrity is essential because area and premises declarations have legal and economic ramifications. Data that are inaccurate, cannot be verified or do not reach their destination within the required timeframes for analysis undermine the response.

How new detections are defined (the case definition) will change during the course of a response as the nature of the disease in the local context is better understood. Premises definitions are also refined to reflect the more accurate picture and meet the response objectives. The data collected are therefore relevant to the prevailing case definition, rather than a precise description of the disease. Early in an incident, most new detections in an RA may be based mainly on field observations, with laboratory testing playing a confirmatory role, whereas later, as incidence declines, testing may become the primary diagnostic tool.

Changes in premises status definitions must be communicated promptly from the SCC and LCC to all relevant functions, with sufficient background information to maintain a common operating picture throughout the response structure.

Active surveillance aimed primarily at demonstrating area freedom, such as prevalence surveys, will contribute to measures of progress towards disease control and eradication. The simplest illustration of progress towards disease eradication or control is the epidemic curve (new detections per unit of time) or similar. The quality of the curve is as important as the shape — missing data reduce confidence.

Other measures of progress may be defined by the containment and decontamination strategies that are put in place on IPs and DCPs, and implementation of vaccination programs. Although this information is not collected by the TaS functions, it may be useful in risk assessments and epidemiological projections.

Surveillance can therefore present a picture of disease transmission, describe both geographic and temporal trends in disease occurrence and populations affected, describe changes in the disease agent (eg virulence), and identify factors mediating disease occurrence. Surveillance can provide information needed to develop and implement strategies for disease control, as well as to develop priorities for the allocation of resources.

3.3.1 Data types

- Population at risk, and its distribution in the area and on premises
- Counts of premises with a given status, as defined by the prevailing case definition
- Geospatial and land tenure data
- Field assignment data (teams dispatched, revisits)
- Legal instruments issued
- Laboratory test results
- Timelines — for example, time from trace or report to surveillance visit, time from confirmation (observation or laboratory test) to database update, time from confirmation to assignment of IP case management

3.3.2 Data sources

- Response database
- Field surveillance team reports
- Real-time tracking of personnel whereabouts
- Laboratory reports (of test results and sample quality)
- GIS

3.4 Demonstrating freedom

Evidence of absence

Where the aim of an EAD response is to regain the status enjoyed by Australia before the incursion or emergence of the EAD, the demonstration of disease freedom is the culmination of response efforts. The time and cost incurred in demonstrating area freedom can be affected significantly by the robustness and management of the TaS data collected in the earlier stages of the response.

Individual IPs and DCPs must also demonstrate property freedom from disease to be resolved and return to their previous status. This eventually leads to contraction of declared areas and national freedom; ideally, it should occur throughout the response as disease control measures are applied. In some circumstances, where time or appropriate seasonal conditions are used to reduce the residual transmission risk of an IP or DCP, resolving their status will take some time, affecting the time required to achieve proof of freedom for the broader area and the return to normal business.

A combination of methodologies are used to demonstrate freedom, depending on the context (individual premises or area); the nature of the disease and environment; existing datasets; available statistical, laboratory and field capabilities and capacities; and quality assurance. Strategies might include use of sentinel animals on IPs, randomised surveys of susceptible populations, and targeted surveillance by producers and private veterinary services.

3.4.1 Data types

- Background data on the population at risk and commodities

- Geospatial and land tenure data
- Health and production data (growth rates, milk yield, egg production, pregnancy rates, mortality rates)
- Observations of clinically susceptible populations for abnormality
- Laboratory data
- Vector detection data
- Data on movements of susceptible populations and commodities
- Data on specific risk factors, such as rainfall, and maximum and minimum daily temperatures
- Antemortem and postmortem data from abattoirs
- Disease investigation data from private veterinarians

3.4.2 Data sources

- TaS records
- Wildlife (including feral) population surveys
- Aggregation surveys
- Passive surveillance
- GIS
- Meteorological records
- Vector trapping and analysis

4 Surveillance application scenarios

The following scenarios are broadly indicative rather than definitions of disease categories. They are intended to highlight factors that may require consideration.

4.1 Highly communicable diseases

Highly communicable diseases are:

- transmitted via live animals, commodities, fomites and wind; environmental conditions may significantly influence the level of transmission risk
- usually fast moving, and therefore widely distributed
- actively controlled via rapid implementation of movement restrictions, destruction of infected animals and/or vaccination.

A classic example is foot-and-mouth disease.

4.1.1 Surveillance to identify extent of infection and risk factors

- Tracing to and from IPs and DCPs.
- Identification of populations at risk via existing databases, combined with geospatial and meteorological analysis, and local knowledge of animal populations and habits.
- Use of data from self-reporting, especially in the CA.
- Targeting areas and populations at risk for surveillance visits.

4.1.2 Surveillance to detect cases

- Use of clinical signs, if specific enough and depending on the stage of the response.
- Use of pen-side tests, if available.
- Confirmatory testing for area prevalence.
- Use of data from self-reporting, especially in the CA.
- Targeting areas and populations at risk in the RA for surveillance visits, particularly in the immediate proximity of IPs.

4.1.3 Surveillance to demonstrate freedom

- Use of epidemic curves.
- Testing remaining risk populations to confirm lack of exposure.

4.2 Vector-borne diseases

Vector-borne diseases are:

- transmitted between animals only via competent insect vectors; environmental conditions may significantly influence the level of transmission risk

- transmitted between regions via movement of either infected vectors or infectious animals to an area with competent, naive vectors
- actively controlled via restricting movement of infectious animals, local vector control and/or vaccination of naive risk populations.

There is very limited capacity for accurate identification of vectors.

An example is bluetongue.

4.2.1 Surveillance to identify extent of infection and risk factors

- Tracing to and from IPs.
- Identification of populations at risk via existing databases such as vector mapping and property data, combined with geospatial and meteorological analysis, and local knowledge of animal and vector populations and habits.
- Use of data from self-reporting, especially in the CA.
- Targeting areas and populations at risk in RAs, but outside known transmission areas (TAs), for surveillance visits and patrols.
- Vector trapping in historically vector-free areas and along their boundaries.

4.2.2 Surveillance to detect cases

- Use of clinical signs, if specific enough.
- Use of pen-side tests, if available.
- Confirmatory testing and vector trapping for area prevalence.
- Use of data from self-reporting, especially in the CA.
- Targeting areas and populations at risk outside known TAs for surveillance visits and patrols.
- Confirmatory testing within the TA.

4.2.3 Surveillance to demonstrate freedom

- Use of epidemic curves.
- Testing risk populations outside the TA to confirm lack of exposure.
- Monitoring immunity of the infected population.
- Monitoring for presence of the infectious agent in vectors in RAs, CAs and the OA.

4.3 ‘Contamination’ diseases

This scenario addresses the situation in which an infectious agent is transmitted in the field via exposure to a ‘contaminated’ material (eg food or therapeutic substance). Transmission between regions is more likely via the contaminated material than via contact between live animals. Transmission would be actively controlled by restricting the contamination at source (eg denying entry of the contaminant into the food chain of susceptible animals).

An example is bovine spongiform encephalopathy.

4.2.1 Surveillance to identify extent of infection and risk factors

- Tracing exposed cohorts to and from IPs.
- Identification of populations at risk via existing databases such as the NLIS, property data, and source and distribution of contaminated materials.

4.2.2 Surveillance to detect cases

- Tracing.
- Use of data from self-reporting.
- Active surveillance at relevant aggregation points (eg abattoirs and knackeries) if exposed cohorts cannot all be confidently traced.

4.2.3 Surveillance to demonstrate freedom

- Use of epidemic curves.
- Testing risk populations outside exposed populations to confirm lack of exposure.
- Control of potential exposure routes.

Appendix 1 Data management

Introduction

An effective data management system is vital to the ongoing and systematic collection, analysis, interpretation and dissemination of data. This information can help to better plan, implement and evaluate efforts to control disease. It is used, for example, to estimate the burden of disease, detect trends signalling changes in the occurrence of disease, detect disease clusters, stimulate epidemiological research, identify risk factors associated with disease occurrence, assist with prioritising resource allocation and assess the efficacy of control measures.

Historically, responding agencies have put most of their resources into data collection and data management functions, rather than into data analysis, interpretation and dissemination. Although data collection and data management are important, data alone are not meaningful without appropriate analysis, interpretation, dissemination and application.

Generally, to manage data effectively, the following aspects of the system should be reviewed by the SCC Biosecurity Information Systems function, in consultation with other relevant functions in the Planning and Operations sections — in particular, Response Planning, Technical Analysis — Epidemiology, and Investigations:

- purpose of data collection, collation and analysis
- framework (everything from field data collection forms to the database system)
- data quality requirements
- collection of data
- entering and storage of data
- reviewing and cleaning of data
- declaration of data quality
- analysis
- reporting.

Because of its importance and complexity, design and construction of an effective data management system, and training in its use are most effectively undertaken outside responses. Some minor changes may be required during the response, and the ability to make such changes should be considered during the design phase.

Design the information system

- Define response goals and functions in relation to information systems support.
- Define user needs.
- Define resource constraints.
- Analyse system requirements.
- Determine the tasks that the system should support.

- Consider system inputs and outputs. The data requirements needed for an effective response should be identified as early as possible in the response. This will allow identification and development of the required standards, which will facilitate entry of valid data and effective data analysis.
- Identify strengths and weaknesses of the information system.
- Determine whether the database can interface with other management information systems.

Implement, evaluate and document the system

- Test system performance.
- Develop an implementation plan, including training.
- Conduct ongoing assessment of quality control.
- Develop an evaluation plan to measure system performance and other user criteria before and after implementation.

The central database

The central database is the administrative heart of a data management system. How well the database operates is determined by the performance of staff, the infrastructure used and the procedures selected to guide operation of the database. Training and supervision of personnel, along with periodic quality assurance review of performance and operations, are major management responsibilities. Regardless of whether the central database is manually based or computerised, all systems will depend on human judgment for final decisions about program operations.

Data analysis

Statisticians and epidemiologists receive training in a variety of analytical methods that require knowledge of the underlying statistical and mathematical foundations used to develop these methods and their application. Providing an exhaustive and detailed description of the different methods available to explore, summarise, analyse and display surveillance data is beyond the scope of this document.

Response programs should therefore ensure that they have access to a statistician or epidemiologist, and should work with the epidemiologist to clarify what data need to be collected. Without the availability of staff who are adequately trained and skilled in collecting valid data to answer proposed questions, and in analysing and interpreting data, the data are likely to be misinterpreted and underused; this will reduce the ability to quantitatively monitor the response strategy.

Ideally, any analysis, summarisation, graphical display or interpretation of data should be based on data that are reliable (reproducible), valid (accurate), complete and timely. Statistical summaries based on data that do not satisfy these characteristics require a discussion of the shortcomings or limitations, and the possible effect on the analysis and interpretation of the data being analysed.

Feedback on data collection and analysis can take place at multiple levels. Careful monitoring of data for completeness and validity must be a regular part of data collection and

interpretation. Inconsistencies in data collection, missing data and other issues require immediate attention to ensure that reports provide information that accurately reflects program efforts.

Appendix 2 Surveillance concepts

This section provides a brief description of specific surveillance activities to improve understanding of each function, and therefore the communication between the Investigation and Technical Analysis — Epidemiology functions during a response. For the purposes of this section, ‘infection’ and ‘disease’ are equivalent; the relevance of these terms will be determined by the case definitions operating during the response.

Selecting the best surveillance technique depends on:

- the purpose of the surveillance (eg to determine how much disease is present or to demonstrate that disease has been eradicated)
- the resources available (some surveillance techniques are more efficient than others, but may give less useful results)
- an understanding of the disease
- an understanding of the population and production system
- the availability of appropriate ‘tests’ and how well they perform.

Often, a combination of surveillance techniques and methods is required. Figure 2 categorises some of the important animal health surveillance techniques.

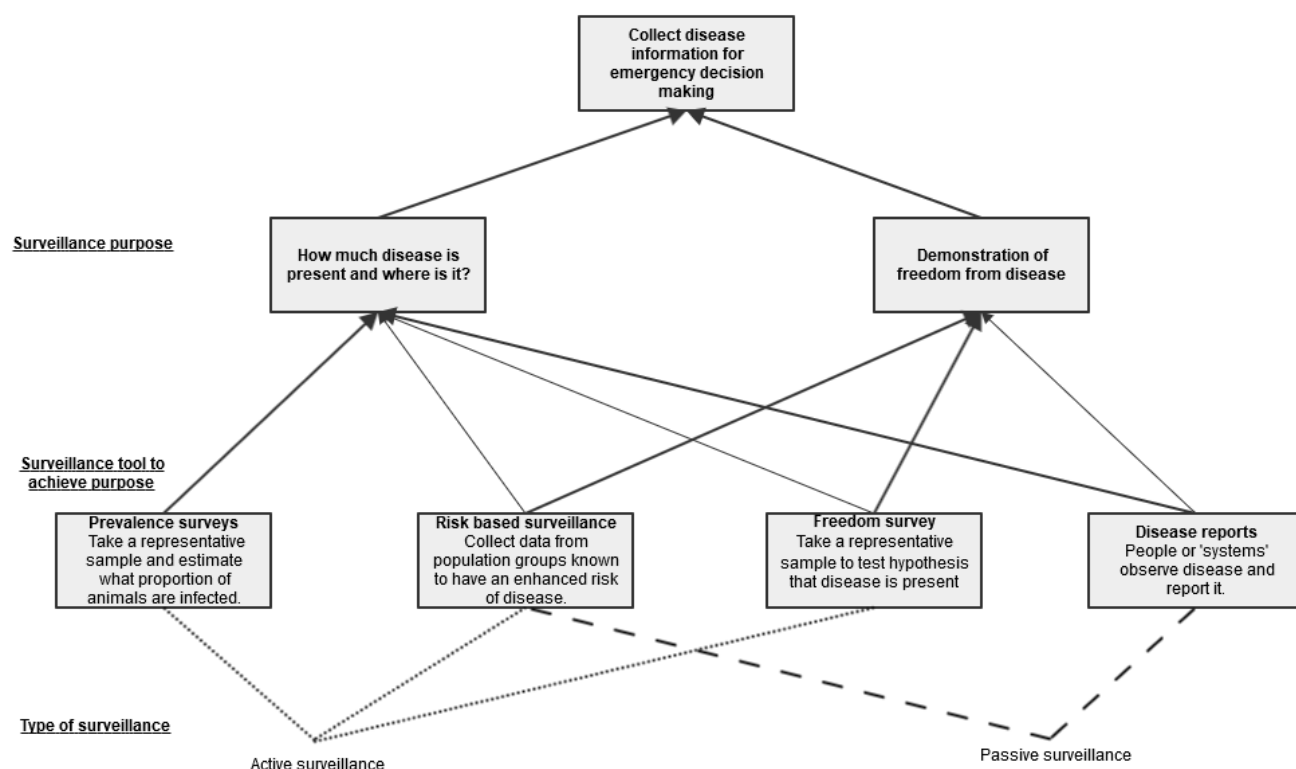


Figure 2 Data collection for animal health surveillance

The primary purpose of surveillance can be considered broadly in two ways:

- How much disease is present, and where is it?
- Has disease been eradicated?

Rarely, a third purpose can be important during an outbreak response: gaining information about what is causing disease. This may be important if a new disease has occurred and little is understood about it. In this case, risk factor data are collected — for example, using a prevalence survey to allow analysis of associations between disease and risk factors. Key resources for a general understanding of animal health surveillance include Cameron et al (2015), Cameron (1999) and Salman (2003).

Several key surveillance tools can be used to address the particular purpose. These are described below.

Prevalence surveys

Prevalence surveys involve conducting a representative survey of at-risk animals. A representative sample is usually a random sample. A test is applied to determine whether each sampled individual (or other unit of interest, such as a pen of animals) is diseased or free from disease. In this manner, the proportion of infected animals can be determined. If the survey is repeated over time, the progress of an eradication attempt can be ascertained.

Surveillance that returns this type of data is commonly referred to as active surveillance.

Risk-based surveillance

Risk-based surveillance involves examining a sample of animals (or other units) with an increased risk of disease.

Given the high risk of infection of the group, if no disease is present, the sample can efficiently demonstrate freedom from disease in the population. Alternatively, if the risk of infection can be quantified through examination of prior research, the sample can be used to estimate the amount of disease in a larger population. Additionally, if particular risk groups in a population are randomly sampled, a large and diverse collection of data can be combined using scenario tree approaches to examine the sensitivity of the surveillance system (Martin et al 2007). This information can be used to improve surveillance systems or to demonstrate freedom from infection.

Freedom surveys

Freedom surveys involve testing a representative sample of a population. If no disease is detected, this can be used to infer that a disease is not present in the sampled population. Key considerations are to generate a sufficient sample size based on the minimum amount of disease that might be present, the confidence required and the performance of the test used to examine the status of animals. Further information can be obtained from Cameron (2002), and Cameron and Baldock (1998ab). Surveillance that returns this type of data is commonly referred to as active surveillance.

Disease reports

Reporting or notifications of disease by the public or veterinarians, detection of unusual syndromes, increased indirect measures of disease and production monitoring are all useful ways to detect disease, or determine whether a disease is spreading. Surveillance that returns this type of data is commonly referred to as passive surveillance.

Cameron et al (2015), Cameron (1999) and Salman (2003) provide a more detailed understanding of animal health surveillance in general.

Abbreviations

ARP	at-risk premises
CA	control area
DCP	dangerous contact premises
EAD	emergency animal disease
EADRP	Emergency Animal Disease Response Plan
GIS	geographic information system
IP	infected premises
LCC	Local Control Centre
NAMP	National Arbovirus Monitoring Program
NLIS	National Livestock Identification System
OA	outside area
RA	restricted area
SCC	State Coordination Centre
SP	suspect premises
TA	transmission area
TaS	tracing and surveillance
TP	trace premises

Glossary

Definitions in square brackets are from Hoinville (2013).

Active surveillance	Structured disease surveys to actively collect disease information. [Investigator-initiated collection of animal health related data using a defined protocol to perform actions that are scheduled in advance. Decisions about whether information is collected, and what information should be collected from which animals are made by the investigator.]
Aggregation surveys	Surveys that use data from concentrations of relevant animals and materials, such as at abattoirs and laboratories.
Contagious disease	Disease that spreads directly between susceptible animals without an intermediate vector or host.
Epidemiology	The study of disease in populations, and of factors that determine its occurrence.
Index case	The first case of the disease to be diagnosed in a disease outbreak. It may not be the site of the first incursion.
Monitoring	Routine collection of data for assessing the health status of a population or the level of contamination of a site for remediation purposes.
Passive surveillance	A system in which veterinary authorities make no active effort to collect disease information (ie the data are volunteered). [Observer-initiated provision of animal health related data (eg voluntary notification of suspect disease) or the use of existing data for surveillance. Decisions about whether information is provided, and what information is provided from which animals are made by the data provider.]
Risk-based surveillance	Surveillance activities targeting areas and populations at risk of infection. [Use of information about the probability of occurrence and the magnitude of the biological and/or economic consequence of health hazards to plan, design and/or interpret the results obtained from surveillance systems.]
Surveillance	A systematic program of investigation designed to establish the presence, extent or absence of a disease, or of infection or contamination with the causative organism. It includes the examination of animals for clinical signs, antibodies or the causative organism.
Tracing	The process of locating animals, persons or other items that may be implicated in the spread of disease, so that appropriate action can be taken.

References and further reading

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