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Performance indicators for rinderpest surveillance

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FOREWORD

In 1986, the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture initiated a programme of assistance to FAO and IAEA Member States for the development of effective, quality assured veterinary laboratory diagnostic services. This programme introduced the use of standardized and internationally validated ELISA-based systems for the diagnosis and surveillance of the major transboundary diseases that affect livestock. This approach has proved of immense value in the monitoring of national, regional and global animal disease control and eradication programmes.

One such programme focuses on the global elimination of rinderpest. Co-ordinated by FAO through the Global Rinderpest Eradication Programme (GREP) the joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture has developed critical diagnostic and epidemiological tools to assist this effort.

As the final stages of the global eradication of rinderpest are reached, it is fitting that the Joint Division should again take the lead in providing guidance to Member States on how best to meet the criteria for quality assurance of national disease surveillance programmes — a prerequisite for international acceptance of freedom from a particular disease. This publication is intended to provide countries involved in rinderpest eradication with a detailed protocol for using performance indicators in evaluating their disease surveillance system and making, where necessary, adjustments to meet the criteria for acceptance specified in the OIE Rinderpest Pathway — a pathway that leads to international recognition of freedom from rinderpest.

An initial publication (IAEA-TECDOC-1161) described guidelines for the use of performance indicators in rinderpest surveillance programmes. This publication now describes in detail the protocols and the linked indicators which have been developed and field validated through a series of FAO/IAEA meetings and through IAEA expert assignments to countries in Africa.

Beyond the specific requirements of the rinderpest eradication programme, performance indicators should become part of the routine assessment system for national disease surveillance programmes. The assurance provided by regular and rigorous application of performance indicators will be invaluable in the risk assessment of a country's veterinary services and as a decision support tool when it becomes necessary to negotiate with international bodies or other countries for the purposes of international trade.

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EDITORIAL NOTE

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INTRODUCTION

The Global Rinderpest Eradication Programme (GREP) is a time-bound effort to eliminate rinderpest from the world by the year 2010. Strategies have been devised and programmes implemented to reduce the clinical incidence of rinderpest to zero. Elimination of disease and infection are being confirmed by statistically valid, active disease surveillance programmes. If accomplished, this will rank along with the smallpox eradication among the greatest milestones in the history of medicine. In both of these ambitious programmes, mass vaccination was accepted as the primary tool of the eradication effort. The WHO Expert Committee wrote in 1959: "It is now generally agreed that if 80 per cent of the population — that is 80 per cent of each and every sector of the population — is successfully vaccinated within a time period of five years, smallpox will die out" [1].

As the smallpox programme progressed, however, it became obvious that mass vaccination alone was not sufficient to achieve full eradication. Serious outbreaks were observed in communities where 90–95% vaccination cover had been attained. Such observations, coupled with logistic problems and accumulating field experience encouraged the Smallpox field officers in West Africa to make a critical strategic shift to Surveillance and Containment as the main approach in the eradication battle. The new strategy focused on rapidly pinpointing new cases, isolating infected persons, and vaccinating contiguous households and villages.

Surveillance and containment quickly broke the smallpox transmission chain even in regions where less than half the population had been vaccinated, and was subsequently adopted by the smallpox eradication drive across the globe. It is not surprising that many post eradication reviewers give surveillance and containment the major credit for the success of the smallpox eradication programme. D. A. Henderson paid tribute to this strategy as follows: I do not mean to belabour unduly the importance of reporting and surveillance but we must bear in mind that unless an effective reporting and surveillance programme is developed, there is no prospect whatsoever for a successful eradication programme [2].

The Pan American Health Organization's (PAHO) Polio Eradication programme concluded recently also relied heavily on the surveillance and containment strategy. In the final stages of the eradication, a great deal of emphasis was placed on enhanced surveillance for acute flaccid paralysis (AFP), rapid case investigation, and aggressive outbreak control.

It is quite clear that surveillance and outbreak control must also play a critical role as we go down the final pathway to the eradication of rinderpest. Poor surveillance clearly contributed to the failure of the JP 15 a previous international attempt to eradicate rinderpest fromAfrica in the 1960's. A good surveillance and containment system can also deal with such new problems as the appearance of new lineages of rinderpest virus. We are not likely to start new vaccination programmes to control these new variants; it is more realistic that once the criteria for rapid identification of a new variant is developed, good surveillance will be used to keep it under control.

How do we know that we have a good surveillance system?

The objective of disease eradication is to reduce the incidence of the disease to zero if possible, or to negligible (un-measurable) levels. Surveillance plays a critical role as a tool for monitoring the efficiency and effectiveness of the eradication programme, and will often provide pointers to the defects in the programme.

Evaluations of surveillance often focus on indirect or secondary measures of performance such as the number of vaccines dispensed, amount of money spent, or number of survey teams in the field. These indicators often simply measure the effort expended on the endeavour, and may not necessarily signify the success achieved in the primary objective of eradication, although it is normally assumed that greater effort carries higher probabilities of success. Such indirect measures contribute somewhat to the overall assessment of the surveillance system, however, they do not tell us with any degree of certainty whether the disease in question is being eliminated.

Successful eradication programmes must result in rapid decline in the incidence and permanent exclusion of the disease in question from the population. Good surveillance must therefore show that the disease no longer exists in the population, and must be able to detect new occurrences quickly enough to permit pre-emptive containment action.

Performance indicators

Performance indicators (PI) are a list of questions and yardsticks designed to assist managers in monitoring and evaluating the efficiency of specific projects and programmes. In health management, PIs are generally focused on measuring the ability of the surveillance system to detect new occurrence of a specific disease, in addition to assessment of the overall efficiency of surveillance.

In the final stages of disease eradication the incidence may be so low that disease finding becomes both very difficult and very crucial. Zero reports present a dilemma, because it is necessary to differentiate true absence of disease from poor surveillance. Under such circumstances, the ability to detect an alternative (infectious) disease, preferably one that exhibits similar clinical signs, is used as a good gauge of the efficacy of surveillance. Knowledge of the normal prevalence of the chosen alternative indicator disease (or disease complex) is required for quantitative assessment of the efficiency of the surveillance. For example, in the final stages of Polio eradication, non-polio acute flaccid paralysis (AFP) was used as the indicator disease. The ability to detect AFP, which is known to occur at the rate of 1 case per 100,000 persons, was taken as a critical measure of the ability of the surveillance system to detect polio, if it had occurred. The surveillance was judged as efficient if it detected 1 case of AFP per 100,000 inhabitants.

Performance indicators for rinderpest surveillance

PIs provide excellent management tools to assess the progress of rinderpest surveillance, particularly in relation to the OIE Pathway (Table I). One of the major objectives of rinderpest surveillance is the uncovering of new disease episodes, consequently the detection (with 95% confidence) of disease occurring at 1% prevalence has been set as the measure of acceptable performance. The various components of the surveillance (passive disease reporting, active surveillance, sero-surveillance, disease investigations, etc.) need to be fine-tuned to meet this target, and PIs can be designed to measure the level of progress of each component towards that target. Because of the rapid nature of the spread of the disease in susceptible populations, it is also important that disease detection should be time delimited, to allow for effective preventive measures.

The stomatitis–enteritis complex (SEC) diseases have been chosen as the alternative indicator for rinderpest surveillance. The SEC is made up of several mucosal and vesicular diseases of cattle that present clinical signs similar to rinderpest, and include malignant catarrhal fever

(MCF), bovine virus diarrhoea–mucosal disease (BVD–MD), foot-and-mouth disease (FMD), infectious bovine rhinotracheitis (IBR), and others. These diseases are present in all countries in Africa at various prevalence rates. Surveillance systems that can detect SEC diseases at the rate they would normally occur in that country will be able to detect rinderpest. Conversely, the ability to detect cases of the SEC is a good indicator of functional surveillance.

Unfortunately most countries in Africa may not have up to date information on the annual incidence of these SEC diseases and consequently it is difficult for them to determine the background prevalence to be set as the target for evaluating the surveillance. These countries will need to review available data to determine a reasonable target.

Basis of PIs for rinderpest surveillance

PIs for rinderpest surveillance are based on the ability of the surveillance system to:

- Detect rinderpest at 1% prevalence with 95% confidence. In order to achieve this:
  - 80% of reporting units (districts, parishes, etc.) in the country must file regular (monthly) reports on time;
  - Active surveillance must evaluate annually at least 300 sample units (herds, villages, etc) selected in a statistically valid (usually random) manner;
  - All suspected cases of rinderpest (i.e. cases showing stomatitis–enteritis signs) are fully investigated (clinical, epidemiological, and laboratory) within two weeks;
  - A serological surveillance system annually examines 4500 serum samples from unvaccinated animals in at least 300 randomly selected sample units (herds or villages);
- Detect cases of SEC diseases (MCF, BVD–MD, IBR, FMD, etc.) at a level similar to the background occurrence rate for the country. The ability to detect the SEC disease is a good indication that the system will detect rinderpest should it occur.

Where the performance is below expectation, it is necessary to identify the problems and weaknesses in the system which need to be corrected to effect improvements. Diagnostic indicators (DI) provide a catalogue of potential problem areas which could contribute to poor performance, and which should be carefully examined by the Chief Veterinary Officer (CVO) in the assessment of the surveillance system. Checklists are basic infrastructure needs, which ought to be in place for optimal performance of the system.

The methods for developing surveillance systems, and for emergency action once an outbreak has been discovered have been described in previous IAEA and FAO documents [3,4]. This manual discusses the use of PIs in the current rinderpest eradication effort under GREP. The primary goal of PIs is to increase the confidence of Chief Veterinary Officers in their surveillance programmes, and ultimately in their ability to meet the criteria for proceeding down the OIE Pathway.

TABLE I. RELATIONSHIP BETWEEN OIE DEFINED CRITERIA FOR FREEDOM FROM RINDERPEST DISEASE AND PERFORMANCE INDICATORS

OIE Criterion	Country must show	Tools & techniques	Quality control	Indicators of Achievement	Relevant PI
i. No clinical rinderpest has been detected for at least five years.	Well established and functional general (passive) disease reporting (surveillance) system.	Revitalized reporting system and improved data handling and communication technologies.	Are there sufficient veterinary professionals in veterinary establishments at the district (or lower) levels? Do these professionals submit regular reports on schedule? What are the mechanisms for chastising tardy and rewarding good field officers?	Regular monthly reports from field officers with evidence of commonly occurring diseases, including the expected number of stomatitis –enteritis complex diseases. National workshop on disease reporting.	1
ii. No rinderpest vaccine has been used for at least 3 years in any susceptible species, and no heterologous vaccine against rinderpest has been used for at least 3 years in cattle, buffaloes and yaks.	Vaccines have been restricted only to those officially designated to have them (ie., are not floating around the country).	Central control of production / importation, storage and distribution of (rinderpest) vaccines.	Records of production / importation. Store inventory/records of issues and returns and destruction of unused vaccines. Monthly vaccination returns.	Serological evidence of absence of rinderpest antibodies in bovine animals born since the cessation of vaccination..	7
iii. The country operates both clinical surveillance and disease reporting systems for rinderpest adequate to detect clinical disease if present.	Well organized active surveillance system in addition to the routine general disease reporting.	Well documented system for active disease surveys, including purposive and randomly selected herds.	Records of samples submitted for laboratory analysis. Records of sero-surveys.	Detailed reports of field investigations of SE diseases detected through active surveys.	2, 3
iv. All clinical evidence suggestive of rinderpest is investigated by field and laboratory methods (including serological assessment) to refute a possible diagnosis of rinderpest.	A summary of diseases (including SE complexes) reported each year by the surveillance system (general & active).	A well equipped/staffed and functional pidemiology unit with well defined disease investigation teams, well equipped and staffed central diagnostic laboratory.	Summary of SE disease investigation for the period, including composition of the investigation teams.	Detailed reports of field investigations. Laboratory reports showing definitive diagnoses, and confirmation from reference laboratories.	4,5, 6
v. There are effective measures in force to prevent the re-introduction of the disease.	A written national contingency plan which will come into effect if a rinderpest case is discovered. Participation of the heads of the Epidemiology unit and the Diagnostic laboratory in the highest decision making committee.	Designated staff and equipment for rapid response. Plan of action (and alternatives) already approved by a high level national committee.	Records of border surveillance activities.. Epidemiological risk analysis of various scenarios of introduction of rinderpest in the country.	Records (or evidence) of an application of the contingency action (if any).	contingency plan

1. OVERVIEW OF RINDERPEST IN AFRICA

1.1. INTRODUCTION: RINDERPEST CONTROL

Rinderpest (cattle plague) once a worldwide menace, has been brought under control in Europe and is now restricted to a handful of foci in Africa and Asia. The JP 15 (Joint Project 15) was the first concerted international effort to eradicate rinderpest from Africa, and effectively brought the disease under control in the late 1960. Unfortunately, JP 15 failed to make the final jump to eradication of the virus, and a new outbreak emerged in late 1978 and spread rapidly over the entire continent, destroying large numbers of cattle and wildlife. The Pan African Rinderpest Campaign (PARC) was organized with the assistance from international donors, and several years of concerted effort has again brought rinderpest to the brink of eradication.

Inadequate surveillance is widely accepted as a major contributor to the failure of JP 15 to achieve final eradication of rinderpest from Africa. The 1978 outbreaks started from a few foci of infection in some parts of Africa where the virus had remained undetected. Veterinary services in African countries also failed to detect the renewed occurrence of disease in their cattle populations early enough to permit pre-emptive action. It could be argued that a more diligent disease search would have discovered the remaining foci, and a more effective surveillance system would have given early warning of renewed disease and allowed prompt, effective intervention.

It is necessary that the mistakes of the JP 15 campaign are not repeated if rinderpest eradication is to succeed. The ongoing effort should progress to eradication of the virus, so that we do not have to go through this process again. It is therefore essential that no foci of infection remain after the programme. The eradication of the virus will release scarce resources to be channelled to other problems.

In 1989, the Office International des Epizooties (OIE) convened an Expert Consultation on Rinderpest Surveillance Systems to define the term *eradication* at the technical and epidemiological levels. The Consultation established a pathway that specified three stages along the road to official recognition of national freedom-from-rinderpest. These stages are: (i) provisional-freedom-from-disease, (ii) freedom-from-disease and finally (iii) freedom-from-infection. The first two stages relate to freedom from clinical syndromes caused by rinderpest virus whereas the third stage is definitive freedom from the presence of rinderpest virus. The OIE Pathway also sets general criteria or conditions that must be met in order to qualify for each of these stages. The majority of these criteria depend on well-executed rinderpest surveillance to demonstrate that the countries can detect rinderpest if it were present, as well as well co-ordinated response to discovery of disease.

The full benefit of rinderpest eradication will come through the preservation and improvement of each nation's livestock production system, increased availability of livestock products to feed the growing populations, and access to international export markets for livestock and livestock products. It is essential therefore to confirm that rinderpest has indeed been eliminated and this can only really be achieved through compliance with the OIE Pathway. This compliance demands effective rinderpest surveillance.

1.2. GREP STRATEGIES FOR RINDERPEST ERADICATION

The OIE Pathway prescribes a strategy for the rinderpest eradication which has three basic steps:

- Mass vaccination to achieve over 80% immunity in the national herds of participating countries. This phase is to be accompanied by careful sero-monitoring programme to evaluate the performance of the vaccination effort, and to develop the laboratory capabilities to be used during the disease finding and surveillance stages of the eradication. Countries can declare themselves provisionally free from the disease at the end of the vaccination phase.

- Disease surveillance phase following the cessation of vaccination, with the objective of rapid identification and extirpation of any remaining foci of rinderpest. At the successful completion of the disease surveillance phase the country can gain the OIE declaration of freedom from the disease.

- Enhanced surveillance for evidence of remaining virus activity, which will lead to the final declaration of freedom from the virus.

Most countries in Africa have completed the mass vaccination phase, and many have now declared provisional freedom from the disease. The next stage for these countries is to demonstrate a well organized surveillance system capable of detecting hidden foci of disease, and any re-introduction of the rinderpest virus in their national herds.

Surveillance

Surveillance is basically keeping a vigilant eye on the animal health status in a given country (or region). It can be defined as all regular activities aimed at ascertaining the health status of a given population with the aim of early detection and control of animal disease of importance to national economies, food security, and trade. In routine national disease management, surveillance is used as tool to keep record of disease occurrences, and analyses of the secular trends assist authorities in detecting major shifts in disease that could lead to epidemics. In specific disease control programmes, surveillance is used to evaluate the effectiveness of control strategies, and to detect needs for mid-course adjustments in the programme. In the last stages of a disease eradication programme, surveillance becomes most important as a tool first for finding the last cases of the disease to be eradicated, and than for keeping a watchful eye for re-entry of the disease agent in the disease-free population.

Regardless of the basic objective, the tools and components of a surveillance system are essentially the same, although there may be variations in the amount of emphasis put on the different components.

1.3. EVALUATION OF RINDERPEST SURVEILLANCE SYSTEMS

Surveillance systems in different countries may vary tremendously in objectives, and sometimes in methodology, and issues critical for one country may not be as important in others. Evaluations are generally tailored to the objectives and capabilities of the particular country, but generally assess how well the specified objectives are achieved. In the case of rinderpest surveillance, the overall objectives are: (1) rapid identification and destruction of

remaining foci of rinderpest virus; and (2) detection of evidence of new or resurgent virus activity.

Chief Veterinary Officers (CVO) will be required to provide solid evidence that their surveillance have the capacity to detect the last foci of infection and new introductions of virus of any lineage. Unfortunately as a country progresses successfully down the OIE Pathway, the frequency of reports of outbreaks, as well as the enthusiasm and alertness of the field officers decline rapidly. It will become increasingly difficult to determine if negative (or zero) reports are due to real absence of disease or poor surveillance effort. A good evaluation system will provide the CVO with a quantifiable measure of the confidence he can place on zero reports, and should guide further modulations of the eradication programme.

1.3.1. Performance indicators

As stated above, PIs are simply tools for evaluating the national surveillance, and assuring policy makers of the quality of the surveillance information they use to make decisions on disease prevention and control. They are useful in convincing national and international bodies (including neighbouring countries, OIE, FAO, etc.) of the efficiency and efficacy of national surveillance. A high score on the PIs assures the CVO that a negative report can be interpreted as indication that there is no disease, and will provide essential support evidence for the freedom from disease and subsequent infection.

Very often PIs are seen as static, statistical data calculated once a year by the government statistician, for purposes of determining poorly performing surveillance units. When properly set out, however, PIs should be dynamic and flexible, and targeted to specific, realistic and measurable goals, and will also indicate weak areas and how these could be corrected to improve the system. The CVO (or his schedule officer) should review the PIs on a regular (perhaps monthly) basis throughout out the year, so that corrective action can be applied when necessary. For instance, units that fail to report for two (or three) consecutive months should receive some input from headquarters — such as a letter requesting explanation, a telephone call, or preferably a visit from headquarters staff. Such dynamic response is preferable to a situation where PIs are calculated at the end of the year only to discover that some units have failed to report for five to six months. PIs should be seen as a dynamic tool for timely detection (and correction) of poor performance.

PIs are applied to specific components of a surveillance system, and are designed to test those attributes that bestow high levels of efficiency on the system. Sensitivity, specificity, and timeliness are the main attributes of a good surveillance system, and these can be readily evaluated by PIs.

High sensitivity is particularly important in the final stages of an eradication programme, when the ability to detect the last few occurrences of a disease becomes the determining factor in the success of the programme. Specificity measures the predictive value positive, the probability that a putative case actually has the disease (i.e. is not a false positive). Evaluation of sensitivity and specificity requires validation with laboratory diagnosis; consequently the proficiency of the national diagnostic laboratory is another measure of performance. Timeliness is also just as important in the present situation with rinderpest. Cessation of vaccination has resulted in the accumulation of a large pool of susceptible animals in many national herds, with the potential for rapid spread of new infections. An outbreak report six months after it had occurred could be disastrous. Major epidemics can only be avoided

through rapid identification and containment. There is also the added danger in the transhumant (nomadic) production systems in most African countries, in that through unrestricted movement, the infected herd could spread the disease very rapidly.

Other important attributes include simplicity, flexibility and acceptability. Simple and flexible systems that have direct flow of information are more responsive and more likely to generate timely reports than complicated systems, which are likely to be misunderstood and misapplied. Acceptability reflects the willingness of individuals in the system to participate in the surveillance activity. This attribute is particularly important in the developing countries where a great deal of the (passive) surveillance effort depends on the field worker, who is often poorly rewarded and poorly motivated. The design of the surveillance system ought to include some consideration and methods for motivating and rewarding the various participants in the system. The proportion of field workers who complete and submit the necessary reports on a regular and timely basis is one measure of the acceptability of the system.

1.3.2. Diagnostic indicators and checklists

When the calculations of PIs indicate a poorly functioning component of surveillance, it is important for the management to identify and resolve the cause of the poor performance. The PIs for rinderpest surveillance have been developed with components to assist the (headquarters) management in troubleshooting when the system shows deficiencies. Diagnostic indicators (DI) are a list of questions and prompts that provide a systematic pathway to resolving poor performances in each component of surveillance. A list of DIs is provided (in Chapter 4) to guide the CVO to the likely reason for the poor performance in each of the PIs. Checklists emphasize the fundamental infrastructure required to assure success of the surveillance scheme. Checklist items vary from availability of trained manpower, to equipment (vehicles, cold boxes etc.) and consumable items (cotton swabs, blood tubes) that are the basic tools of surveillance. Checklist items have been provided where they are considered necessary for optimal performance of the surveillance component (Chap.5).

1.4. COMPONENTS OF SURVEILLANCE SYSTEMS

1.4.1. Passive surveillance

Disease reporting is the backbone of passive surveillance systems, and a well co-ordinated disease reporting network is perhaps the single most important component of disease surveillance. Passive surveillance revolves around the herdsman or herd owner's willingness to report a disease event to the local veterinary officer. The veterinary officer must in turn be able to identify the specific disease entities, and then be willing to report such diagnosis to the relevant central authorities. The success of passive surveillance further depends on the ability (or willingness) of the central authorities to allocate the necessary resources for gathering, analysing and distributing the information, and to do all this with the necessary urgency to make the information useful.

Under-reporting is the most serious problem encountered by passive surveillance systems, and is particularly marked in developing countries where the basic communication networks required for efficient reporting either do not exist or are poorly developed. Many countries appear not to have the resources or the political will to set up efficient disease reporting networks that have the necessary communications and computing hardware and motivated staff.

Performance indicators for passive rinderpest surveillance measure the regularity, timeliness, and contents of normal disease reports sent from field veterinary officers to headquarters. It is expected that the reports should contain evidence of endemic infectious diseases, including cases characterized by clinical signs of stomatitis and enteritis, which are to be expected and occur at a measurable rate. Irregular, untimely or empty reports raise doubts about the efficiency of surveillance.

1.4.2. Laboratory diagnosis

Data from routine diagnostic services will contribute a great deal to disease surveillance, and are particularly useful for the non-reportable diseases. When their services are utilized widely by practising veterinarians, diagnostic laboratories can serve as efficient early warning system for detecting exotic diseases or new occurrences of endemic disease, and thus can make significant contribution to surveillance.

Performance indicators assess how quickly and thoroughly suspicious cases are investigated and fully characterized — either through confirmation of the suspicion or finding a differential diagnosis. PIs also measure effectiveness of feedback from the laboratories to the field veterinarians and livestock owners.

1.4.3. Active surveillance

Active surveillance is literally going after the unreported diseases, and uses surveys to obtain information on specific diseases. Active surveillance is particularly important in the late stages of eradication programmes, when it is absolutely necessary to find and eliminate the last hiding places of the disease. Even where it is well set up, passive surveillance becomes less efficient in detection as the eradication programme reduces the incidence of the disease, and it is necessary to use active surveillance to detect the final cases.

Advantages over passive surveillance, especially as a tool for detecting disease in the final phases of eradication programme, include the following.

- Active survey information can be collected in a statistically valid manner that includes the entire cattle population in the country. This reduces the problem of under-reporting, and presents a true picture of the disease situation in the country.
- Active surveys utilize experienced staff highly trained to recognize the disease of interest, rather than depending on livestock owners or indifferent field veterinary staff to report to headquarters.
- If the disease survey is carefully planned and well executed, active surveillance will generate accurate information on the true disease situation in the country very quickly and at a relatively lower cost than passive surveillance.

The poor state of disease reporting in many GREP countries makes active surveys almost mandatory to obtain high quality data on the real status of the disease from all parts of a country. The effectiveness of active surveillance can be assessed by how readily the surveys identify diseases of the SEC, which present clinical signs similar to rinderpest. The ability to detect such clinical signs provides the necessary confidence that rinderpest will be readily identified if present.

There are several methods to organize active surveillance for rinderpest. Carefully planned, statistically sound surveys can be supplemented with purposive sampling of the most likely

hideouts of the disease, or questionnaire surveys of livestock owners and herders, or slaughterhouse surveys and sentinel herds. The herdsman, the cattle trader and the middleman can all play important roles in active surveillance, because they are often knowledgeable about the disease, as well as the prevailing rumour about possible new occurrences.

Active surveys should give special attention to remote and inaccessible areas, which are often not properly covered by the veterinary services. Such areas are often the last hiding places of the virus. Novel approaches, including the use of well-motivated veterinarians or specially trained (and financially motivated, in spite of recent accent on sustainability and cost recovery) veterinary assistants should be re-explored to reach such area.

Susceptible wildlife species can also serve as sensitive indicators of rinderpest infection. Countries with large populations of such wildlife should monitor wildlife for outbreaks, unexpected deaths and other signs of infection. Where feasible, sero-surveys of wildlife would be useful method of early detection of virus infection [3].

Performance indicators for active surveillance include the number (and distribution) of districts surveyed, number of stomatitis–enteritis disease complex incidents discovered and reported within a given period. The laboratory component of active surveillance also measures the number of cases of SEC reports investigated, appropriately sampled, and definitively diagnosed in a given time period. The quality (training/experience) of the survey teams and laboratory personnel also contribute to the level of confidence in active surveillance activities and findings.

1.4.4. Sero-surveillance

Sero-surveillance detects evidence of new or increased activity of the infectious agent of interest, usually through detecting agent-specific antibodies in animals that should not have such antibodies. The objective of rinderpest sero-surveillance is to confirm the absence of rinderpest virus in a population or to confirm the emergence of new virus infection by detecting antibodies in unvaccinated adolescent animals (2–3 yrs). In the final stage of the OIE Pathway (freedom-from-rinderpest), a statistically valid sero-surveillance programme will be indispensable in establishing the final eradication of rinderpest.

It is suggested that sero-surveys be confined to two-year old animals, for the following reasons: (1) Most countries in Africa have stopped vaccination against rinderpest for at least two years, consequently animals two years old or younger should not have antibodies to rinderpest; (2) Although the decay (disappearance from circulation) of maternal antibodies depends on the initial level ingested in the colostrum, experience has shown that colostral antibodies do not persist for up to two years in the majority of cattle; (3) In most breeds of cattle two-year old animals are readily identifiable, (by size and eruption of two lower incisor teeth) even in areas that experience poor nutrition and retarded growth.

Samples for sero-surveillance are normally collected in a statistically defensible (random) manner, to increase the confidence that the result represents the real state of the disease in the country. As in active surveillance, it is often useful to target areas that have increased probability of harbouring infected animals (purposive sampling), such as border regions that have frequent contact with cattle from other regions or countries, herds along cattle trade routes and major cattle markets, and parts of the country that have poor track records for regular disease reporting.

The major cost of surveillance is often in getting to the herd, and combining sero-surveillance with active surveillance can reduce costs. Sero-survey teams can arrange to examine the herds they bleed for signs of the disease, and, where feasible, also examine other herds within the same area.

Performance indicators for sero-surveillance measure the quantity of serum samples collected *and* tested, with results reported to headquarters within a specified period.

1.4.5. Wildlife surveillance

Susceptible wildlife in close contact with unvaccinated cattle can be used as sentinel populations to detect the introduction of (mild) strains of rinderpest virus (which may not produce severe clinical signs in cattle). High mortalities and unexplained deaths in highly susceptible wildlife are indication of potential infection, and require active disease investigation. Wildlife surveillance (including serological surveys) is required for the OIE certification of freedom-from-rinderpest in countries where wildlife exists in appreciable numbers.

Performance indicators for wildlife surveillance include number of serum samples collected, tested and reported within 120 days of collection.

1.4.6. Others

Additional useful information on disease status in a country can be obtained from

- Abattoir (slaughter slab) samples and other grab samples collected for other purposes. Unless trace-back facilities are available, abattoir samples may not be useful in the final phase of eradication programmes.
- Sentinel herds, particularly placed in the border areas or along the major trade routes. Such herds come in frequent contact with herds from other countries and regions, and can be sampled on regular intervals to detect evidence of new introductions of infectious agent.
- Indicator species: In some instances, small ruminants have been used as indicators of viral activity for cattle viruses. This is particularly important when the infection of cattle does not result in overt clinical disease, and hence may not be obvious to the herdsman or the attending veterinary personnel.
- Peste des petits ruminants (PPR), normally a disease of small ruminants, should be taken into consideration in the overall risk assessment for rinderpest. Cattle mixed with sheep and goats infected with PPR can become infected with this virus. Although clinical disease does not occur, the cattle will develop antibodies to PPR which can be confused with rinderpest antibodies in some serological assays. An understanding of the incidence of PPR in small ruminants is useful in interpreting serological results in areas where cattle and small ruminants share grazing space.

1.5. FOLLOW-UP ACTION

Detection of a suspected case (showing evidence of SEC) or evidence of infection should trigger at least the following activities, regardless whether the report came from routine general or active surveillance.

- Detailed investigation of the putative outbreak, to confirm the diagnosis, (or arrive at a definitive (differential) diagnosis), and to define the extent of the outbreak by identifying the extent of involvement of in-contact herds.
- Prompt initiation of pre-arranged, specific (emergency) actions to contain the outbreak and eliminate the disease [4].

1.5.1. Stomatitis–enteritis outbreak investigation

Ideally, there should be an agreed and documented national plan for handling suspected rinderpest outbreaks. Investigation teams may be organized at the district level, with backup from headquarters, or teams can originate from headquarters all the time. In either case, teams should be made up of well trained or experienced veterinarians who are conversant with rinderpest and field investigations. The team should be aware of their assignment, and be prepared to go on short notice, fully supplied with the materials and equipment for investigation and sample collection.

A two-stage investigation may be useful to reduce the number of false alarms. A team from the Divisional Veterinary Office (DVO team) could carry out initial investigation of a report to assess the situation and collect samples. If there is reasonable suspicion, or they are unable to rule out rinderpest, then a more detailed investigation can be carried out by an expert team from the regional or national headquarters.

1.5.2. Investigation team

Regardless of the mode chosen, it is important that the field investigations (and also active surveillance) use good, competent, dedicated people who have some measure of imagination, and are willing to work hard. It may not be very easy to find such ideal persons, however, a bit of encouragement can make good people excellent. For instance, reporting officers who have produced regular, good reports can be drafted into disease investigation teams as a type of reward (especially if they get additional field allowances) for their dedication. If they continue to excel, they can be given more responsible positions. Such recognition of competence will encourage others to put out their best. The seemingly arbitrary appointment of unsuitable people to high positions is perhaps the most important contributor to low morale among government staff in the developing countries. A vacant post may very well be better than one filled with the wrong person, and sending the wrong message.

1.5.3. Objectives and outcomes of investigations

The objective of outbreak investigation is to collect descriptive field data and (diagnostic) samples on a high percentage of infectious stomatitis–enteritis disease episodes within a reasonable period of time from the initial report or recognition. Information and samples collected should lead to either a diagnosis of rinderpest or an identification of one of the other diseases of the SEC (i.e. bovine viral diarrhoea (BVD), infectious bovine rhino-tracheitis (IBR), malignant catarrhal fever (MCF), etc.) as a definitive differential diagnosis.

As presented in Fig.1., there are three possible outcomes of a stomatitis–enteritis investigation

Confirmed rinderpest: This outcome is achieved by laboratory isolation of live virus or detection of rinderpest antigen, ribo nucleic acid (RNA) or a four-fold rise in rinderpest specific antibody in paired samples from identified animals. In areas where vaccination has

ceased, a statistically significant increase in seroprevalence between paired survey sample sets could also be used.

Discard: If the stomatitis–enteritis outbreak is conclusively shown not to be rinderpest. There are only two possible ways to achieve this classification: (1) A definitive differential diagnosis confirmed by laboratory methods. (2) The outbreak is shown to be rinderpest negative by virus, antigen and RNA detection methods and negative on repeated serologic investigation.

Rinderpest compatible episode (outbreak): This category represents all clinical reports that were either not investigated or for which a definitive diagnosis was never made and a valid paired serological investigation was not accomplished. It should be noted that most serological investigations in endemic or vaccinated populations are inconclusive. Therefore, the serological escape route from the rinderpest compatible category is probably only useful in countries that have ceased vaccination for a period of years and are well advanced down the OIE Pathway.

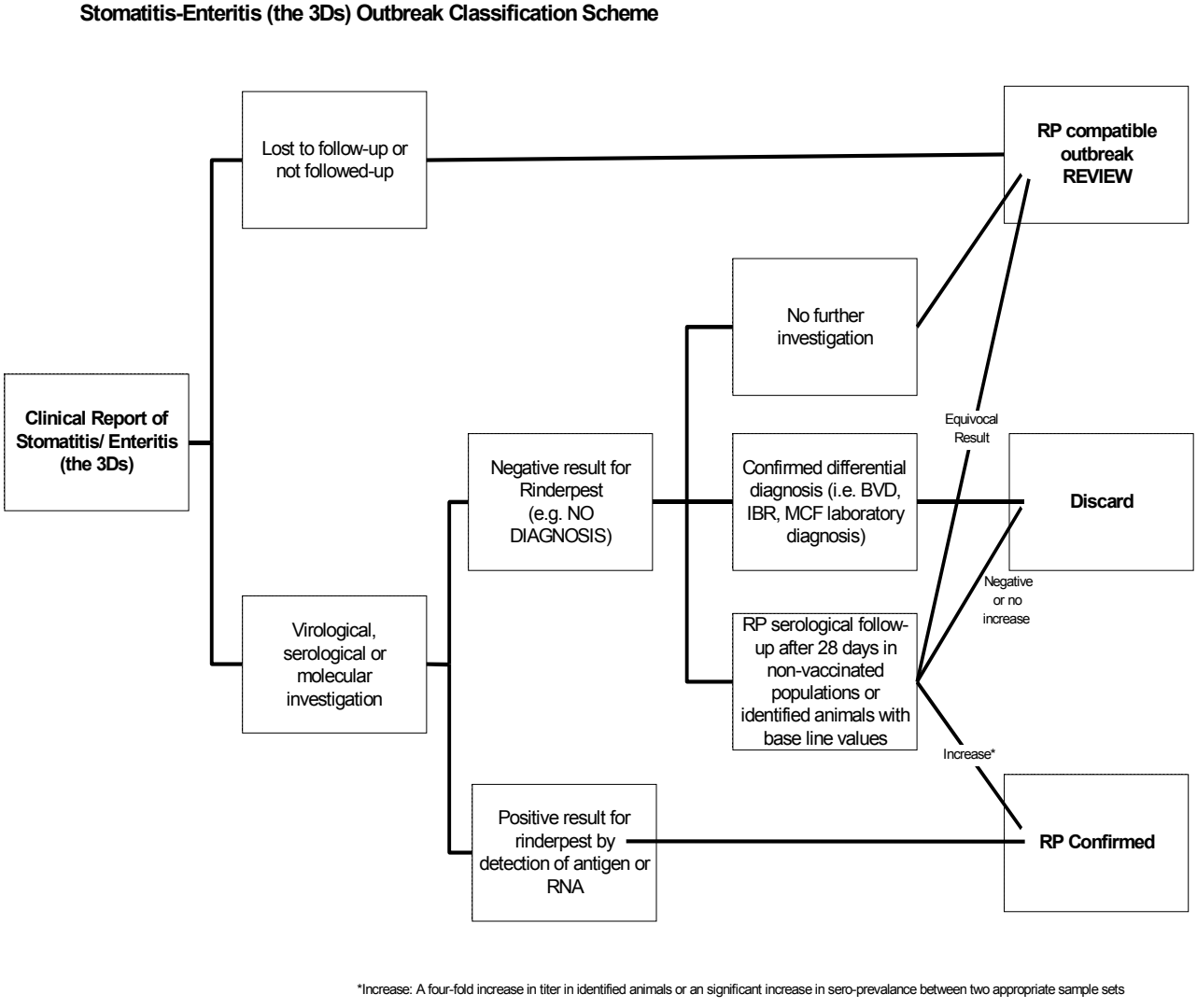

FIG.1. Possible outcomes of a stomatitis–enteritis investigation.

The rinderpest compatible outbreak category could be described as the rinderpest suspect category. It contains all those disease episodes for which rinderpest was never entirely ruled out. The rinderpest compatible outbreak category is therefore the red flag category. The goal of the surveillance programme is to keep this category as small as possible using proven laboratory methods. Disease episodes classified as rinderpest compatible should be periodically reviewed by a panel of experts preferably from both inside and outside the national veterinary service.

In some instances, stomatitis–enteritis disease episodes occur that are both clinically consistent with the stomatitis–enteritis outbreak definition and are epidemiologically characteristic of rinderpest. That means that they have been observed to be behaving in a population in a manner consistent with one of the known lineages of rinderpest virus. These disease episodes are considered rinderpest probable outbreaks. Probable outbreaks are treated the same way as other stomatitis–enteritis disease episodes in the outbreak classification scheme, however all means should be exhausted to confirm the outbreak rapidly, and special action may be warranted to contain the outbreak prior to the availability of a laboratory diagnosis. Recent experience has shown that repeated investigation, repeated sample collection and repeated laboratory testing may be required to confirm some rinderpest probable disease episodes.

It should be noted that the emphasis on a definitive differential diagnosis made in the scheme is perhaps more stringent for ruling out rinderpest than was required in the past. This is due in part to the recent experience of GREP that multiple investigations of stomatitis–enteritis disease episodes were required to make a diagnosis of rinderpest. The requirement of a definitive differential diagnosis in order to rule out rinderpest is particularly relevant to those countries that have initiated the OIE Pathway.

1.5.4. Collection of samples

Samples and specimens often need to be collected from diseased or dead animals for laboratory diagnosis. Collection of adequate samples is critical to rapid, accurate diagnosis. To enhance the diagnostic value of samples, the following factors have to be borne in mind.

- Some of the samples should be collected from cases in early stages of clinical disease (e.g. within 48 hours of the appearance of discharges).
- Ocular and nasal swabs should be obtained from as many affected animals as possible.
- Serum samples should be obtained from all animals showing pyrexia, and those that appear to have recovered. Animals showing pyrexia should be carefully identified for future bleeding two weeks after the first (acute phase) bleeding. If possible, animals in the in-contact herds should be bled.
- Scrapings should be obtained from oral lesions, and tissues (spleen, lymph nodes, peyes patches) from recently deceased animals or those sacrificed *in extremis* (if such lesions or cases are present).

In the event that fresh cases cannot be located, sampling may not be diagnostic and therefore not effective. All means should be exhausted to find fresh cases.

Investigation teams should be ready to collect samples, and therefore have the necessary sampling materials available at all times. The diagnostic window (Fig.2) for rinderpest is about five days beginning at the onset of fever. The best samples can be obtained at the time of onset of lacrymation and oral lesions up until the onset of diarrhoea. This is generally 24 to

48 hours after the onset of fever. Thereafter, viremia declines. Thus, timeliness is essential in sample collection. Ideally, all cases should be sampled at the time of initial detection. In the event that sample collection is completed later, even the next day, secondary cases should be identified and sampled, in addition to the primary cases.

1.5.5. Investigation of antibodies in sera of unvaccinated animals (sero-surveillance results)

The first step when sero-surveillance shows evidence of renewed viral activity (by presence of rinderpest antibodies in sera of unvaccinated cattle) is to re-check the serum samples carefully to ascertain that they are not from animals young enough to have maternal antibodies, or old enough to still have antibodies from previous vaccination, or from small ruminants. Additional samples (serum, ocular and nasal swabs, unclotted blood) should be collected from the herd, and other herds in the area, and tested for antibodies and rinderpest virus antigen or nucleic acid. A detailed epidemiological investigation of the district should be initiated to determine the probable origin (source) of the virus.

It must be appreciated that there may be more than one lineage of rinderpest virus circulating in a population, and repeated sampling may be required to fully define the situation. Similarly, current tests do not allow one to distinguish between antibody responses to wild-type and vaccine viruses. Until tests are developed which can identify all lineages and differentiate between vaccination and infection with wild-type rinderpest virus, seroprevalence data will need to be interpreted in the context of descriptive data from other surveillance activities and vaccination statistics in order to understand disease prevalence in endemic or recently vaccinated populations.

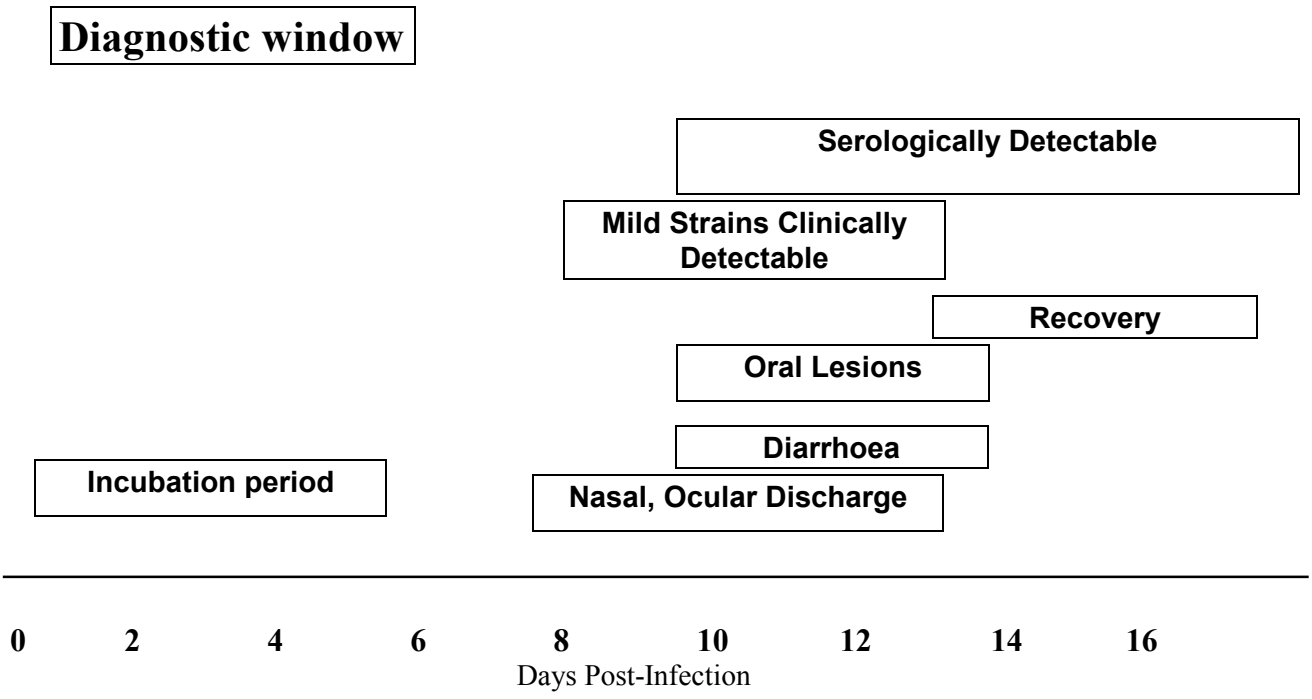

FIG.2. Diagnostic window for rinderpest.

1.5.6. Questionnaire

Standard questionnaire formats should be used for active surveys as well as investigation of reported outbreaks. Questionnaires are particularly useful to:

- Organize the necessary information required to maintain some uniformity and consistency, such that important information is not omitted in some farms.

- Outline the questions in such a way that the answers can be checked off. Villagers are often wary of having their opinions recorded, and the less writing as they answer, the better.

There are already a large number of questionnaire designs available in FAO and IAEA publications, as well as other independent published material on field investigation, in addition to formats already in existence in various countries. Each country and CVO can create their formats based on any of these existing designs, as long as the important information is collected.

Salient information that should be obtained from a herd under survey are listed below. It may be difficult to obtain some of the information because herdsmen may have misgivings about some of the questions. Herd structures for example, are difficult to obtain because traditional cattle rearers are generally reluctant to give out information on their herds. It is important, however, to have some estimate of the number of animals on the farm (even if age groups and sexes cannot be classified). The number of animals in the herd is required as a denominator in calculating epidemiological rates and proportions.

Contents of a survey questionnaire:

- Herd location/structure (at least an estimate of the total number of animals of each species). If possible age and sex distribution/herd movement (Where has it come from? Where is it going?);
- Owner name and contact address (to facilitate reporting back);
- Date of visit;
- Description of main clinical signs;
  - Date of onset, how many sick now, how many dead, and how many recovered?
  - What is the farmer's diagnosis?
  - Treatment (if any) and by whom
  - Previous occurrence of such disease;
- Any other clinical signs / problems (abortions, tryps, dermotophilus, lumpy skin disease (LSD), external or internal (gastro-intestinal) parasites);
- Stomatitis–enteritis signs;
- Number of animals sold (if any) and bought into the herd, and why.

An example of a simplified survey format is given.

Active Disease Survey Form (*Example)*

Herd-Id | **Owner's name**

Date (dd/mm/yy) | **Village** | **Parish** **District**

Address

Map Coord. **Lat:** **Long:**

Production system? .....
Movement? .....
Main Species/breed: .....

Herd Structure

Age gp yrs	**Bovine** male	female	***# sick Bov***	**Ovine** male	female	**Caprine** male	female	**other** male	female	**# sick (indicate spp)**
0–1										
1–2										
2–3										
> 3										
totals	0	0	0	0	0	0	0	0	0	

Animals sold/culled: **Reason:**
New animals introduced: **Reason:**

Vaccinations: ☐ **Rinderpest** ☐**CBPP** ☐**Blackquarter** ☐**Other……**

Date: …… …….. …… …….

Major Clinical signs	**# Affected**	**Predominant Age**	**# Dead**
1			
2			
3			

Detail history & signs: ***(previous occurrence?): Y / N*** ***Date:***

***Date of onset*:**

Samples collected ☐***Blood*** ☐***Serum*** ☐***Swabs*** ☐***Biopsy*** ☐***Scraping*** ☐***Other***
Details: (pl. use extra sheet for detailed description of the animals sampled)

Clinical Diagnosis
Measures taken: ☐***Quarantine*** ☐***Vaccination*** ☐ ***Dip Treatment*** ☐ ***None Other……***
Details

_____ _____
Survey Team ID ***(Leader/Veterinarian)***

1.6. SYNOPSIS

The setting of PIs necessitates the refinement of the objectives of surveillance. It is important that GREP participants are in agreement on a number of points:

- The overall objective of GREP is to eradicate rinderpest virus; therefore rinderpest surveillance is designed to detect all forms of rinderpest virus infection including mild and occult infection.
- The stomatitis–enteritis outbreak definition and classification
- Disease surveillance is not designed to detect rinderpest. It is designed to detect as many episodes of infectious diseases as possible, including particularly the majority of disease episodes compatible with the stomatitis–enteritis outbreak definition. It is the function of outbreak investigation and laboratory surveillance to provide a definitive diagnosis for the majority of detected stomatitis–enteritis disease episodes.
- All GREP Member States, including those that have declared Provisional Freedom-from-rinderpest, are endemically infected with disease agents other than rinderpest that will result in stomatitis–enteritis disease episodes and if their surveillance programmes are to be considered effective, they must be detecting and investigating stomatitis–enteritis disease episodes.
- The objective of laboratory diagnosis is to provide a definitive diagnosis in a high percentage of stomatitis–enteritis disease episodes. Capacity building in regard to the ability of national laboratories to make definitive differential diagnosis is essential to effective surveillance.
- The components of surveillance systems and the need for the evaluation of performance.

GREP strongly recommends the approach outlined in this document, however, it is important that the participants are themselves convinced. Participants are encouraged to fully discuss, voice any reservations they may have and suggest amendments where appropriate.

PIs require considerable discussion and field testing before they can be fully implemented. In addition, to reviewing the PI concepts, participants in national surveillance programmes are encouraged to discuss practical challenges to implementing PIs in their day to day work.

Summary of PIs in rinderpest surveillance

PIs for rinderpest measure components or surveillance, and are designed as proportions with time delimited numerators and denominators. The two main denominators used in these calculations are:

- Number of administrative districts
- Population of susceptible species (normally, cattle and domestic buffaloes. In some case, small ruminants as well). At this point in the rinderpest eradication effort when most countries have stopped vaccination, it is assumed that all cattle are susceptible.

Key indicators

Table II shows PIs for each component of the rinderpest surveillance activity. Much of the information detailed below has been discussed at various levels and tested under field conditions in Africa

TABLE II. RINDERPEST SURVEILLANCE PERFORMANCE INDICATORS

Surveillance component:	**Performance Indicator**
General (passive) disease surveillance	1. Proportion of districts forwarding routine monthly disease reports in the proper format within 30 days for at least 10 months of the year.
Active disease search and reporting	2. Proportion of districts (in the country) actively surveyed for rinderpest (by any method: participatory, questionnaire-based and clinical) with results reported within 90 days.
Specific stomatitis–enteritis reporting	3. Number of reports of stomatitis–enteritis (cases) received, at headquarters within 30 days of first contact per 100,000 heads of susceptible species.
Stomatitis–enteritis outbreak investigation	4. Number of reports of stomatitis–enteritis fully investigated (including proper sampling) by a veterinary professional within 7 days of receiving the report per 100,000 heads of susceptible species.
Preliminary rinderpest diagnostic testing	5. Number of cases examined by rinderpest antigen, serological, immuno-histopathological and/or RNA detection techniques with preliminary results reported within 3 days of receipt of samples at the laboratory per 100,000 heads of susceptible species.
Stomatitis–enteritis case definitive diagnosis	6. Number of stomatitis–enteritis cases diagnosed definitively by laboratory methods at national and/or reference laboratories within 60 days of receipt of samples per 100,000 heads of susceptible species (e.g. RP, BVD, MCF, ECF, etc.).
Sero-surveillance	7. Number of serum samples collected and tested with results reported within 120 days of collection per total population of susceptible species in the country.
Wildlife surveillance (special indicator)	8. Number of serum samples collected and tested from wildlife with results reported within 90 days of collection per thousand heads of susceptible species.

2. PERFORMANCE INDICATORS AND THE OIE PATHWAY

Countries participating in the Global Rinderpest Eradication Programme (GREP) will move progressively from freedom from rinderpest disease to freedom from virus infection, leading to a world free of rinderpest by the year 2010. A system for verifying the progress towards eradication has been outlined in the Recommended Standards for Epidemiological Surveillance Systems for Rinderpest, commonly called the OIE Pathway (Fig.3. and ANNEX 1), which defines the criteria that a participating country will need to meet for full recognition that it has achieved eradication and is free of the disease and the causative virus.

The need to move smoothly and successfully down the OIE Pathway is perhaps the most insistent reason for applying PIs to surveillance in African countries. The rite of passage to acceptance by OIE requires clear evidence of robust and effective disease surveillance, and PIs can provide this evidence and generate some of the documentation required to support the formal application to the OIE. Even if the need to satisfy the OIE criteria did not exist, the application of PIs will still be very useful in validating national surveillance systems, and positioning the country well in international trade in livestock and livestock products.

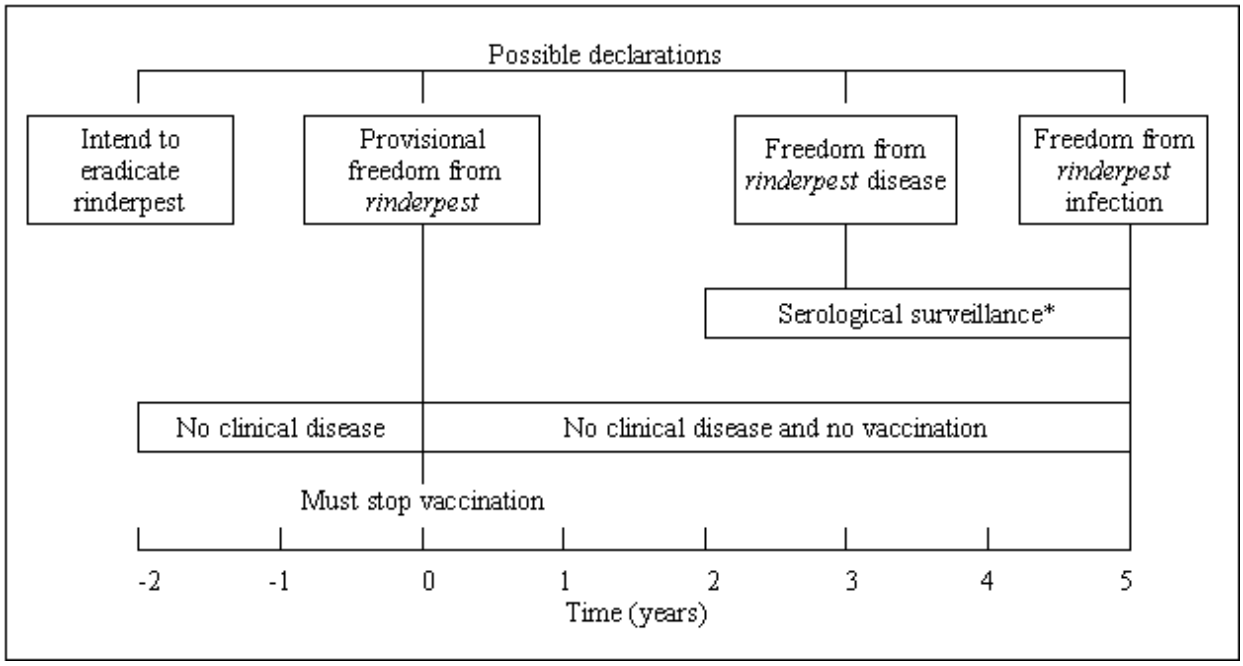

FIG.3. Diagrammatic representation of the OIE pathway.

The conditions of the OIE Pathway will be met if a country can show that the surveillance system can detect (with 95% confidence) clinical disease and virus infection occurring at 1% prevalence. The veterinary services in each country will rely on efficient surveillance to provide the required level of confidence and prove the absence of disease and infection.

Experience has shown that such level of confidence can be achieved by a surveillance system that has the following quantifiable attributes:

– At least 80% of the districts (or other reporting units) provide regular (at least monthly) reports.

- An active disease finding programme (active surveillance) is in place, and capable of evaluating annually at least 300 sample units (herds, villages, parishes, etc.) selected randomly or in other statistically valid manner.
- Active disease investigation teams are set up and carry out full (clinical, epidemiological and laboratory) investigations on all suspected cases and outbreaks.
- A serological surveillance programme annually collects and examines at least 4500 serum samples from at least 300 herds selected in a statistically valid (random) manner.
- A well equipped and adequately staffed diagnostic laboratory capable of providing rapid, quality diagnostic backup to the disease investigation programme.

These attributes can be evaluated qualitatively and quantitatively with PIs, to provide a measure of confidence on the national surveillance set-up. PIs will assess how close the surveillance system in a given country has come to the goal of detecting disease at 1% prevalence (within the 95% confidence limits).

Performance indicators can also be linked directly to the specific OIE criteria, to evaluate the efficiency of each of the components of surveillance. For example, adequate scores in the PIs 1, 2, and 3 indicate that passive and active surveillance, (including active disease reporting) are sufficient to detect rinderpest if cases occur. Similarly, PIs 4, 5, and 6 relate to investigation and diagnosis of SE complex diseases, and if scores were within acceptable limits, the country would have demonstrated the ability to detect, identify and diagnose rinderpest if it occurred. PI 7 deals with sero-surveillance and the capacity (of the country) to (a) detect new (or hidden) cases of rinderpest, and (b) verify that no vaccination is going on in countries that have ceased vaccination — provided samples are taken from animals at an age group that would have lost their maternally derived antibodies.

In countries which have declared provisional freedom from disease, acceptable PI scores can provide strong support to a claim that the country satisfies the OIE criteria, i, iii, and iv, and is eligible for the OIE declaration of freedom-from-rinderpest disease. Continued excellent PI scores will also assist in meeting the criteria i and ii of the OIE declaration of freedom-from-rinderpest infection (see Annex 1 for the OIE criteria). Criteria v of the freedom-from rinderpest disease requires that the country prepare a national (emergency preparedness) plan for rapid containment of new cases of rinderpest. The methods for preparing the plan are outlined in the FAO EMPRES publication [4]. Countries that have significant populations of wildlife are expected to fulfil criteria iii in freedom-from-rinderpest virus set.

Tables I and III show the relationship between the OIE criteria sets and PIs.

TABLE III. RELATIONSHIP BETWEEN OIE DEFINED CRITERIA FOR *FREEDOM FROM RINDERPEST VIRUS* AND PERFORMANCE INDICATORS

OIE Criterion	**Country Must show**	**Tools & Techniques**	**Quality Control**	**Indictators of Achievements**	**Relevant PI**
(i) The country should have been declared free from rinderpest disease at least one year earlier, and continues to meet the requirement for this status.	Evidence that OIE has declared the country free from the disease.	–	–	–	–
(ii) There should have been and effective sero-surveillance system in operation for a period of at least two years, and the findings must be consistent with freedom from infection. Sero-surveillance must include other species.	Similar to 4.2(iii) Continuing general (passive) active and sero-surveillance activities.	Active surveys in statistically selected sample units as well as purposive surveys of high risk areas *and* small ruminants>	Reasonable number of samples from SE cases submitted for laboratory diagnosis. Survey reports>	At least 4500 serum samples from statistically selected sample units>	7
(iii) Investigation into infection of wild susceptible species must be carried out where these species occur in significant numbers. Sampling should be done where possible. Additional strategic sampling of domestic stock should be done in areas adjacent to large game populations.		Serological and clinical surveys of sentinel cattle herds near game reserves. Careful monitoring of *unusual* deaths in wildlife species (*especially bovine and small ruminant species*).	How many cattle herds in the vicinity of game reserves have been identified for regular monitoring.	Serum samples from wildlife and sentinel herds.	8

2.1. RE-TOOLING THE SURVEILLANCE SYSTEM

2.1.1. Passive surveillance

Recent experience and observations indicate that the existing surveillance set-up in many African countries may lack the efficiency to detect disease at 1% prevalence, and are unlikely to be able to satisfy specific OIE criteria. Passive (general) disease reporting systems exist in some form in all countries, albeit plagued by poor communication networks, inadequately staffed field stations coupled with poorly motivated field officers and a general lack of understanding of the importance and mechanics of disease reporting.

Conflicting policy decisions, often heavily influenced by international organizations, have also contributed to the general inefficiency. In many countries, World Bank-initiated decentralization programmes have resulted in independent districts with the result that the District Veterinary Officer (DVO) is removed from direct supervision of the centre, and thus has no obligation to report to the Chief Veterinary Officer (CVO). In another instance, the IMF's structural adjustment policy directives have resulted in severe attrition of field staff in many countries. One country was required to reduce the veterinary manpower from 1400 to 200 to meet the IMF requirements. In yet another example, programmes introduced by donor agencies have harmed delivery of veterinary services to remote villages. In the past field staff were encouraged to reside in remote villages and hamlets with such inducements as bush allowance, relocation/inconvenience allowance, field allowance, etc. Recent programmes of privatization of veterinary services and cost recovery have precluded such allowances making it difficult to provide services to those areas. Unfortunately the nomadic herdsmen, for whom cattle rearing is often not an economic venture, are the worst affected by the push for privatization and cost recovery.

Revitalization of the disease reporting system will require

- Co-ordinated seminars on surveillance for all veterinary staff, with specific training for non-professional staff manning field stations
- Improved staffing, particularly of the field stations, but also of staff trained in data management and analysis.
- Streamlining the communication networks to improve information flow.
- Investing in transportation, data management, and communications equipment.

2.1.2. Active surveillance

Active disease search goes beyond the traditional investigation of epidemics and sporadic disease outbreaks. It is a relatively new concept, especially for African countries and differs from general (passive) surveillance in that the veterinary services have to make active effort to collect the disease information which is geared specifically for purposes of surveillance. Active surveillance requires well-organized, regular (sustained) disease finding effort. There are several approaches to the design and implementation of active disease surveillance, ranging from direct clinical observation of selected herds to the questionnaire based appraisal methods. Sentinel herds especially at the borders with contiguous countries or along cattle trade routes are sometimes targeted specifically to search for new diseases which may be introduced from outside the country. In countries with large populations of nomadic herdsmen (who make a habit of selling sick animals) the cattle markets are often good sources of information on current disease outbreaks.

Each country has to work out a suitable surveillance protocol taking into consideration relevant factors such as available funds, expertise, and equipment. **Annex 3** outlines suggestions for developing an active surveillance protocols. Detailed information can be found in the excellent manual by Angus Cameron http://www.ausvet.com.au/ [5].

2.1.3. Sero-surveillance

Most countries have participated in the rinderpest seromonitoring exercise, and therefore have the basic field experience and laboratory set up to organize a sero-surveillance programme. Sampling protocols for surveillance to demonstrate absence of disease should be different from those seromonitoring purposes, and countries have to determine the relationship between active disease search and sero-surveillance.

2.1.4. Wildlife surveillance

Countries where large populations of susceptible wildlife, especially where there is reasonable contact between the wildlife and cattle populations, can use the wildlife as non-vaccinated sentinel populations in their surveillance programs. Although serological surveillance of wildlife is costly, active surveillance of wildlife population dynamics is very important, and may provide early indication of new or resurgent disease.

3. MEASUREMENT OF PERFORMANCE INDICATORS

PI measurements estimate how closely the hands-on implementation of each component of surveillance approaches the targets described in Chapter 1, which are aimed at detecting disease occurring at 1% prevalence. Calculations are often related to the cattle population in the country, and PIs are time-delimited to emphasize the importance of timeliness in rinderpest surveillance activities. This chapter sets out the methods for calculating the PIs for the various components of surveillance, and tips on facilitating the operational aspects.

3.1. PERFORMANCE INDICATORS FOR PASSIVE DISEASE SURVEILLANCE

General (Passive) surveillance relies heavily on the routine monthly reports which field veterinary offices (DVOs) return to headquarters, usually on predefined forms. The reports contain information on livestock production and disease problems in the area under jurisdiction, based on veterinarians' direct observations and information from livestock owners and herdsmen.

The PI is calculated as the proportion of field units (DVOs) who submit their reports on time each month for at least 10 months of the year. The calculation is set up as follows:

$$\frac{No.\,of\ \ field\ units\ reporting\ every\ month\ \ for\ at\ least\ 10\ months}{Total\ number\ of\ \ reporting\ units\ in\ the\ country} \times 100$$

A practical approach to the determination of PI 1 would be to use a summary form for tabulating reports received at headquarters, as shown in Table IV below. A clerical officer is assigned to check-off reports as they are received. The completed summary together with the report is reviewed by the professional staff in the epidemiology unit, who can evaluate the contents of the reports.

Many countries have several types of reporting formats, such as disease outbreak report forms, monthly disease summary forms, disease (investigation) status forms, quarterly and annual report forms, etc. For the purposes of the general (passive) disease surveillance, the interest is in the monthly disease summary reports, which presumably would contain information on disease outbreaks that occurred during the month. Similarly, quarterly and annual reports will normally reflect information already in the monthly reports.

TABLE IV. SAMPLE OF CONTROL /SUMMARY FORM FOR MONTHLY RETURNS FROM FIELD UNITS

Mark (x) for each report received by the end of the reporting period, L (late) for reports received after the reporting period, and (–) where no reports are received

Form 1: Summary for the Year 20….

Reporting Unit	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total Reports for Yr 20….**	**Remarks**
Unit 1 Mwanga	x	x	x	–	L	x	x	x	x	x	x	x	10	
Unit 2 Sojundi	x	x	x	x	x	x	x	x	–	x	x	x	11	requested forms
Unit 3 Luxo	x	x	x	x	x	x	x	x	x	x	x	x	12	
Unit 4 YellaN	x	x	x	L	–	–	x	x	–	–	–	–	5	wrong forms
Unit 5 Oropu	x	x	x	x	x	x	x	x	x	x	x	x	12	
Unit 6 Abala	–	x	x	x	x	x	x	x	x	x	x	x	11	
Unit 7 Jere	x	x	x	x	x	–	–	x	x	x	x	x	10	
Unit 8 Agua	–	–	x	x	x	x	x	x	x	x	x	x	10	funds for
Unit 9 Meni	–	–	–	–	–	–	–	–	–	–	–	–	0	
Unit 10 Ochor	x	x	x	x	x	x	–	x	x	x	x	L	10	asked for fuel
Unit 11 Mutum	x	x	x	x	x	x	x	x	x	x	x	x	12	
Unit 12 Jesso	–	–	–	–	–	–	–	–	–	–	–	–	0	
Unit 13 Nyindo	x	x	x	–	–	–	–	x	x	x	x	x	8	used wrong form
Unit 14 Temek	x	x	x	x	x	L	x	–	x	x	x	x	10	
Total Acceptable Reporting Units														***10***
Total Units														**14**

$$PI(\%) = \frac{10}{14} \times 100 = 71\%$$

The minimum acceptable PI is 80%; this means that if 80 percent or more of the reporting units are sending in their reports regularly, it can be accepted that general disease surveillance meets the target. A lower score, as in the example above, should prompt the CVO to ask questions, and initiate action to improve the situation.

The first, perhaps obvious question should be: Why are some units not reporting? Effort to resolve this question will first evaluate the level of inputs necessary for proper reporting from

- The reporting officer may either not understand the importance and urgency of the reports, or may be casual about reporting because of poor compensation and disenchantment with headquarters.
- The district may not have the required report forms.
- Some districts may not have sufficient funds to send the completed forms by courier or other rapid transit methods.

The summary forms may be able to pinpoint some problems (from comments of field staff) but it will require detailed analysis of the reports to recognize others. For example, reports submitted on scraps of paper or inappropriate forms suggest that some of the units may not have the proper report forms.

The summary format can also assist the CVO in trapping problems early. For instance, by reviewing the summary form every month, a unit that fails to report for two consecutive months should attract a query from the Chief, either a letter asking for explanation, or preferably a visit from headquarters staff. More widespread delinquency could indicate fundamental problems and should trigger a training workshop or seminar for field workers. Such feedback from headquarters would improve the reporting process and eventually the PIs.

Districts that are deficient in reports should be considered priority areas for purposive sampling in planning active surveillance programmes. Superior reporting units can be readily identified and rewarded, for example, by recruiting the staff from such units in the teams for active surveillance duties (for which they can get some field allowance, in addition to the recognition).

3.2. PERFORMANCE INDICATORS FOR ACTIVE DISEASE SURVEILLANCE

Active surveillance collects information on the health status of national herds using carefully planned disease surveys. Statistically structured sampling, (such as stratified random sampling) will produce a more valid view of the health and disease situation in the entire country, and plug gaps that may exist in the general surveillance information. In addition, purposive sampling which targets areas of greatest risk, such as trade routes, border states, areas with poor (passive) disease reporting history, and remote areas that have limited veterinary contact, greatly improves the effectiveness of active surveillance in ferreting out hidden foci of disease.

The PI for active surveillance measures the Proportion of districts (or other administrative units) surveyed using active disease search techniques, and for which the results are reported within 90 days of the survey.

The calculation can be set out as follows:

$$\frac{No.\,of\ districts\,/\,local\ governments\,/\ parishes\ \ surveyed\ actively\ per\ year}{Total\ number\ of\ \ districts\,/\,local\ governments\,/\ \ parishes\ in\ the\ country} \times 100$$

The acceptable PI is 10–20% (per year) of the districts or other sample units) in the country. The criteria for proceeding down the OIE Pathway requires that active disease surveys be carried out in at least 300 sample units (herds) selected by a statistically valid random sampling technique (300 represents the number of herds which will allow detection of disease

occurring at 1% prevalence with 95% confidence, provided the herds are selected by random method). Additional herds can be selected by purposive sampling from areas of highest risk. The 10–20% can be made up of follows:

- The district surveyed for purposes of meeting the OIE random sampling criterion (at least 300);
- Districts selected because they are on international borders, or on cattle trade routes, or for showing poor (passive) reporting, or for reason of being remote, inaccessible or neglected for one reason or the other (i.e. those selected for purposive sampling);
- Districts surveyed because of suspected outbreak(s).

The random sampling of 300 districts must be done for the country to proceed down the OIE Pathway. The additional groups listed above will strengthen the country's case.

3.2.1. Setup for active surveillance

Active disease surveys require considerable (expert) manpower and material resources for proper planning and execution. The importance of random selection has been stated above. It is also important that the survey teams have clear understanding of the objectives and the methodology of the survey, as well as the critical importance of the results of their work.

There are several approaches to the design of active disease surveys. Some countries may wish to set up one or more survey teams for the entire country. The advantage of this centrally co-ordinated approach is that a few teams can be made up of well-trained persons who will also gain experience as they proceed. The standard of the survey will be uniform and dependable. The major disadvantage is the cost of travelling around the country.

Another solution would be to assign each DVO to do the active surveillance in his district. The DVO could organize a team to visit one or two randomly selected herds/villages once every two or three months. In a year each DVO could survey up to 24 herds, and in a country with 200 districts, this number of actively searched herds will be more that the OIE requirements.

The obvious advantage of the district based active survey is the simplicity and low cost. The major disadvantage is in the variations in the abilities of the different DVOs, and the potential for bias which could occur because the DVO will normally be familiar with his district, and may choose the farms to present a particular scenario. Pre-survey workshops could be used to harmonize the survey techniques and reduce the variations among the DVOs. To reduce bias, the national Epidemiologist (headquarters) could draw up the units to be sampled by each DVO and, even which DVO should be sampling in a given year. In addition, headquarters may send epidemiologists to assist and supervise the DVOs on some of the surveys.

3.2.1.1. Calculations based on a centrally co-ordinated survey

Table V outlines the summary table for data obtained from a centrally co-ordinated active survey. The CVO of Butomi, a country in central Africa, has decided to actively look for disease in all of his eight provinces. His sampling unit is the village, and he has decided to select the sample units on the basis of the total villages in each province, and also the relative cattle population in the province. He has set up six field teams, made up of one epidemiologist, one clinician or pathologist (from the University), one laboratory technologist

(from the central laboratory or the University), the DVO of the province or district, and two assistants from the local veterinary office. In addition to the 254 villages selected by stratified random sampling, another 50 villages along the border areas, near cattle trade routes, or having large cattle markets were also sampled. The results are set out below.

TABLE V. SUMMARY OF ACTIVE SURVEILLANCE: BUTOMI 2000

Province	**No of Units[1] surveyed/ total units**	**Dates survey started**	**# SE[2] cases seen**	**Samples collected[3]**	**# of other cases**	**Date last samples submitted**	**Sampling team (team leader)**
Bama	1 / 1	June 1	0	bl, ,	6	Jun 14	Kereku
Gulda1	15 / 75	Jul 14	1	bl sw1,2	25	Jul 30	Igbined
Wayor	49 / 343	Jul 1	2	bl, spl, ln	12	Aug 15	Maman
Kidal	1 / 1	Jun 9	0	bl	2	June 11	Ibrahim
Akhram	44 / 308	Jun 29	4	ln, sw bl	50	Aug 20	Ibrahim
Bidar	70 / 560	Jul 12	2	sw bl	38	Sept 2	Denzel
Segu	46 / 322	Jun 25	8	sw,bl ,ln	22	Aug 3	Kereku
Utulieu	29 / 145	Jul 16	0	bl,	15	Aug 30	Amram
Totals	**254 / 1755**		**17**		**170**		
Purposive sampling	50		8		23		
Total units sampled	***304***						
Total SE			***25***		193		

[1]Units = villages, parishes, local governments, herds, or other sampling unit.
[2] Stomatitis-enteritis cases
[3]Samples: bl = blood (for serum) sw = swab (ocular (1) or nasal (2)) spl = spleen, ln = lymph node biopsy

$$PI\ for\ Active\ Surveillance = \frac{304}{1755} x100 = 17.32\%$$

Acceptable limits 10–20%

3.2.1.2. District oriented surveys

If the second approach is used, then Table IV can be organized from reports sent in from the DVO, and the matter of *timeliness* of the reports will have to be taken into consideration in arriving at the PIs.

3.2.2. Performance indicators for the active reporting of stomatitis–enteritis cases

Disease conditions characterized by stomatitis and enteritis are present in all GREP countries, albeit at varying levels of prevalence. Countries that are able to detect such diseases that have clinical signs similar to rinderpest would be very likely to detect rinderpest in their national herds, whether in a hidden foci or re-introduced from outside.

The following are some of the common cattle diseases seen in Africa that can produce clinical signs of stomatitis enteritis complex (stomatitis, (erosions/lesions in the buccal mucosa), enteritis (diarrhoea), ocular and nasal discharges, and fever): paratuberculosi, (Johne's disease), campylobacter (vibrio), bovine virus diarrhoea – mucosal disease (BVD–MD), papular stomatitis, malignant catarrhal fever (MCF), salmonellas, infectious bovine rhinotracheitis (IBR), gastrointestinal protozoa (giardia, coccidia, amoebae) foot-and-mouth disease (FMD), pasteurella pneumonia (shipping fever), and parasitic gastro–enteritis.

These disease conditions may not always produce all the clinical signs of rinderpest, but they all produce one or more of the signs. Field staff should not aim at making definitive diagnosis, but should report all clinical cases suggestive of rinderpest, and allow experienced epidemiologist/clinicians to deliberate on the detailed report and make decisions on what merits further investigation. This approach is particularly important in the face of the appearance of new lineages of rinderpest virus, which often present with mild clinical signs that vary quite significantly from the established norms.

Disease reporting procedures will naturally vary from country to country, but the field officer must endeavour to inform the CVO, as a matter of priority, as soon as he or she encounters a new case or disease incidence (outbreak) suspected to be rinderpest. It is also very important that the nearest veterinary officer (usually the district veterinary officer) who can initiate investigations) is informed so that an investigation can be launched with the least delay. In practice it may be most effective to report suspected disease incidences to the nearest DVO, and send a copy to the CVO.

The PI measures the number of reports of outbreaks of stomatitis-enteritis conditions received at headquarters per year per unit of animal population (usually per 100,000 cattle).

Reports of stomatitis-enteritis cases can come to headquarters from one of the following sources:

- Regular (monthly) disease reports;
- Disease outbreak reports from farmers, herd-owners, and middle-men, which may be reported directly to headquarters staff, or through the district veterinary office, or village head/community health worker. If reported through the latter, these may be included in the monthly reports;
- Cases found during organized active disease surveys.

In calculating the PI, it should be remembered that outbreaks involve herds, and may include one or more cases. A report of three cases in one herd or two cases each in two herds in physical contact, constitute one report. If, however, the same outbreak is reported twice by two independent sources (e.g. the DVO and a herdsman), these should be counted as two reports. Here the emphasis is on the efficiency of reporting.

The calculation can be set out as follows:

$$\frac{No.\ of\ reports\ of\ outbreaks\ of\ SE\ received\ (from\ all\ sources)\ within\ 30\ days}{Total\ number\ of\ cattle\ in\ the\ country\ /\ 100{,}000}$$

The acceptable PI will vary from country to country, and will depend on the baseline data on the normal occurrence of SE complex diseases in each country. This data must be determined for each country based on the routine occurrence of the SE complex diseases in the past (as reflected in the general disease reporting system). Where this information is not readily available, it is not unreasonable to assume a surveillance sensitivity of 0.5 to 1 (one) outbreak of stomatitis–enteritis per 100,000 cattle per year.

At such levels, a country that has 8,000,000 cattle should be seeing about 40 to 80 cases of SE per year. The target for such hypothetical country would now be set at 40–80 SE complex cases per year.

$$0.5\,or\,1\times\frac{8{,}000{,}000}{100{,}000}=40\,to\,80\,cases\,of\,SE\,per\,year$$

3.2.3. Calculations of the PI (active reporting of SE) for Butomi: (an example)

Number of SE outbreaks reported from active surveillance (Table V) = 25

Outbreaks reported by herdsmen, farmers, district veterinarians (headquarters records) = 8

Total SE outbreaks (25 + 8) = 33

Cattle population of Butomi 3,100,000

$$PI\,(Active\,disease\,reporting)=\frac{33}{3{,}100{,}000}\times 100{,}000=1.06$$

Approximately 11 cases per million cattle (or 1 case per 100,000)

3.2.3.1. Timeliness

The second measure of performance for the PI (Active disease reporting) is the interval between the detection of the outbreak and the arrival of the report at headquarters. It is expected that as in the PI for general (passive) disease surveillance, at least 80% of the outbreaks identified should be reported to headquarters within 30 days of the detection. In consideration of what is at stake, however, it is essential therefore that outbreaks in which signs of stomatitis and enteritis occur be reported immediately to the headquarters and investigation initiated within three days. As stated above, rapid identification and containment action is absolutely necessary to abort potential epidemics.

Most countries probably already have statutory forms for reporting disease outbreaks; a disease reporting form is also included in this manuscript (Annex IV). It is also important to send in a report to headquarters even when no stomatitis–enteritis outbreak has been encountered in the district, so as to distinguish between zero report and no report.

3.3. PERFORMANCE INDICATORS FOR STOMATITIS–ENTERITIS OUTBREAK INVESTIGATION

The basic goal of rinderpest surveillance is to detect the majority (at least 80%) of all new outbreaks within 2 weeks (14 days) of the appearance of the index case, and to take emergency containment action within 2 weeks to halt the spread of the outbreak. The effectiveness of the outbreak investigation will determine the success of the containment action. The Smallpox eradication campaign illustrated the value of diligent verification of all observations and rumours in formulating containment strategies. Outbreak investigations are perhaps the most critical element in the surveillance and containment approach to the eradication of infectious diseases. Even when the outbreak is not rinderpest, full

characterization through outbreak investigation is required to confirm that rinderpest is truly eradicated.

The steps in outbreak investigations and handling of rinderpest emergency planning have been outlined earlier [4]. Investigations involve both field epidemiological work and laboratory assessment of samples. Performance can therefore be assessed by

- Proportion of reports fully investigated (by epidemiological, clinical and laboratory methods) within a given time frame;
- Proportion of reports for which a definitive diagnosis has been achieved;
- Interval between notification of suspected outbreak and initiation of investigation.

The PI for the field investigation component is the proportion of stomatitis–enteritis outbreaks investigated within 7 days of receiving the report by a veterinarian or competent field investigator.

The target for this PI should be 80% to 100%.
Ideally, 80% of the reports should be investigated within 48 hours of receiving the report, and 100% should be investigated within 7 days.

For all investigated outbreaks, investigation forms with epidemiological, clinical and laboratory information should be completed within 28 days of the initial report.

Field investigation should include clinical examination as well as collection of samples and specimen for laboratory diagnosis (See Chapter 1).

The actual investigation of an outbreak may occur in phases, depending on the route of the initial report. If the report is presented to the DVO, he or she should immediately (a) dispatch an outbreak report to headquarters (even if the field veterinarian had also copied the report to the CVO) and (b) launch an investigation and collect the appropriate samples for laboratory confirmation. Depending on the level of suspicion and perhaps the quality of staff available at the district, headquarters may decide to send an expert team led by a capable epidemiologist and a clinician, or may wait for the preliminary investigation report from the DVO before making a decision on sending another team.

If the outbreak report is made to the headquarters directly, a team should be dispatched immediately to join the DVO in the investigation. It is important, however, that the investigation should be initiated within 7 days of the report, considering that the diagnostic window for rinderpest is rather narrow (Fig. 2).

3.3.1. Calculation

Using the example of Butomi (Table V)
Number of SE outbreak reports (from active surveys and other reports – see 3.2.3.) = 33
Number of outbreaks fully investigated with proper samples within 7 days = 28

$$PI\ for\ SE\ outbreak\ investigation = \frac{28}{33} \times 100 = 84.4\%$$

3.4. PERFORMANCE INDICATORS FOR LABORATORY INVESTIGATIONS

National laboratories are expected to test the samples received from field investigation of suspect outbreaks, and provide a preliminary result within 3 days of the receipt of the samples. The proper samples must be collected and submitted to the laboratory in good condition, and the laboratory should have the full complement of tests, reagents and trained persons. National laboratories should have available one or more of the antigen detection tests which are used currently for rapid confirmation of rinderpest. The agar gel diffusion (AGID) test is simple, quite specific, but generally not sufficiently sensitive to detect low levels of antigen which may be present in nasal or ocular swabs, and therefore should be backed up with either immuno-capture ELISA (ICE) or PCR techniques.

Where the initial laboratory assessment does not confirm rinderpest, further tests should be done using other diagnostic tests to confirm or rule out rinderpest, and samples should be sent to the regional or world reference laboratories. It is obviously important to determine the definitive diagnosis even when initial tests rule out rinderpest so as to confirm beyond doubt that the outbreak is not rinderpest. In some instances where infection is with the new lineages of rinderpest virus, it has been observed that repeated testing may be necessary for confirmation.

The PI for laboratory investigation measures the number of cases examined by adequate laboratory methods, with a preliminary result reported in 3 days of the receipt of the samples, per 100,000 cattle.

3.4.1. Calculations

As in the previous calculations, the summary table can be set up to simplify collation of data and calculation of PI, as shown in Table VI.

TABLE VI. SUMMARY TABLE FOR KEEPING TRACK OF SAMPLES SUBMITTED TO THE LABORATORY

Sample No [1]	**Lab No**	**Date Collected**	**Date received**	**Rinderpest Diagnostic Tests**	**Other Tests**	**Lab Diagnosis**	**Pi (Elisa)**	**Date rept. sent**	**Date sent to Ref. Lab**	**Comments**
NW02	0254	22/2/98	25/2/98	AGID, ICE, cELISA	BVD, IBR, FMD PPR	FMD		1/3/98	25/3/98	confirmed FMD
K231	0255	27/2/98	28/2/98	AGID, ICE, cELISA	IBR, FMD PPR	None		10/3/98	25/3/98	Awaiting
L 149	0256	5/5/98	12/5/98	ICE	nil	None		14/5/99		Putrid
J876	0257	6/5/98	6/5/98	AGID, ICE, cELISA	IBR, FMD PPR BVD	IBR		12/5/98	25/5/98	confirmed IBR
J 885	0258	6/5/98	6/5/98	AGID, ICE, cELISA	BVD, IBR, FMD PPR	IBR		12/5/98	25/5/98	Confirmed
Y231	0259	4/8/98	7/8/98	AGID, ICE, cELISA	BVD, IBR, FMD PPR	FMD		20/8/98	25/9/98	Awaiting
Y244	0260	5/8/98	7/8/98	AGID, ICE, cELISA	BVD, IBR, FMD, PPR	FMD		20/8/98	25/9/98	Awaiting result

Note:
[1]Sample No = Number assigned by the field officer. Assumes other epidemiological information (Location of outbreak, # of animals, Species, Age, sex, and type of samples can be linked to the field number)

Set-up for calculating PI

From Table V: Number of samples submitted to the laboratory = x
From Table VI: Number of samples received at the laboratory in good condition = y
From Table VI: Number of samples examined by rinderpest diagnostic tests with results reported within 3 days = z
From records at headquarters: Cattle population of the country (Butomi) = 3,100,000.00

$$PI\ for\ laboratory\ confirmation = \frac{z}{3{,}100{,}000} \times 100{,}000 = k\ (per\ 100{,}000\ cattle)$$

If the value of x is much higher than y, the CVO has to determine why many of the samples are either not arriving at the laboratory, or arriving in poor condition (see diagnostic indicators Chapter 4)

3.5. PERFORMANCE INDICATORS FOR DEFINITIVE DIAGNOSIS

It is essential to obtain a definitive diagnosis for all suspected outbreaks as quickly as possible after the recognition, so as to avoid awkward rumours and suspicion that could damage the credibility of the veterinary services. Chief Veterinary Officers should appreciate that confirming a case as rinderpest does not portray their country in a negative light, but could attract outside assistance for rapid control of the outbreak.

Most countries now have the capability to identify rinderpest antigen using the agar gel diffusion (AGID) test, the immuno-capture ELISA (ICE), or a nucleic acid hybridization technique. There are regional reference laboratories in Cote d'Ivoire (Bingerville) and Kenya (Muguga) and an international reference laboratory in the United Kingdom (Animal Diseases Lab, Pirbright) for further differential diagnostic work that cannot be done at national laboratories.

Performance of national laboratories can be evaluated on the basis of the following criteria:

- Condition of the specimen on receipt. It is expected that 100% of the specimen should be in good condition when received at the laboratory. Poor specimen give equivocal results, which may be misleading. It is necessary that the laboratory work closely with the epidemiological teams in field investigation, in such areas as provision of sample containers and specimen bottles, as well as receiving samples from the field. Laboratory staff should be available to receive and process samples, even if these samples are delivered on the weekends.
- Interval between receipt of the samples (specimen) and the laboratory results. It is expected that preliminary results should be ready in 3–7 days, and a good laboratory should have the full report on the desk of the CVO within 30 days. More importantly, the laboratory personnel should notify the CVO (or the representative epidemiologist) ***IMMEDIATELY*** when a specimen from a suspected outbreak of rinderpest is received from a field or private veterinarian.
- Differential diagnosis (including reports from reference laboratories) should be ready within 3 months of receipt of the specimen from the field.

The PI for laboratory diagnosis is determined as the number of stomatitis–enteritis cases diagnosed definitively by laboratory methods at national and/or reference laboratories within 60 days of receipt of samples per 100,000 heads of susceptible species.

This PI can be determined directly from the summary form Table VI

3.6. PERFORMANCE INDICATORS FOR SERO-SURVEILLANCE

Absence of rinderpest antibodies in animals born since cessation of vaccination confirms that vaccination has indeed stopped, and perhaps more importantly, that rinderpest virus is not circulating in the national herd. Well-organized serological surveillance is required to establish the evidence.

The PI for sero-surveillance measures the number of serum samples collected (from herds selected in a statistically random manner) tested, and reported within 120 days of collection. The timeliness of testing and reporting is particularly vital because sero-surveillance is expected to provide early warning of new introduction of the disease, which should trigger rapid containment activity to stop the spread. Thus any suspicious cases should be identified early and investigated rapidly. Serological reports produced six months after the samples were collected are not as useful to the disease surveillance system.

In practice it may be more cost-effective to combine sero-surveillance with the active disease survey since they both require random selection of herds across the country. The same team can collect serum samples from the herds (or villages) they are observing for signs of clinical disease. Collection of 15 to 20 serum samples from each of 300 herds will meet the 4500 samples specified by the PI.

PI for serological surveillance = number of serum samples collected, tested and for which results are reported within 120 days of collection.

The target is 4500 serum samples per year (i.e. 15 animals sampled from each of 300 randomly selected units). The PI does not measure the randomness of the sample, however randomness is addressed in one of the DIs.

If the serological surveillance is sustained (at least annually) for several years, and the samples are collected in a statistically valid manner (using some form of random selection), and all the samples are free of rinderpest antibodies, the CVO can be fairly certain that the virus no longer exists in his country, in accordance with the OIE Pathway. (Or more accurately, that the probability of the virus existing in the country is negligible.)

Subsequent serological surveys become very powerful tools for detecting new appearances of virus infection (and disease). Statistically selected herds (or other sampling units) will be augmented with purposive sampling of high-risk herds (e.g. those in border areas, cattle markets, or near cattle trade routes) to provide a robust early warning system, particularly for new lineages of rinderpest virus that may not show the full range of overt clinical manifestations.

The PI does not evaluate the appropriateness of population definition. The 4500 sera specified is the number of samples required to detect rinderpest in an infinite (> 100,000 animals) population at 1% prevalence with 95% confidence.

4. DIAGNOSTIC INDICATORS

Low scores in the PI indicate problems in the set-up or execution of disease surveillance. The problems should be identified and resolved as quickly as possible to restore confidence in the surveillance information. Diagnostic indicators (DIs) are provided as guideposts for the review of potential shortcomings and problems in the system, and will generally also indicate workable remedies. This section will highlight the most important DIs that can be used to evaluate the various PIs outlined in the previous chapters. It should be pointed out that the list of DIs presented in this chapter is not exhaustive, and careful study of the problem in each environment may well reveal additional or different DIs.

4.1. PI 1 GENERAL DISEASE SURVEILLANCE

Number of districts forwarding general disease reporting formats within 30 days of the end of the month at least 10 months of the year per total number of districts.

Diagnostic indicators

1.1. Proportion (%) of districts that have functional veterinary infrastructure (in terms of veterinary clinic(s) or other veterinary presence) and resources for conducting veterinary practice in the region under its jurisdiction.

1.2. Proportion (%) of districts that have a qualified veterinary professional or a trained disease reporting agent.

1.3. Proportion (%) of districts that have been supplied with reporting formats during the previous two years.

1.4. Proportion (%) of districts that have filed at least one correctly completed disease reporting format during the year.

1.5. Proportion (%) of districts that have filed incorrectly completed disease-reporting formats during the year.

1.6. Proportion (%) of districts that have filed general disease occurrence reports using non-standard formats or through non-standard channels.

1.7. Number of national summary reports, newsletters or bulletins on animal disease statistics prepared and distributed to decision -makers, surveillance system participants, and the OIE within 60 days of the completion of the reporting period.

DIs 1 to 3 are directed at the availability of the basic infrastructure inputs necessary for a functional general (passive) reporting system. DIs 4 to 6 are concerned with the level of knowledge concerning disease reporting in the various districts. DI 7 is about the outputs (in terms of reports) from the national veterinary services. Regular newsletters are an excellent (and necessary) feedback mechanism to encourage the district officers to continue to send in reports.

The quality of the report, that is, the validity of the contents, is more difficult to evaluate, and must be assessed in conjunction with reports from contiguous districts, diagnostic laboratories, and active survey results.

4.2. PI 2 ACTIVE DISEASE SURVEILLANCE

Number of districts surveyed using active disease search techniques (participatory, questionnaire-based and clinical) with results reported within 90 days per total number of districts

Diagnostic indicators

2.1. Fully developed and documented national active disease search procedure/ methodology.

2.2. Number of staff trained over the last three years to carry out active disease surveys.

2.3. Number of survey/interview formats or checklists prepared and distributed to trained staff over the last two years.

2.4. Number of surveys analysed and reported this year per number of surveys undertaken.

2.5. Number of completed surveys judged to be reliably collected and analysed per number of surveys undertaken.

2.6. Number of summary or national reports providing an overview of data and information obtained by active disease search programmes during the year.

The first three DIs determine if specialized prerequisite resources are available. The third DI specifically deals with the recording system. In the case of participatory epidemiology, prepared questions and lists may be used for the interviews and to facilitate the recording of results.

DIs 2.4 and 2.5 identify weaknesses in the sub-component activity chain from data collection to analyses and reporting. These DIs are not time-dependent. High values for these DIs in the face of a low PI suggest that low performance is due to a lack of timeliness.

DI 2.5 also measures the quality of data and analyses. If surveys are not of serviceable quality, the entire investment is lost and decision-makers lose confidence in their ability to understand the ongoing situation. Appointment of dedicated, well trained staff particularly with regard to participatory interview techniques will have considerable impact on the quality of data.

DI 2.6 is a measure of the effectiveness of data utilization. The information resulting from the system must be made available to decision makers to actualize its value. Further, feedback to participants will improve motivation.

4.3. PI 3 STOMATITIS-ENTERITIS DISEASE REPORTING

Number of reports of stomatitis-enteritis received at headquarters per month per 100,000 heads of susceptible species.

Diagnostic indicators

3.1. Number of reports of stomatitis-enteritis diseases received during the year from all channels per 100,000 heads of susceptible species (ASER).

3.2. Number of reports forwarded (from district or regional veterinary offices) within 30 days to the national co-ordination office per total number of reporting formats received. (i.e. the proportion of reports obtained through the veterinary services).

3.3. Number of SE outbreaks reported to the national co-ordination office using routine (general disease surveillance) reporting formats through the normal reporting channels, per total number of reports received through all channels during the year. (similar to 3.2 above but is not time dependent; similar to 3.1 but refers to reports from the veterinary services only).

3.4. Proportion (%) of districts forwarding reporting formats (zero or outbreak reports) at least 10 months out of the year. (This is analogous to PI 1, i.e. the PI for the general diseases reporting).

3.5. Number of man-days dedicated to active field search and farmer contact specifically related to stomatitis-enteritis surveillance during the year per 100,000 heads of susceptible species. (Covered by the active surveillance indicators).

DI 3.1 measures all reports received regardless of the timeliness of reporting and the reporting channel. In order to be measurable, the report must be in some way recorded, noted or at least communicated (even if verbally) to the central epidemiology unit. If this DI is low, it strongly suggests that either surveillance is inactive or that surveillance personnel are failing to interact effectively with livestock owners.

DI 3.2 measures only the timeliness of the forwarding of reports to the central epidemiology unit.

DI 3.3 measures the extent of the use of the active disease-reporting channel regardless of timeliness. Reports may be coming to the attention of the co-ordination office by channels other than the active disease reporting system. That may be by telephoning, verbally, the general disease reporting system, etc. DI 3.3 is meant to measure the effective utilization of the formal SE reporting channel as opposed to more ad hoc methods of reporting SE outbreaks. It is important to note that field offices are encouraged to make telephone reports of SE outbreaks, however, telephone reports should always be followed up by systematic paper reporting.

DI 3.4 determines the proportion (%) of districts reporting regularly.

DI 3.5 is an important indicator that measures a prerequisite for effective active surveillance, adequate manpower input. Active surveillance must be one of the activities recognized in staff job descriptions and time budgets.

Calculations

In order to calculate the active disease reporting DIs 3.1, 3.3 and 3.4, it is suggested that reports are sorted and counted by five categories.

A Number of outbreak report forms received within 30 days
B Number of outbreak report forms received within 30 days
C Number of outbreak report forms received after 30 days

D Number of zero report forms received after 30 days

E Number of outbreak reports received by other channels within 30 days

F Number of outbreak reports received by other channels after 30 days

The formula for the PI would then be

$$\frac{A + E}{\textit{Total susceptible population} / 100{,}000}$$

Similarly, the formulas for the DIs would be

DI 3.1	DI 3.2	DI 3.3
$\frac{A + C + E + F}{TSP / 100{,}000}$	$\frac{A + B}{A + B + C + D}$	$\frac{A + C}{A + C + E + F}$

Where A, B, C, D, E & F equals the totals in category A, B, C, D, E & F, respectively, and TSP equals the total susceptible population.

Please note that the value of DI 3.1 equals the annual rate of SE reports received by the passive and active disease reporting system. Also note that ad hoc reports, category E & F, are counted in this calculation. This information should be entered on the first page of the Annual Rinderpest Surveillance Performance Report, pg. 2, item 3.d. (ASER – active stomatitis enteritis reports (see also active stomatitis enteritis outbreaks, ASEO)).

4.4. PI 4 STOMATITIS-ENTERITIS INVESTIGATION

The proportion of stomatitis-enteritis outbreaks investigated within 7 days (of receiving the report) by a competent veterinarian or trained field investigator.

Diagnostic indicators

4.1. Number of reports investigated by an expert team per 100,000 heads of susceptible species.

4.2. Average number of days between receipt of report and outbreak investigation for all outbreak investigations undertaken during the current year.

4.3. Proportion (%) of provinces/regions/states in which investigations have been undertaken.

4.4. Proportion of SE outbreaks reports that have been subsequently confirmed by expert investigation.

4.5. Proportion (%) of investigations leading to the detection and clinical diagnosis of cases meeting the stomatitis-enteritis case definition during the year.

4.6. Number of active stomatitis-enteritis cases (ASEC) discovered annually per 100,000 heads of susceptible species.

4.7. Proportion (%) of districts/offices with sampling materials.

4.8. Proportion (%) of districts/offices with staff trained in appropriate sample collection techniques.

4.9. Proportion (%) of cases sampled at the time of detection (initial investigation) (per total number of cases detected).

4.10. Average number of days between detection of cases and case sampling for all cases sampled during the year.

4.11. Proportion (%) of cases never sampled per total number of cases detected.

DI 4.2 assesses the timeliness of investigation. Timeliness in clinical case investigation is essential as clinical symptoms in individual cases normally have a duration of up to 7 days. An investigation taking place on the sixth to seventh day post-report will probably have to rely on secondary cases to make a clinical diagnosis.

DI 4.3 determines if surveillance is being conducted throughout the country. It may be the case that not all districts have stomatitis-enteritis outbreaks to investigate in a particular year. However, it is a reasonable assumption that all or almost all provinces are experiencing outbreaks of stomatitis-enteritis in a given year.

DIs 4.4 and 4.5 relate to the quality of investigations. Indicator 4.4 is intended to measure the accuracy with which the SE clinical outbreak definition is being applied by field staff. In order to calculate this indicator, outbreak reports will have to be reviewed annually. Based on the symptoms reported in the stomatitis-enteritis outbreak reporting format, the reviewer will need to determine whether or not the investigating agent correctly diagnosed the disease event. DI 4.5 asks the question: What proportion (%) of the investigations are finding representative cases?

DI 4.6 represents ASEC, a very important statistic that must be calculated as part of the annual reporting requirements (see Annex II, annual rinderpest surveillance performance reporting format). It is the annual clinical case rate for detected stomatitis-enteritis cases by active disease surveillance (ASEC) and is one of the standards for PI 6. Note that ASEC only includes cases formally documented in the active reporting system. The ASEO allows inclusion of outbreaks not formally reported. The ASEC does not incorporate ad hoc case reports because it is assumed that all cases should be incorporated in the formal reporting system by the time of completion of the investigation.

DIs 4.7 and 4.8 determine if the prerequisite equipment and trained staff are available.

DIs 4.9 and 4.10 measure the timeliness of sample collection. Timeliness in sample collection is essential if samples are to be diagnostic.

The quality of sampling will be analysed as part of the rinderpest diagnostic testing PI (PI 5) as this information is more easily obtained from the sample submission forms and the state of the samples when they arrive at the laboratory.

Tips for calculation

As with the active disease reporting indicator, the most efficient way to calculate the Outbreak Investigation PI and DI is to sort and count the reports by category. This can be done manually or electronically.

For calculation of the PI, reports of cases that were investigated and appropriately sampled (by the local office) within seven days of the date the report was received should be selected and counted. 'Appropriately sampled' means that the correct diagnostic samples were collected. Thus, all investigations counted under this PI should have been investigated within seven days and

- were clinically SE negative or
- were clinically SE positive and correctly sampled.

For DI 4.1, all reports that were investigated regardless of timeliness should be selected and counted. For DI 4.3, the reports need to be sorted by province, region or state.

For DI 4.4, each reporting format and the associated narrative report will have to be reviewed and sorted as correctly diagnosed or incorrectly diagnosed.

For DIs 4.5, 4.6, 4.9, 4.10 and 4.11 the reports would need to be sorted into two groups based on the diagnosis of the original investigator: those investigations that detected clinical cases and those that did not. Subsequently, only those investigations that found SE cases will be analysed.

The value returned by DI 4.6 is the ASEC and equals the total number of SE cases detected by the active disease reporting system. This value should be entered on the first page of the annual rinderpest surveillance performance report, pg. 2, and item 3.e (see Annex II).

The formats should then be sorted and the cases sampled counted by three categories:

A	B	C
Cases sampled on the same date as the clinical investigation	Cases sampled after the initial clinical investigation	Cases never sampled

The formula for DI 4.9 would be

DI 4.9	DI 4.11
$\frac{A}{A + B + C}$	$\frac{C}{A + B + C}$

Where A, B and C equals the total cases in category A, B and C, respectively.

4.5. PI 5 PRELIMINARY RINDERPEST DIAGNOSTIC TESTING

Number of cases examined by rinderpest antigen or RNA detection techniques, or by serological, immunological or histopathological methods, with preliminary results reported within 3 days of receipt of samples per 100,000 heads of susceptible species.

Diagnostic indicators

5.1. List of diagnostic techniques available and fully operational.

5.2. Number of sample-sets received for stomatitis-enteritis investigation annually per 100,000 heads of susceptible species.

5.3. Proportion (%) of case sample-sets received in reliable condition (adequate cold chain, good labelling, etc.).

5.4. Proportion (%) of case sample-sets received that include appropriate samples (i.e. correct sample-type collected at the appropriate time).

5.5. Average number of days elapsed between the receipt of samples and the reporting of results.

5.6. Proportion (%) of case sample-sets for which results are not obtained or reported.

DI 5.1 establishes the techniques that are available for rinderpest diagnosis in the country.

DI 5.2 establishes whether samples are reaching the laboratory.

DI 5.3 determines if the samples reaching the laboratory are in good enough condition to be reliably tested. Samples in poor condition should still be tested, however, negative results will not be meaningful.

DI 5.4 goes further and asks if the samples are likely to be diagnostic should rinderpest be the cause of the outbreak. In other words: Were these the samples of the right type and taken at the appropriate time?

DI 5.5 evaluates if the time factor could be the cause of under-performance by measuring the average number of days until reporting.

DI 5.6 determines the rate of failure to complete rinderpest laboratory examinations. It is very important that complete failures to test and report are kept to a minimum and carefully scrutinized to prevent reoccurrence.

4.6. PI 6 STOMATITIS-ENTERITIS DEFINITIVE DIAGNOSIS

Number of stomatitis-enteritis cases diagnosed definitively by laboratory methods at national and/or reference laboratories within 60 days of receipt of samples per 100,000 heads of susceptible species.

Diagnostic indicators

6.1. List of RP and differential diagnostic techniques available nationally, regionally, and at the world reference laboratory.

6.2. Number of sample sets received for stomatitis-enteritis investigation per 100,000 heads of susceptible species during the year.

6.3. Average number of days between receipt of samples and definitive diagnosis for all sample sets received.

6.4. Number of SE cases definitively diagnosed as rinderpest.

6.5. Number of SE cases definitively diagnosed as not due to rinderpest by identification of another causal agent (BVD, IBR, MCF, ECF, FMD, etc.).

6.6. Number of SE cases definitively diagnosed as not due to rinderpest by secondary serological investigation.

6.7. Number of rinderpest compatible cases that remained undiagnosed at year-end.

6.8. Number of rinderpest compatible cases that were forwarded to reference laboratories for further investigation.

The first DI lists the differential diagnostic assays, which can be run at the national laboratory.

DI 6.2 establishes the number of samples that the laboratory receives and DI 6.3 evaluates the average elapsed time between sample receipt and diagnosis.

DIs 6.4 to 6.7 measure the relative frequency of different diagnostic outcomes using the criteria of the SE outbreak classification scheme. The value of DI 6.4 corresponds to the confirmed rinderpest category. The sum of DIs 6.5 and 6.6 corresponds to the discard category. indicator 6.7 gives the number of undiagnosed rinderpest compatible events. This DI is the red flag category. All case-sets identified under DI 6.7 should be reviewed frequently (at least quarterly) at the laboratory, and annually at headquarter's epidemiology unit.

DI 6.8 measures the relative use of international reference laboratories. The reference laboratories are a resource for strengthening rinderpest surveillance that Member States should exploit, especially Member States that have a large proportion of undiagnosed rinderpest compatible outbreaks.

4.7. PI 7 SERO-SURVEILLANCE

Number of serum samples collected and tested with results reported within 120 days of collection per number of populations identified.

Diagnostic indicators

7.1. Proportion of herds/sample units from which 4500 samples were collected (i.e. out of the total number of herds/units identified in the country).

7.2. Proportion of cattle in the country bled for serum collection.

7.3. Total number of serum samples forwarded with supporting data to the sero-surveillance laboratory within 45 days of collection.

7.4. Total number of serum samples received by the laboratory in reliable condition.

7.5. Quantity of reagents available expressed in number of sera that could be tested.

7.6. Total number of serum samples tested within 45 days of receipt by the laboratory

7.7. Total number of serum samples tested with results reported within 75 days of receipt by the laboratory.

7.8. Proportion (%) of sampling sites successfully sampled per total number of sites defined in the annual random sampling plan.

DI 7.1 determines the proportion (%) of sampling units that were reliably sampled without regard to timeliness. The second DI determines the average number of samples collected per populations regardless of timeliness.

DI 7.3 measures the timeliness of sample collection and submission. DI 7.4 measures the quality of samples collected and submitted.

DI 7.5 checks if sufficient reagents were available to complete the sero-surveillance plan. Lack of reagents has been a major constraint in the past due to funding and procurement problems.

DI 7.6 evaluates the timeliness of sample testing and DI 7.7 looks at the timeliness in both testing and reporting.

DI 7.8 is a gauge of how closely the sample sets conform to the random sampling plan. It is a measure of the randomness of the sample and the reliability of the prevalence rates found by the sero-surveys.

4.8. PI 8 WILDLIFE SURVEILLANCE

Number of serum samples collected and tested with results reported within 90 days of collection per 1000 head of highly or moderately susceptible species.

Diagnostic indicators

8.1. Number of staff trained and equipped to immobilize wildlife for the purpose of sample collection per thousand heads of highly or moderately susceptible species

8.2. Amount of funding available for wildlife surveillance per thousand heads of highly or moderately susceptible species.

8.3. Number of serum samples collected per thousand heads of highly or moderately susceptible species.

8.4. Number of serum samples tested per thousand heads of highly or moderately susceptible species.

8.5. Number of serum samples for which results were reported per thousand heads of highly or moderately susceptible species.

5. CHECKLISTS

Checklists identify basic infrastructure needs for successful surveillance, and will range from training of personnel to equipment and consumables for fieldwork, depending on the components of surveillance. Checklists assist in planning as well as in troubleshooting various aspects of surveillance when performance needs to be improved. In this chapter we have outlined checklist items for various components of surveillance.

5.1. CHECKLISTS FOR GENERAL (PASSIVE) SURVEILLANCE

Passive surveillance requires an efficient national communications network that will ensure that disease episodes are reported quickly to the headquarters, and communicated to field workers all over the country. Most African countries need to invest in communications equipment and training to revamp their disease reporting networks.

At the national level, it would be useful to hold a workshop for field veterinarians during which the national strategy is discussed, the reporting forms are explained (and distributed), the mode of collecting information and submitting forms are outlined. Field workers will also have the opportunity to present their views and problems.

At the level of the field officer, some of the basic inputs necessary for successful disease reporting include the following.

- Disease report forms
- Transport facilities to facilitate visits to herds and farms
- Specimen containers and sample collection/ preservation facilities (including cold boxes)
- Some means for rapid communication with the national epidemiologist (radio-telephone, fax, e-mail, or courier messenger)
- Funds for rewarding herdsmen/farmers/veterinary assistants who report verifiable cases in the stomatitis / enteritis disease complex.

At the headquarters (epidemiology unit) there should be

- (Trained) Epidemiologists
- Computer facility to collate and analyse data, and for publication/distribution of the resulting information. This includes hardware and appropriate software.

If all the necessary inputs are present, and the level of reporting from the units is still low, the diagnostic indicators should be used as a guide to further evaluation.

5.2. CHECKLISTS FOR ACTIVE DISEASE SURVEILLANCE

1. A well developed (and documented) active disease survey procedure or methodology, so that disease surveys are not haphazard affairs.
2. A number of staff trained and deployed into teams for the surveys. These persons should be very familiar with the national survey protocols, and understand the fundamental issues involved in the surveillance programme. It needs to be re-emphasized that such teams should consist of the best people available. As suggested earlier, one approach is to set up a few core teams at headquarters, and recruit district veterinary officers who have had outstanding records of passive reporting into the core teams.
3. Equipment and (consumable) materials required for the surveys. These may vary from simple interview and recording forms to sampling materials (for blood and tissue samples), cold chain, transport (vehicles and fuel), and medication and other incentives for the livestock owners.
4. Facilities for the analysis of the specimen obtained during the survey and the processing of resulting information. These include the laboratories, the laboratory procedures, and the reagents required to analyse the sample; the facilities (computers, software and trained persons) for collating, analysing, reporting and distributing the information obtained, including feedback to the field veterinarians and herd-owners in the survey areas.

5.3. CHECKLIST FOR LABORATORY DIAGNOSES

- Access to basic equipment and facilities, such as good water supply, stable electricity supply, assay equipment (ELISA readers, pipettes, tips, incubators, refrigerators, etc.).
- Trained staff must be available to run the laboratory tests, as well as for other maintenance and technical support.
- The reagents for rinderpest diagnosis (ELISA, AGID) and for the differential diagnosis must be available.
- Well established channels for co-operation between the laboratory and the epidemiology unit to facilitate handling, testing and reporting of the results.

5.4. CHECKLIST FOR SEROLOGICAL SURVEILLANCE

- Surveys for serosurveillance should start two years after cessation of vaccination.
- Two-year-old animals should be bled for serological surveillance to establish absence of infection – because they would have lost maternally derived antibodies, and also it is easier to identify their age.
- Serum samples collected for seromonitoring should not be used for serosurveillance - primarily because the two surveys have different objectives, and attempts to mix them up could result in confusion.
- Purposive sampling of high risk herds are also useful in serosurveillance, and should be encouraged in addition to the statistically selected sample units.

DEFINITION OF TERMS

Selected terms are defined in relation to rinderpest epidemiology as used in this document. For the most part, these terms are adapted to rinderpest epidemiology from the WHO documents on performance indicators for polio eradication and the Centre for Disease Control (CDC) Manual for the Surveillance of Vaccine Preventable Disease, the CDC Case Definition for Infectious Conditions Under Public Health Surveillance (MMWR 1990; 39 (No.RR–13)).

3Ds or three Ds	The 3Ds refer to discharge, diarrhoea and death. This was a simplified case definition for stomatitis–enteritis. The detailed SE outbreak efinition presented in this report replaces the 3Ds for systematic epidemio-surveillance purposes.
ASEC	Active stomatitis–enteritis cases. The number of SE cases detected annually by the active disease surveillance per 100,000 heads of susceptible species is termed the ASEC, and is used as a standard for some indicators.
Case	A case is regarded as the occurrence of disease in a single animal. An outbreak may consist of several cases epidemiologically linked together.
Checklists	Checklists contain an inventory of basic material or/and infrastructure prerequisites needed to get the system to function properly. These may be as simple as marking pens or as complex as training programmes.
Confirmed case or outbreak	Any case or outbreak that has been confirmed by recognized laboratory methods, or is epidemiologically linked to a confirmed outbreak.
Diagnostic indicators (DI)	DI measure the effectiveness of components of the system, and play a role in identifying constraints or inefficiencies that contribute to poor performance
Epidemiologically characteristic	Disease episodes (not yet confirmed) behaving in a population in a manner compatible with the classic patterns of the known lineages of rinderpest.
Epidemiologically linked	Cases or disease episodes that are spatially and temporally related. In the case of rinderpest, an outbreak of stomatitis–enteritis occurring within 90 days of another confirmed outbreak in animals sharing the same watering or grazing resources, should be considered as epidemiologically linked, and regarded as confirmed.
Outbreak	An Outbreak (or disease occurrence or disease incident) is defined as a discrete occurrence of a disease episode independent of other episodes. An outbreak may involve one or more cases. (An outbreak does not imply an epidemic or major eruption of disease).
Performance indicators (PI)	PI are quantifiable measures of system output and sensitivity, They are usually statistics designed as indicators of task achievement, and provide simple tools to assess the progress made towards implementation of stated goals.

Probable case or outbreak	Any outbreak (episode of disease) that meets the stomatitis–enteritis outbreak definition and is epidemiologically characteristic of rinderpest is a probable outbreak. Cases making up a probable outbreak are considered probable cases.
Rinderpest compatible case or outbreak	Any case or outbreak of disease in a rinderpest susceptible species that meets the stomatitis–enteritis clinical outbreak definition.
SEC	Stomatitis–enteritis cases. The number of clinical case reports showing Stomatitis–Enteritis signs (e.g. BVD, IBR and MCF, FMD, etc.) received annually by the General Disease Reporting System per 100,000 heads of susceptible species is termed the SEC and used as a standard for some indicators.
SEO	Stomatitis–enteritis outbreaks (disease episodes). The number of outbreak reports showing Stomatitis–Enteritis signs (e.g. BVD, IBR and MCF, FMD, etc.) received annually by the General Disease Reporting System per 100,000 herds is termed the SEO and used as a standard for some indicators.
Stomatitis–enteritis clinical episode	Episodes of contagious disease exhibiting clinical signs of ocular and nasal discharge and any other two of the following signs: • Fever • Erosions in the buccal mucosa • Excess salivation • Corneal opacity • Diarrhoea • Death. Note that the criteria apply to the outbreak (or disease episode), and individual animals (cases) may not necessarily show all the signs.
Suspected case or outbreak	Any case or outbreak of disease in a rinderpest susceptible species that meets the stomatitis–enteritis clinical outbreak definition and is not epidemiologically linked to a confirmed case or outbreak.
Zero reporting	The filing of negative reports or reports of the absence of disease episodes, etc. A zero report documents that the reporting office is active. The alternative, non-reporting of zero incidences, cannot be distinguished from a failure to conduct surveillance or report.

Annex I

THE OIE PATHWAY

Step 1. Provisional freedom from rinderpest

For a country to declare itself or a zone within the country provisionally free from rinderpest, it must fulfil the following conditions:

(i) no clinical disease should have been detected for at least two years;
(ii) there is an effective veterinary service which is able to monitor the animal health situation in the country;
(iii) the service investigates all clinical evidence suggestive of rinderpest;
(iv) there is an effective reporting system, both from the field to the central veterinary authority, and by that body to the OIE;
(v) there is a reliable system for preventing the introduction of infection which is carried out by proper border control, quarantines, etc.;
(vi) all vaccinations against rinderpest will cease by the date of the declaration. The OIE and neighbouring countries must be notified of this decision (in writing), giving the date from which vaccination ceased.

Step 2. Freedom from rinderpest disease

A country or a zone which has not vaccinated against rinderpest for at least five years and has throughout that period had no evidence of rinderpest may be declared free from rinderpest disease by the OIE based on conclusions of the FMD and Other Epizootics Commission, provided that the country has had throughout that period and maintains permanently an adequate disease reporting system.

OR

A country which has declared itself, or a zone within the country, to be provisionally free from rinderpest may be declared by the OIE free from rinderpest disease provided that the following criteria are met:

(i) no clinical rinderpest has been detected for at least five years;
(ii) no rinderpest vaccines have been used for at least three years in any susceptible species, and no heterologous vaccines against rinderpest have been used for at least three years in cattle buffaloes or yaks;
(iii) the country operates both clinical surveillance and disease reporting systems for rinderpest adequate to detect clinical disease if it were present;
(iv) all clinical evidence suggestive of rinderpest is investigated by field and laboratory methods (including serological assessment) to refute a possible diagnosis of rinderpest;
(v) there are effective measures in force to prevent the re-introduction of the disease.

On meeting these criteria, a country may apply to the OIE to be declared free from rinderpest disease. To maintain this status, a country must continue to meet these requirements until it is declared free from rinderpest infection, and must annually report a summary of developments to the OIE.

If it is not practical to achieve national freedom from rinderpest disease in a single step, a country may apply to the OIE for zones within the country to be declared free from rinderpest

disease provided that, provided these zones are clearly demarcated, and each zone meets the criteria outlined for a freedom from disease).

Step 3. Freedom from rinderpest infection

A country which has not vaccinated against rinderpest for at least ten years and has throughout that period had no evidence of rinderpest disease or rinderpest virus infection may be declared free from rinderpest infection by the OIE based on conclusions of the FMD and Other Epizootics Commission, provided that the country has had throughout that period and maintains permanently an adequate disease reporting system.

OR

A country which has either vaccinated against rinderpest within the last ten years or has had clinical evidence of rinderpest, may be declared by the OIE to be free from rinderpest infection if the following criteria are met:

(i) it should have been declared free from rinderpest disease at least one year earlier, and continues to meet the requirements for this status;

(ii) there should have been an effective serosurveillance system in operation for a period of at least two years, and the findings must have been consistent with freedom from infection. This serosurveillance must include other susceptible domestic stock in addition to cattle;

(iii) investigations into infection in wild susceptible species must be carried out where these species occur in significant numbers. Where there are opportunities, sampling should be done when possible. Additional strategic sampling of domestic stock should be done in areas adjacent to large game populations to enhance the possibilities of detecting the presence of virus in the game. The findings must be consistent with freedom from infection.

On meeting these criteria, a country may apply to the OIE to be declared free from rinderpest infection. Declaration of freedom from rinderpest infection can only be made for the country as a whole, and not for zones within a country.

Application of the OIE pathway

The OIE Pathway basically requires the participating country to provide evidence of (a*) a viable national veterinary services, which has effective surveillance systems efficient enough to detect rinderpest disease and virus if present (or introduced) in the country, and* (b*) a well organised plan to rid the country of such disease (or virus) should it be re-introduced.*

1. Effective veterinary services

The country should be able to show that it has

- adequate supply of well trained veterinary manpower deployed in such a manner to gather the surveillance date required for understanding the disease status of the country. This requires a list of veterinary manpower and their distribution (*deployment*) in the country, as well as evidence of specific training for rinderpest surveillance either internationally or through nationally co-ordinated workshops. Well established state and provincial diagnostic laboratories provide additional evidence of strong veterinary services.

- Well articulated and documented national plan for disease control, including the establishment of committees at the highest levels of government for rapid decision making on matters concerning livestock disease control.
- Well instituted veterinary epidemiology unit, adequately staffed and properly equipped to collect, analyse and report on disease situation in the country. The epidemiology unit should have clearly established (and documented) procedures for active surveillance (disease finding) and investigation of suspected outbreaks. This unit will also undertake to co-ordinate

    ⇒ Monthly, quarterly and annual disease reports from all reporting units (whether districts, parishes, or local government area (LGA). The more complete (in terms of all units reporting regularly) the reports, the better the case.

    ⇒ Reports from the diagnostic laboratories on samples submitted for sero-surveillance, disease investigation, and routine diagnosis of infectious diseases.

    ⇒ Summary reports for the CVO which will engender regular reports for international bodies (OIE, FAO, PARC, etc.), as well as newsletters for distribution to the livestock industry stakeholders (field veterinarians, farmers, diagnostic laboratories, private veterinary practitioners, veterinary schools, universities and special research institutes).
- Adequate budgetary provisions for disease control.
- Well equipped and properly staffed central diagnostic laboratory.

The structure for good veterinary services is already in place in most GREP countries, albeit functioning at various levels of efficiency. Where the functional efficiency of the surveillance system is less that optimal, the CVO should consider seriously how the system can be rekindled.

2. Improving surveillance infrastructure

- A workshop or seminar involving field and laboratory staff in which the surveillance set-up is discussed with experts in disease surveillance (from national Universities, FAO, IAEA, or PACE) would assist in revitalising the surveillance system. Specific emphasis should be put on recognizing rinderpest-like clinical signs in farms and herds. The workshop / seminar is a good forum to

    ⇒ Introduce and review samples of disease reporting forms, preferably updated and optimized for computer-aided data input and analysis (perhaps in line with TADInfo) . Samples of output from the data analysis / reporting system should also be discussed so that all participants clearly understand the aims and direction of the programme. Importance of good (routine) disease reporting should be emphasised with reference to GREP.

    ⇒ Introduce and discuss the protocol for active disease surveys, again to familiarise participants with the plans, and obtain inputs (and commitment) from the field staff. Emphasis should be put on sample collection, storage and timely submission (cold chain).

    ⇒ Review the line of action to be taken in the case of suspected outbreak of rinderpest, and agree on the line of flow of reports from the field officers (i.e.

whether directly to the CVO office, or through the DVO, or both) so as to avoid confusion and speed up reporting process.

⇒ Discuss possible rewards for compliance with the desired reporting requirements (and punishment for failure to report).

3. Contingency planning

All participating countries should develop national plans of action for containment and control of rinderpest cases discovered at this stage of the eradication programme. The plan should include:

- A written national plan for the actions to be taken in the case of a suspected outbreak. The plan should include actions and procedures, who should take the actions, and who should authorise them. There should be written evidence (e.g. minutes of a meeting) that such actions have received 'prior clearance' from the highest level of government. Such document should contain:

  A. A list of options in the case of confirmed outbreak. This options must have been discussed and agreed upon. *Examples* include

     1. Slaughter of infected cattle (or herds?) with (or without) compensation. If compensation is to be given, the value and method should be specified.

     2. Vaccination (?); which animals should be vaccinated (*infected herd? In contact herd? Ring vaccination?*) and with which vaccine ?

     3. Further surveillance of the herd and area ? For how long? By whom? etc.

  B. A list of National Committees, which will oversee the application of the disease control activities. *At least* 3 committees should operate:

     1. An Epidemiological committee - for investigating suspected cases and taking a decision on whether or not an outbreak has occurred. This committee should include a trained epidemiologist, a clinician, and a pathologist, and a laboratory person. In large countries regional committees can be set up to facilitate rapid investigation. In either case, there should be a professionally qualified person (team-leader?) who should take responsibility for the decision that rinderpest has occurred.

     2. A professional committee to invoke control measures. This committee will review the report from the investigating committee and select the control option to be applied, will apply the control measures, and the necessary follow up activities. This committee should include

        a) The Chief Veterinary Officer (or other head of national veterinary services)
        b) Deputy CVO
        c) National rinderpest co-ordinator
        d) Head of the epidemiology unit/head of the epidemiology committee (if different)
        e) Head of the Central Diagnostic Laboratory
        f) DVO in the district or region where the outbreak has occurred.
        g) Chief of Police in the region/district where the outbreak has occurred.

3. The policy committee, should be responsible for setting the national policy concerning control of disease outbreaks, with special reference to rinderpest. Should be at the highest level of government, and should include

   a) Minister responsible for agriculture/livestock
   b) Permanent Secretary, Ministry of Agriculture
   c) Permanent Secretary, Ministry of Finance
   d) Chief Veterinary Officer
   e) Head of Central Diagnostic Laboratory
   f) A non-government, professional representative (e.g. Dean Faculty of Veterinary Medicine, or Chairman, National Veterinary Association)
   g) Chief of Police
   h) Non-professional representatives (including lay or farmer representatives)

Organizing the active surveillance systems

Models for direct disease finding:

Option 1

- Regular visits (by each District Veterinary Officer) to (randomly) selected farms in his area. During the visit, he will check the herd clinically, interview the owner (questionnaire) probing for 'rumours' of outbreaks of diseases, including (*or perhaps particularly*) those characterized by stomatitis and enteritis; and collect blood samples from 15 to 20 animals.

  ⇒ This approach can be modified to achieve the OIE stipulation that at least 300 herds selected randomly should be sampled to achieve the objective of finding disease at 1% level. A random sample of 100 — 350 DVO can be drawn (annually) and each DVO should be asked to select some herd (1 to five herds, depending on the number of DVOs selected) in his area to sample. The selection of the number of herds can be dependent on the cattle densities — i.e. the more herds will be selected from areas with higher cattle densities.

- Regular visits (about once per month) to the cattle market - to examine animals clinically, collect samples from those showing signs, and collect information from cattle traders and herd-men from various parts of the District concerning possible disease occurrence.
- Regular (monthly or weekly) visits to the slaughter houses/slabs to examine cattle before and after slaughter. If regular meat-inspection occurs, the inspector should keep careful records of suspicious cases for further follow-up.
- Establishment of 'sentinel' herds, especially in the border districts. Regular (monthly or bi-monthly?) visits to inspect animals, collect blood samples and information from the herdsmen and cattle traders should provide valuable information.

Each DVO should be provided with materials for sample collection (needles, vacutainers) and storage, forms, and cold packs, and petrol money. Perhaps headquarters can arrange to pick up the samples and completed forms on a regular basis. Alternatively, the DVO can send the samples by 'hand delivery ' to the regional headquarters, to be collected by courier from the

central headquarters / laboratory. In addition to collecting the samples, headquarters can sometimes send a supervisor to participate in the sample collection, as a form of internal audit.

If each DVO visits two farms and one market per month, the system should be able to produce adequate coverage of the country annually in terms of direct disease finding, and yet reduce the logistic problems of sending a surveillance team to the field, especially in large countries.

The main advantage of the use of DVO is that he usually knows the livestock producers in his region, and normally enjoys a degree of rapport with them.

Option 2

A second approach is to set up one or more national survey team(s) well equipped with transport, bleeding materials. The team would then establish a timetable for serosurvey of various parts of the country. The team could also look for disease in the herds slated for bleeding, as well as in contiguous herds. This approach has the advantage of being more independent (of the DVO), and with practise, the members will become more adept in recognising disease. The obvious disadvantage is the higher cost, in terms of initial capital outlay, as well as the operating cost (filed allowance, fuel, etc.).

Option 3

In some countries, regional laboratory exist and could be used as a launch pad for direct surveillance, utilising laboratory personnel and the DVOs in the region. This approach is somewhat of a compromise between Options 1 and 2 in that it uses regional surveillance teams. This option can also accommodate persons outside the Ministry, such as staff of Faculties of Veterinary Medicine. Very often experienced epidemiologists in Faculties of Veterinary Medicine can be ‘contracted’ to survey areas of the country close to their University.

Annex II

ANNUAL RINDERPEST SURVEILLANCE PERFORMANCE REPORT FORMAT

Annual Rinderpest Surveillance Performance Report

Name and Address of Head of Veterinary Services

Country:

Name of Head of Veterinary Services:

Exact Title:

Full Address:

Telephone Number(s):

Fax Number(s):

Telex Address:

E-mail Address:

Name of Preparer:

Exact Title:

Annual Rinderpest Surveillance Performance Report

Basic Data Sheet

All data should be reported per calendar year (January 1 to December 31). Performance indicators should be calculated after all surveillance activities are completed or after the time limits specified in the indicators have elapsed, whichever comes first. In any event, the deadline for submission is May 31st of the year following the reporting period.

1. Record Identifier

Country:	
Year:	
Date of Report:	

2. Susceptible Domestic Population

Cattle:	
Buffaloes:	
Other:_____	
Total Susceptible:	

3. Basic Data

a. Total Number of Districts Nationally:		
b. Number of Outbreaks Reports of BVD, IBR and MCF Received by the General Disease Reporting System per 100,000 susceptibles:		= SEO
c. Number of Case Reports of BVD, IBR and MCF Received by the General Disease Reporting System per 100,000 susceptibles:		= SEC
d. Number of Stomatitis-Enteritis Reports Obtained Through Active Surveillance per 100,000 susceptibles (DI 3.1):		=ASEO
e. Number of Stomatitis-Enteritis Cases Detected as part of Outbreak Investigation per 100,000 susceptible (DI 4.6):		= ASEC

4. Outbreak Classification: Using the **Stomatitis-Enteritis Outbreak Classification Scheme** report the total number outbreaks by category for the current year:

Rinderpest Compatible Outbreaks:		= DI 7.4
Discard Outbreaks:		= DI 7.5 + 7.6
Rinderpest Confirmed Outbreaks:		= DI 7.7

Rinderpest Surveillance Performance Indicators (PI)

Indicator	Numerator	Denominator	PI Value	PI Standard
1. General Disease Reporting Number of districts forwarding general disease reporting formats within 30 days of the end of the month at least 10 months of the year per total number of districts.				>80%
2. Active Disease Search Number of districts surveyed using active disease search techniques (participatory, questionnaire-based and clinical) with results reported within 90 days per total number of districts.				10 – 20%
3. Active Disease Reporting Number of reports of stomatitis-enteritis received, at headquarters per month per 100,000 heads of susceptible species.				SEO[1]
4. Stomatitis-Enteritis Outbreak Investigation The proportion of stomatitis-enteritis outbreaks investigated within 7 days (of receiving the report) by a competent veterinarian or trained field investigator.				SEC[2] and ASEC[3]

[1] The number of SE outbreaks reported should be at least comparable to the number of clinical reports of BVD, IBR, MCF, etc. received by the veterinary services through the General Disease Reporting System (SEO).

[2] The number of SE cases sampled and tested should be at least comparable to the number of clinical reports of BVD, IBR, MCF, etc. received by the veterinary service through the General Disease Reporting System (SEC).

[3] The number of SE cases sampled and tested should be at least comparable to the number of SE cases detected by the Active Disease Surveillance System (ASEC).

Indicator	Numerator	Denominator	PI Value	PI Standard
5. Rinderpest Diagnostic Testing Number of cases examined by serological, immunohistopathological, RNA or antigen detection techniques with preliminary results reported within 3 days of receipt of samples per 100,000 heads of susceptible species.				SEC and ASEC
6. Definitive Diagnosis Number of stomatitis-enteritis cases (e.g. RP, BVD, MCF, ECF, etc.).diagnosed definitively by laboratory methods at national and/or reference laboratories within 60 days of receipt of samples per 100,000 heads of susceptible species				SEC and ASEC
7. Serosurveillance Number of serum samples collected and tested with results reported within 120 days of collection per total number of populations identified in the country.				4500
8. Wildlife Surveillance (Special Indicator) Number of serum samples collected and tested with results reported within 90 days of collection per thousand heads of susceptible species.				

Annex III

DIAGNOSTIC INDICATORS REPORT FORMATS

General Disease Reporting Diagnostic Indicator Report

1. *Number of districts forwarding general disease reporting formats within 30 days of the end of the month at least 10 months of the year per total number of districts.*

Indicator	**Numerator**	**Denominator**	**Value**	**Standard**
1.1 Proportion (%) of districts that have functional veterinary infrastructure (in terms of veterinary clinics and resources for conducting veterinary practice in the region).				>80%
1.2 Proportion (%) of districts that have a qualified veterinary professional or a trained disease reporting agent.				>80%
1.3 Proportion (%) of districts that have been supplied with reporting formats during the last two years.				>80%
1.4 Proportion (%) of districts that have filed at least one correctly completed disease reporting format during the year.				>80%
1.5 Proportion (%) of districts that have filed incorrectly completed disease reporting formats during the year.				<20%
1.6 Proportion (%) of districts that have filed general disease occurrence reports using non-standard formats or through non-standard channels.				<20%
1.7 Number (and list) of national summary reports, newsletters or bulletins on animal disease statistics prepared and distributed to decision-makers, surveillance system participants and the OIE within 60 days of the completion of the reporting period.				13 OIE 4 National

Active Disease Surveillance Diagnostic Indicator Report

2. Number of districts surveyed using active disease search techniques (participatory, questionnaire-based and clinical) with results reported within 90 days per total number of districts.

Indicator	Numerator	Denominator	Value	Standard
2.1 Has an active disease search procedure/methodology been developed?				Yes
2.2 Number of staff trained over the last three years to carry out active disease surveys.				>80%
2.3 Number of survey/interview formats or checklists prepared and distributed to trained staff over the last two years.				>80%
2.4 Number of surveys analysed and reported this year per number of surveys undertaken.				10 – 20%
2.5 Number of completed surveys judged to be reliably collected and analysed per number of surveys undertaken.				10 – 20%
2.6 List of summary or national reports providing an overview of data and information obtained by active disease search programmes during the year.				4

Active Disease Reporting Diagnostic Indicator Report

3. Number of reports of stomatitis-enteritis received, recorded and forwarded within 30 days per 100,000 heads of susceptible species.

Indicator	**Numerator**	**Denominator**	**Value**	**Standard**
3.1 Number of reports of stomatitis-enteritis received during the year from all channels per 100,000 heads of susceptible species (ASER, *enter on Annual Rinderpest Surveillance Performance Report, pg. 2, item 3.d.).*				SEO
3.2 Number of reports forwarded within 30 days to the national co-ordination office per total number of reporting formats received.				>80%
3.3 Number of SE outbreaks reported to the national co-ordination office using reporting formats per total number of reports received by all channels during the year.				>80%
3.4 Proportion (%) of districts forwarding reporting formats (zero or outbreak reports) at least 10 months out of the year.				>80%
3.5 Number of man-days dedicated to active field search and farmer contact specifically related to stomatitis-enteritis surveillance during the year per 100,000 heads of susceptible species.				>80%

Stomatitis-Enteritis Outbreak Investigation Diagnostic Indicator Report

4. The proportion of stomatitis-enteritis outbreaks investigated within 7 days (of receiving the report) by a competent veterinarian or trained field investigator.

Indicator	**Numerator**	**Denominator**	**Value**	**Standard**
4.1 Number of reports investigated by an expert team per 100,000 heads of susceptible species.				>80%
4.2 Average number of days between receipt of report and outbreak investigation for all outbreak investigation undertaken during the preceding 12 months.				<7 days
4.3 Proportion (%) of provinces/regions/states that have undertaken investigations.				>80%
4.4. Proportion (%) of SE outbreaks incorrectly diagnosed based on the criteria of the SE case definition per total number of SE reports investigated.				<20%
4.5 Proportion (%) of investigations leading to the detection and clinical diagnosis of cases meeting the stomatitis-enteritis case definition during the year.				
4.6 Number of stomatitis-enteritis cases detected annually per 100,000 heads of susceptible species (ASEC, *enter on Annual Rinderpest Surveillance Performance Report, pg. 2, item 3.e.).*				SEC
4.7 Proportion (%) of districts/offices with sampling materials.				>80%

Indicator	Numerator	Denominator	Value	Standard
4.8 Proportion (%) of districts/offices with staffed trained in appropriate sample collection techniques.				>80%
4.9 Proportion (%) of cases sampled at the time of detection (initial investigation) per total number of cases detected.				>80%
4.10 Average number of days between detection of cases and case sampling for all cases sampled during the year.				<7 days
4.11 Proportion (%) of cases never sampled per total number of cases detected.				<20%

Rinderpest Diagnostic Testing Indicator Report

5. Number of cases examined by rinderpest antigen / RNA detection techniques, or by serological/ immunohistopathological methods, with preliminary results reported within 3 days of receipt of samples per 100,000 heads of susceptible species

Indicator	**Numerator**	**Denominator**	**Value**	**Standard**
5.1 List of diagnostic techniques available and fully operational.				At least AGID
5.2 Number of case sample-sets received for stomatitis-enteritis investigation annually per 100,000 heads of susceptible species.				SEC and ASEC
5.3 Proportion (%) of case sample sets received in reliable condition (adequate cold chain, labelling, etc.).				>80%
5.4 Proportion (%) of case sample sets received that include appropriate samples (e.g. correct type and timing of sampling).				>80%
5.5 Average number of days elapsed between the receipt of samples and the reporting of results.				<3 days
5.6 Proportion (%) of case sample sets for which results are not obtained or reported.				0

Definitive Diagnosis Diagnostic Indicator Report

6. Number of stomatitis-enteritis cases diagnosed definitively by laboratory methods at national and/or reference laboratories within 60 days of receipt of samples per100,000 heads of susceptible species (e.g. RP, BVD, MCF, ECF, etc.).

Indicator	**Numerator**	**Denominator**	**Value**	**Standard**
6.1 List RP and differential diagnostic techniques available nationally. List RP and differential diagnostic techniques available regionally. List RP and differential diagnostic techniques available at the world reference laboratory.				At Least RP AGID
6.2 Number of case sample sets received for stomatitis-enteritis investigation per 100,000 heads of susceptible species during the year.				SEC and ASEC
6.3 Average number of days between receipt of samples and definitive diagnosis for all sample sets received.				<60 days
6.4 Number of SE cases definitively diagnosed as rinderpest (enter on Annual Rinderpest Surveillance Performance Report, pg.2, Item 4.a).				
6.5 Number of SE cases definitively diagnosed as not due to rinderpest by identification of another causal agent (BVD, IBR, MCF, ECF, etc.).				
6.6 Number of SE cases definitively diagnosed as not due to rinderpest by secondary serological investigation.				
6.7 Number of rinderpest compatible cases that remained undiagnosed at year-end (*enter on Annual Rinderpest Surveillance Performance Report, pg. 2, Item 4.c).*				0
6.8 Number of rinderpest compatible cases that were forwarded to reference laboratories for further investigation.				

Serosurveillance Diagnostic Indicator Report

7. Number of serum samples collected and tested with results reported within 120 days of collection per number of populations identified.

Indicator	Numerator	Denominator	Value	Standard
7.1 Proportion of herds/sample units from which 4,500 samples were collected (i.e. out of the total number of herds/units identified in the country.				>80%
7.2 Proportion of cattle in the country bled for serum collection.				4,500
7.3 Total number of serum samples forwarded with supporting data to the sero-surveillance laboratory within 45 days of collection per total number of populations				4,500
7.4 Total number of serum samples received by the laboratory in reliable condition				4,500
7.5 Quantity of reagents available expressed in number of sera that could be tested				4,500
7.6 Total number of serum samples tested by the laboratory within 45 days of receipt				Same value as 7.4
7.7 Total number of serum samples tested with results reported within 75 days of receipt by the laboratory.				Same value as 7.4
7.8 Proportion (%) of sampling sites successfully sampled (i.e. per total number of sites defined in the annual random sampling plan).				95%

Wildlife Surveillance Diagnostic Indicator Report

8. Number of serum samples collected and tested with results reported within 90 days of collection per thousand heads of highly or moderately susceptible species.

Indicator	**Numerator**	**Denominator**	**Value**	**Standard**
8.1 Number of staff trained and equipped to immobilise wildlife for the purpose of sample collection per thousand heads of highly or moderately susceptible species				
8.2 Amount of funding available for wildlife surveillance per thousands heads of highly or moderately susceptible species.				
8.3 Number of serum samples collected per thousand heads of highly or moderately susceptible species.				
8.4 Number of serum samples tested per thousand heads of highly or moderately susceptible species.				
8.5 Number of serum samples for which results were reported per thousand heads of highly or moderately susceptible species.				

Annex IV:

ACTIVE STOMATITIS-ENTERITIS REPORT FORMAT

Stomatitis-Enteritis Outbreak Reporting Format

Complete and forward one format per stomatitis-enteritis (SE) report. In the event that no reports were received complete the first three lines, indicating 'No' for item three. This will constitute a zero report for the month. A narrative report should be attached which describes clinical and epidemiological features in detail. The report should also state the action taken as a result of the findings.

1. Reporting office			
2. Month/Year			
3. Report received this month	Yes	No	
4. Date report received			
7. Report registry entry number			
6. Location Province			
District			
Village			
Owner (if available)			
Latitude and Longitude			
7. Report source	Veterinarian	Staff	
	Livestock Owner	Other_____	
8. Name and position of staff receiving report			
9. Investigated clinically?	Date_____	No	
10. Name and position of investigating officer			
11. Clinical signs observed in aggregate of cases ***Please list clinical signs observed in order of frequency*** **			
12. Diagnosed as SE outbreak?	Yes	No	
13. Cases sampled?	Date_____	No._____	No
If Yes, What samples were collected? (Type and number)			
14. Name and position of staff collecting samples			
15. Size of herd affected			
16. Number of cases			
17. Number dead			

** *Please pay particular attention to the signs of Stomatitis enteritis complex diseases*: **Ocular/nasal discharges, fever, oral lesions, salivation, corneal opacity, diarrhoea, death.**

19. Age group affected		
20. Last Outbreak in area		
21. Last Vaccination in area		
22. Narrative report attached?	Report Ref_____	No
Prepared by:	Position:	
Signature:	Date:	

Annex V

LABORATORY PERFORMANCE INDICATOR WORKSHEETS

Rinderpest Diagnostic Testing

The first checklist contains the names of the available rinderpest diagnostic techniques.

'Operational' — means the test is currently done routinely in the laboratory with a high degree of quality assurance.

'To be acquired' — means that the laboratory is in the process of introducing, setting up, or improving the quality of performance for the test.

Thereafter, the evaluator should go to the specific checklist for that test and inventory all the resources necessary to make the test operational. If a test is not present and not targeted for acquisition, the evaluator should enter 'no' in the second column and move on.

Rinderpest Diagnostic Techniques	Operational	To be acquired	Not available
Clearview test			
Agar gel immunodiffusion (AGID)			
Immunocapture ELISA			
Immunohistochemistry			
Virus isolation / neutralisation			
PCR			
Animal inoculation			

Clearview Test	Quantity
Test kits	
Sample diluents	

Agar Gel Immunodiffusion	Quantity
Equipment	
Bunsen burner or stove	
Petri dishes	
100 and 500 ml Reagent bottles	
Gel cutter	
10 ml pipettes	
Vacuum pump / suction	
Pasteur pipettes	
Materials	
Agar	
Borate saline	
Reagents	
Hyperimmune serum	
Positive Control Antigen	
Trained Staff	
Test protocol	

Immunocapture ELISA	Quantity
Equipment	
ELISA reader	
Plate shaker	
pH meter w/ spare electrodes and standards	
Balance	
Stirrer w/ magnetic bars	
Computer	
Source of distilled water (*type of water still*)	
Micropipetting equipment (*types and number*)	
100, 500 and 1,000 ml Reagent bottles	
Carboys (*water storage containers*)	
Pipetting bulb or controller	
Refrigerator/ freezer, (*type and capacity*)	
Materials	
ELISA plates	
Micropipetting tips	
Pipetting reservoirs (troughs)	
1, 5 and 10 ml pipettes	
Reagents	
Immunocapture ELISA kit	
Wash buffers	
Trained staff	
Test protocol	

Immunohistochemistry	Quantity
Basic capacity to perform histopathology	
Reagents	
Rinderpest hyperimmune sera	
ABC staining kit	
Staff trained in immunohistochemical staining	
Test protocol	

Polymerase Chain Reaction	Quantity
Equipment	

Virus Isolation	Quantity
Equipment:	
Laminar flow safety cabinet	
Autoclave	
Incubator (*types available*)	
Inverted microscope	
Tissue homogenizers	
pH meter w/ spare electrodes and standards	
Water bath	
Stirrer w/ magnetic bars	
Balance	
Refrigerator/Freezer, non-frost free	
-70 Freezer (recommended)	
Liquid nitrogen (LN) freezer (recommended)	
LN transport bottle (recommended)	
Pipette bulbs or controller	
100, 500 and 1,000 ml Reagent bottles	
100 and 500 ml Graduated cylinders	
Cell counting chamber	
Materials:	
25 and 125 cm^2 Tissue culture flasks	
Cryovials	
1,5 and 10 ml Pipettes	
Sterile syringes	
Liquid nitrogen source (recommended)	
Reagents, media and cell lines:	
Eagles MEM, autoclavable	
Trypsin	
Versene (EDTA)	
Antibiotics (pen/strep or gentamycin)	
Fungazone	
Glutamine	
Calf serum	
Fetal calf serum (recommended)	
Sodium bicarbonate solution	
PBS	
Trained Staff	
Protocols	Available/No/Comment
Preparation of primary BK cells	
Cell passage	
Cell freezing and recovery	
Virus isolation	

Animal Inoculation	Available/No/Comment
Containment Facilities	

Sample Quality Checklist

Sample Quality Indicators	Yes/Percent No
Samples arrive in adequate cool box with ice	
Serum Samples free of haemolysis	
Samples free of gross contamination	
Samples accompanied by sample submission forms	
Samples clearly marked	
Sample containers robust, no breakage	

Sample Set Appropriateness Checklist

Case Sample Set Parameters	Yes/No
Ocular and nasal swabs	
Serum sample	
Scrapings from erosions, if present	
Tissue samples, if dead or moribund case	

Outbreak Sample Set Parameters	Yes/Percent No
Ocular and nasal swabs from all affected animals	
Serum samples from all affected and contact animals	
Scrapings from erosions, if present	
Tissue samples from dead or moribund cases	
At least one case sampled within 48 hours of the appearance of discharges	

Definitive Diagnosis

Supplemental Diagnostic Laboratory Requirements

Diagnostic Techniques

Differential Diagnostic Techniques	Available/To Be Acquired/No
Bovine viral diarrhoea	
Virus Isolation	
PCR	
Malignant catarrhal fever	
Histopathology	
PCR	
Infectious bovine rhinotracheitis	
East Coast Fever	
Staining	
PPR	
FMD	

Serosurveillance

Competitive ELISA	Quantity

Sample Collection

Sero-sampling Input	Result
Number of functional vehicles-months dedicated to sero-surveillance per population.	
Fuel price per litre	
Amount of vehicle running costs budget per population	
Daily per diem rate	
Amount of per diem budgeted and released per population	
Number of staff man-months assigned to sample collection per population	
Quantity of vacutainers and needles on hand per population	
Quantity of marking pens on hand per population	
Number of cool boxes on hand per population	
Is the capacity and distribution of ice sources adequate?	
Number of field centrifuges per population	
Number of transfer pipettes per population	
Number of serum transport or storage containers per population	

ABBREVIATIONS

AFP	acute flaccid paralysis
AGID	agar gel diffusion
ASEC	active stomatitis-enteritis cases
ASEO	active stomatitis-enteritis outbreaks
ASER	active stomatitis-enteritis reports
BVD	bovine viral diarrhoea
BVD–MD	bovine virus diarrhoea–mucosal disease
CDC	Centre for Disease Control
cELISA	competitive ELISA
CVO	Chief Veterinary Officer
DI	diagnostic indicators
DVO	Divisional Veterinary Office
ECF	East coast fever
ELISA	enzyme linked immunosorbent assay
FMD	foot-and-mouth disease
GI	gastro-intestinal
GREP	Global Rinderpest Eradication Programme
IAEA	International Atomic Energy Agency
IBR	infectious bovine rhinotracheitis
ICE	immuno-capture ELISA
JP 15	Joint Project 15
LGA	local government area
LN	liquid nitrogen
LSD	lumpy skin disease
MCF	malignant catarrhal fever
PARC	Pan African Rinderpest Campaign
PCR	polymerase chain reaction
PI	Performance indicator
PPR	peste des petits ruminants
RNA	ribo nucleic acid
RP	rinderpest
SE	stomatitis–enteritis
SEC	stomatitis–enteritis complex

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