General information and advice: Within a surveillance system, several surveillance activities can be implemented, which can be separated into **surveillance components**(Hoinville et al., 2013).

Framework details: Extensive discussions have been carried out within the RISKSUR consortium in order to define the scope of a surveillance component. In practice, the identification of unique surveillance components can vary according to the level of details needed. For instance “serological surveys in poultry” can be seen as a single component if the “target population” is defined simply as “poultry”, but it can appear as multiple components if the target population is detailed based in the target species, breaking it down into, for instance, “serological surveys in domestic chickens” and “serological survey in domestic ducks”. For the purpose of the RISKSUR surveillance design framework, a surveillance component was defined as a surveillance activity which is characterized by:

- Being directed against one specific hazard. While it is recognized that some surveillance activities support the detection of multiple hazards (for example clinical surveillance, post-mortem and abattoir inspections), the framework supports the design of surveillance one hazard at a time. Activities that support multiple hazards should be listed, and can then be “reused” when designing surveillance systems targeting other hazards. Please refer to section Multi-hazard surveillance for a multiple hazard surveillance description.
- Targeting one specific animal population, which can be defined at the species level (for example chickens) or target sector (p.e. layers), as long as all characteristics listed below to define a component are the same.
- A specific data source (sampling point and case definition).
- A specific sampling strategy, including the possible use of risk-based sampling.
- A specific data collection method (means of data acquisition and study design).
- When sampling is applied, a specific design prevalence (and precision when appropriate) and confidence level.

Within the RISKSUR design framework a surveillance designer is encouraged to first think about all surveillance components that are/will be part of the surveillance system, and list them to have an overview. The next steps of surveillance design then focus on each of these components at a time. Data collection is generally the most resource consuming step of surveillance implementation, and therefore it is the driver of the surveillance design. Based on this assumption, it is expected that some methods of data collection (such as sample collection) are already in place or planned to be performed, and surveillance will be designed around those methods. This is the motivation behind starting the design process by listing the expected surveillance components, based on a few key characteristics:

2.1. Target species

Animal species (or animal group or even other materials) which will be sampled for active surveillance. On the framework, based on the definition above, users can only add ***one*** species per component (each surveillance component should be defined for one species at a time). If multiple species will be targeted in the surveillance, the surveillance designer should add more surveillance components.

2.2. Target sector

From among the species or categories selected above, the designer should consider whether surveillance will focus on a particular sector. Multiple sectors per component, however, the design must be the same for all sectors. If for instance sampling will differ between sectors, one should consider increasing the number of components and designing one component for each sector.

2.3. Geographical area

What is the geographical area covered by this specific activity, in relation to the total area the surveillance system covers (defined at the surveillance system level)? It can be, for instance, “entire region” or specific areas. Designers should at this point consider the entire area covered by the activity. Any differences in sample allocation due to varied risk in different regions will be addressed later in the framework.

2.4. Data collection point

It refers to where your units can be reached, and therefore where samples will be collected. At this stage the designer should consider the availability of an accurate sampling frame. If it is not possible to identify and locate farms/herds/flocks, it should be considered where animals can be located and sampled. In the surveillance framework, the following are listed:

- at the source (farm, wild life habitat, etc) - frequently used for surveillance aimed at detecting cases to facilitate control and surveillance for food-borne disease
- abattoir - used for diseases which can only be diagnosed post mortem (e.g. prion diseases) and to reduce cost of surveillance by making use of data that is already available
- coordination centre
- artificial insemination centre - frequently used for early detection of disease to prevent widespread dissemination of disease
- rendering plants - used for diseases which can only be diagnosed post mortem (e.g. prion diseases)
- diagnostic laboratory
- markets
- others

2.5. Study type

There are various criteria that can be used to classify types of surveillance study, these are the options that we have used within the surveillance framework:

- **Passive surveillance:** observer-initiated provision of animal health related data (e.g. 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 is made

by the data provider. Often used for early detection of disease that cause clinical disease

- **Survey:**investigator-initiated active collection of animal health related data from individual units in a population over a set period of time, to assess the disease status within the population. This can be carried out using a sample of the population of interest or using a census of all units. Surveillance is usually aimed at assessing changes in disease status over time so generally repeated surveys are required when carrying out surveillance. Surveys of all units in the population can be used when the aim is to detect cases and facilitate eradication. Surveys are also frequently used to demonstrate freedom from disease.
- **Continuous data collection:** investigator-initiated active collection of animal health related data from individual units in a population which is not limited to a particular time period, to assess the disease status within the population. This can be carried out using a sample of the population of interest or using a census of all units. Some examples are: abattoir surveillance, ongoing self-monitoring by producers, pre-entry testing, … Continuous monitoring is often used for case detection to facilitate control and for food-borne diseases.
- **Sentinel surveillance:** repeated collection of information from the same selected sites or groups of animals (e.g. veterinary practices, laboratories, herds or animals) to identify changes in the health status of a specified population over time. These sentinels should act as a proxy for the larger population of interest; they may be selected on the basis of risk but can also be selected randomly or on the basis of convenience or compliance. Sentinel surveillance is frequently used for early detection of vector-borne disease and can also be used for estimation of prevalence of endemic disease.
- **Participatory surveillance:**use of participatory rural appraisal methods (such as ranking, scoring and visualisation techniques) to conduct risk-based, hazard-specific surveillance. The approach uses semi-structured interviews with key informants. This enables communities to provide their knowledge regarding health events, risks, impacts and control opportunities by gathering qualitative health data from defined populations. Participatory methods have been more widely applied in developing countries to date and have been used for early detection of disease and prevalence estimation.
- **Indicator-based surveillance:**traditional disease surveillance which relies on the collection of data about the occurrence of pre-defined diseases or conditions and which uses agreed-upon case definitions; these data are analysed to produce indicators that point towards the existence of a threat. Indicator-based surveillance may be hazard-specific or general and includes the use of clinical or other data for syndromic surveillance.
- **Syndromic surveillance:** Surveillance that uses health-related information (clinical signs or other data) that might precede or substitute for formal diagnosis. This information may be used to indicate a sufficient probability of a change in the health of the population to deserve further investigation or to enable a timely assessment of the impact of health threats which may require action. This type of surveillance is not usually focused on a particular hazard so can be used to detect a variety of diseases or pathogens including new (emerging) diseases. Syndromic surveillance has been used for early detection and also for case detection during outbreaks
- **Other**

2.6. Type of disease indicator

In the surveillance framework, the following are listed:

- antibody detection
- pathogen detection

- gross pathology
- pathology diagnostic (microscopic)
- indirect indicators
- other

2.7. Type of sample collected

In the surveillance framework, the following are listed:

- clinical reports
- blood/serum/plasma
- ear notch
- tissue (biopsy)
- tissue (post mortem)
- milk
- semen
- urine
- feces/ fecal swab
- other swab (not fecal)
- meat juice
- environmental sample
- other swab (not fecal)