**SUPPLEMENTARY MATERIAL**

**Section S1. Definitions used in this systematic review, based on the Animal Health Surveillance Terminology Final Report from Pre-ICAHS Workshop.**

* **Threat**: the hazard or infectious disease which can potentially affect a susceptible population and spread between individuals and herds. Depending on the spread of the hazard along populations, the health and economic consequences are variable.
* **Pattern of disease occurrence**:
* ***Endemic***: a disease that is known to be present in the population of interest.
* ***Sporadic***: a known disease which occurs intermittently in an irregular or haphazard pattern.
* ***Exotic***: a previously defined (known) disease that crosses political boundaries to occur in a country or region in which it is not currently recorded as present.
* ***Re-emerging***: a previously defined (known) disease that is currently either absent or present at a low level, in the population in a defined geographical area that re-appears or significantly increases in prevalence.
* ***New (emerging)***: a previously undefined (unknown) disease or condition, which may result from the evolution or change in an existing pathogen or parasite causing a change of strain, host range, vector, or an increase in pathogenicity; or may be the occurrence of any other previously undefined condition.
* **Surveillance**: the systematic, continuous or repeated, measurement, collection, collation, analysis, interpretation and timely dissemination of animal health and welfare related data from defined populations, essential for describing health hazard occurrence and to contribute to the planning, implementation, and evaluation of risk mitigation measures.
* **Active (proactive) surveillance**: investigator-initiated collection of animal health related data through actions scheduled in advance using a defined protocol. Decisions about whether information is collected, and what information should be collected from which animals is made by the investigator.
* **Passive (reactive) 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.
* **Enhanced passive surveillance**: observer-initiated provision of animal health related data with active investigator involvement *e.g.* by actively encouraging producers to report certain types of disease or active follow up of suspect disease reports.
* **Risk-based surveillance**: use of information about the probability of occurrence and the magnitude of the biological and/or economic consequence of health hazards to plan, design or interpret the results obtained from surveillance systems. Risk-based surveillance can include one or several of the following four approaches:
* ***Risk-based prioritisation***: determining which hazards should be selected for surveillance based on information about the probability of their occurrence and the extent of biologic and/or economic consequence of their occurrence.
* ***Risk-based requirement***: use of prior or additional information about the probability of hazard occurrence to revise the surveillance intensity required to achieve the stated surveillance purpose.
* ***Risk-based sampling***: designing a sampling strategy to reduce the cost or enhance the accuracy of surveillance by preferentially sampling strata (*e.g.* age groups or geographical areas) within the target population that are more likely to be exposed, affected, detected, become affected, transmit infection or cause other consequences (*e.g*. large economic losses or trade restrictions).
* ***Risk-based analysis***: use of prior or additional information about the probability of hazard occurrence, including contextual information and prior likelihood of disease, in the analysis of surveillance data to revise conclusions about disease status.
* **Sentinel surveillance**: the 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.
* **Participatory surveillance/expert opinion**: participatory surveillance explores traditional information networks by using participatory rural appraisal methods such as ranking, scoring and visualising techniques to conduct risk-based, hazard-specific surveillance. The approach uses semi-structured interviews with key informants to enable communities to provide their knowledge regarding health events, risks, impacts and control opportunities by gathering qualitative health data from defined populations. The analysis of participatory data emphasizes the comparison of information obtained from multiple informants using a variety of techniques to obtain the most likely interpretation of events. The objective is to enhance sensitivity by identifying cases based on a clinical case definition; these may then be evaluated and confirmed using rapid tests in the field or laboratory diagnostics. Conventional epidemiological investigation techniques can be used to evaluate and confirm outbreaks detected by participatory surveillance as part of trace-back and forwards.
* **Syndromic surveillance**: surveillance that uses health-related information (clinical signs or other data) that may 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 threat and can be used to detect a variety of diseases or pathogens including new (emerging) diseases, so it is particularly applicable for early warning surveillance.

**Table S1. List of variables for the literature review of surveillance approaches for early detection**

| **Table** | **Name of the variable** | **Data type** | **Description** | **Comment** |
| --- | --- | --- | --- | --- |
| ID | ID | AutoID | Unique identifier for the paper |  |
| ***ARTICLE GENERAL INFORMATION*** | *Reviewer* | Character | Name of the person who did the article review |  |
| *Title* | Character | Title of the article |  |
| *Author(s)* | Character | Author(s) of the article |  |
| *Type of paper* | Character | Describes the article category | Choose between "Article", "Review", "Oral communication", "Poster" or "Report" |
| *Year of publication* | Numeric | Year the article was published |  |
|  | *Disease/threat - general* | Character | Name of the disease(s) category on which the article focuses | Some threats or diseases can be grouped in a category (*e.g.* avian influenza). Indicate "several diseases" when the article focuses on many rare or diverse diseases that cannot be included in the other specific categories. |
|  | *Disease/threat - specific* | Character | Name of the specific disease(s) on which the article focuses | Specify diseases (*e.g.* avian influenza A). |
|  | *Pattern of disease occurrence* | Character | Describes the pattern of disease occurrence in the study area | Choose between "Endemic", "New", "Exotic", " Re-emerging", "Not applicable (NA)" or "No data (ND)" |
|  | *Disease presence* | Character | Describes the disease presence in the study area | Choose between "Present", "Absent", "Suspected", "Unknown", "Early detection" or "No data (ND)" |
| ***REVIEW OF THE METHODS CURRENTLY APPLIED*** | *Target species* | Character | Describes the animal species on which the article focuses |  |
|  | *Human involved (zoonosis)* | Yes/No | Describes if the target disease is zoonotic |  |
|  | *Continent* | Character | Name of the continent(s) where the study area is located |  |
| *Country/ies* | Character | Name of the country(ies) where the study area is located |  |
|  | *Region/s* | Character | Name of the region(s) where the study area is located |  |
|  | *Time frame* | Date | Specifies the time period when the study took place | Provide the date in the YYYY/MM/DD-YYYY/MM/DD format |
| **Table** | **Name of the variable** | **Data type** | **Description** | **Comment** |
|  | *Spatial/Temporal evolution* | Character | Specifies whether the changes mentioned in the article have occurred in the spatial and temporal components in the described method(s)/approach(es) | For example: Arbovirus surveillance has evolved in California: (1) monthly testing of sera from two flocks of sentinel chickens and sporadic virus isolation attempts from *Culex* mosquitoes collected from riparian and park habitants; (2) surveillance activities were expanded to include additional park sites and representative residential areas; and (3) Orange County surveillance was also supplemented by monitoring the SLE virus in a wild bird community |
|  | *Risk-based method* | Yes/No | Specifies whether the method(s)/approach(es) is(are) described in the risk-based article |  |
|  | *Risk-based category* | Character (list) |  | Choose from “RB prioritisation”, “RB requirement”, “RB sampling”, “RB analysis”, or a combination of these |
|  | *Risk factors* | Character | Describes the risk factors considered in the article | For example: Risk of entrance of EHDV by three possible entry pathways |
| ***REVIEW OF THE METHODS CURRENTLY APPLIED*** | *Type of approach - general* | Character | Specifies the general surveillance type | Choose from "Active", "Passive", "Epidemiological method”, or a combination |
| *Type of approach - specific* | Character | Specifies the specific surveillance type | Choose one of the specific categories (see Table 5) |
|  | *Type of approach - detailed* | Character | Describes the surveillance type | Briefly describe the type of approach(es) used |
|  | *Stage of surveillance* | Character | Specifies the stage of surveillance that each methodology supports | Choose from ‘Risk profiling’, ‘Sampling design’, ‘Data collection and management’, ‘Data analysis’, and ‘Evaluation’ |
|  | *Stage of surveillance - detailed* | Character | Describes how each specific methodology supports each stage | Briefly describe the application of the methodology(ies) |
|  | *Data source* | Character | Describes the type of data | Choose between "Primary" (data obtained in the study), "Secondary" (external data used in the study) or "Primary and secondary" |
|  | *Surveillance scope* | Character | Specifies the scope of surveillance in terms of target hazards | Choose from “General”, “Multi-objective” or “Single” |
| *Aim(s) of the study* | Character | Describes the aim(s) of the article |  |
| *Aim defined?* | Yes/No | Is the objective clearly defined? |  |
|  | *New technologies affecting SS* | Character | Describes the new technologies affecting the surveillance systems used in the article |  |
|  | *Data management* | Character | Does the article describe the real data obtained or does it perform simulations of data? | Choose from "Real data", "Simulation" or "Real data and simulation" |
| **Table** | **Name of the variable** | **Data type** | **Description** | **Comment** |
|  | *Sample size* | Character | Indicates sample size |  |
|  | *Sample unit - general* | Character | Indicates sample unit | Choose from "Individuals", "Herds" , "Holdings", "Several" (when the article focuses on several units) and "Other" (if the unit is not contained in any of the former categories) |
|  | *Sample unit - specific* | Character | Specifies the sample unit for the "Several" and "Other" categories |  |
|  | *Pooled samples* | Yes/No | Are the samples pooled? |  |
| ***REVIEW OF THE METHODS CURRENTLY APPLIED*** | *Sampling method* | Character | Describes the sampling method or the form of data collection |  |
| *Sampling scheme* | Character | Describes the sampling scheme | If applicable |
| *Tests used* | Character | Describes the diagnostic test used | If applicable |
| *Surveillance results* | Character | Describes the main results of the article |  |
|  | *Analysis method* | Character | Describes the statistical methods to analyse the data obtained in the article |  |
|  | *Standard legislation* | Character | Indicates the legislation mentioned in the article | If applicable |
|  | *Benefits* | Character | Describes the benefits mentioned in the article of the method(s)/approach(es) described |  |
| ***COST-EFFECTIVENESS OF CURRENT SURVEILLANCE METHODS FOR EARLY DETECTION*** | *Time to detection* | Character | Describes the time needed to detect the disease/threat using the method(s) /approach(es) described in the article |  |
| *Personal/material/ economic resources* | Character | Describes the necessary personal/material/economic resources for detecting the disease/threat using the method(s)/approach(es) described in the article |  |
| *Total costs* | Character | Describes the total costs needed to detect the disease/threat using the method(s)/approach(es) described in the article |  |
| **Table** | **Name of the variable** | **Data type** | **Description** | **Comment** |
| ***CURRENT LIMITATIONS*** | *Current limitations* | Character | Describes the current limitations mentioned in the article of the method(s)/approach(es) described |  |
| ***FUTURE PROSPECTS*** | *Future prospects* | Character | Describes the future prospects mentioned in the article of the method(s)/approach(es) described |  |
| ***VALIDATION / EVALUATION*** | *Validation / Evaluation* | Character | Describes the method(s) used in the article to validate and/or evaluate the models developed |  |
| ***EXCLUDE*** | *Exclusion* | Yes/No | Should this article be excluded from the analysis? |  |
| *Reason* | Character (predefined) | Provides reason(s) for excluding the article | If applicable (see the list in Table 2) |
| ***WP ADDITIONAL*** | *WP* | Character | Indicates which WP(s) are more suitable for analysing the article | If applicable |
| ***COMMENTS*** | *Comments* | Character | Provides further comments | If applicable |