

Rinderpest surveillance performance monitoring using quantifiable indicators

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Summary

This paper describes an objective system of monitoring the performance of disease surveillance. The system was developed through dialogue with a number of countries in Africa and adopted as part of the Global Rinderpest Eradication Programme of the Food and Agriculture Organization of the United Nations. The performance monitoring system uses a clinical stomatitis-enteritis case definition, an outbreak investigation classification scheme, and a series of eight performance indicators to measure the sensitivity, specificity and timeliness of the surveillance system. Field-testing indicates that the approach is successful when good record-keeping is practiced and highlights the importance of dialogue in helping to ensure that the system is simple and acceptable. The system provides a quantitative measure of the efficacy of national disease surveillance programmes and of the quality of data derived from such programmes for use in international disease control, animal health information exchange and trade risk analysis.

Keywords

Eradication – Indicator – Monitoring – Performance – Rinderpest – Risk analysis – Surveillance – Trade – Veterinary Service.

Introduction

Effective disease surveillance is a prerequisite for participation in the international trade in livestock; it is vital for effective emergency preparedness programmes and successful disease eradication programmes. All too frequently, national and international programmes have no quantitative measure of their surveillance activities, and the absence of passive reports is often taken to mean the absence of disease, and no further inquiry is undertaken. The result can be a serious underestimation of the magnitude of the prevalence of disease or a complete failure to recognise the presence of a disease, which may have a significant economic or health impact.

In international trade today, the issue of determining the quality of the data that is produced by animal health surveillance and service delivery systems is becoming increasingly important, and the quality of the data can only be assessed if there is an

objective way of quantifying the performance of the systems. The World Trade Organization (WTO) Sanitary and Phytosanitary (SPS) Agreement has established the concept of acceptable risk and specifies that risk analysis methodologies be used in making trade movement decisions. The agreement states that, rather than striving for zero risk when trading in animal products, countries should develop transparent risk measurement procedures and establish appropriate, realistic risk tolerances based on scientific principles. Increasing emphasis is being placed on disease prevalence statistics and tests of disease freedom (4), and as a basis for quantitative risk analysis, national authorities are requesting statistics to substantiate the effectiveness of surveillance programmes. This paper addresses the crucial need, at both national and regional level, for reliable techniques for measuring the effectiveness of surveillance and service delivery systems.

The Global Rinderpest Eradication Programme (GREP) aims to rid the world of rinderpest by the year 2010. The secretariat of

GREP, located within the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases Programme of the Food and Agriculture Organization of the United Nations, was first established as the global umbrella for the regional programmes of the Pan-African Rinderpest Campaign, the West-Asian Rinderpest Eradication Campaign, and the South-Asian Rinderpest Eradication Campaign. The work of GREP is now focused on Sudan, Kenya, Somalia and Pakistan, with the aim of eliminating the last three remaining foci of rinderpest in the world and verifying the eradication of rinderpest through surveillance. If this is successful, it will be the first time that an animal disease has been eradicated globally.

The use of serosurveillance data to assess disease-reporting systems has long been established (17). Statistical methods for the detailed evaluation of the completeness of reporting (8, 12, 13, 24, 25), i.e., those that compare multiple components of surveillance systems, have been developed, but evaluations of the overall quality of surveillance and service delivery systems have focused on qualitative checklists or scoring systems (16, 21).

Until now, there has been no simple and real-time method for monitoring the performance of a comprehensive surveillance system; no method that assists decision makers to assess the credibility of surveillance information rapidly and objectively. The authors present a system of quantifiable performance indicators (PI) for real-time monitoring of the sensitivity, specificity, and timeliness of GREP rinderpest surveillance (15). Should poor performance be noted, diagnostic indicators (DI) can be used as part of programme evaluations to determine the cause of underperformance. Diagnostic indicators are similar to PIs, but are more detailed and measure specific sub-tasks or steps in the process. One set of DIs is presented as an example.

The rinderpest system is based on lessons learnt from extensive international experience of eradication programmes for animal and human vaccine-preventable diseases. Performance indicators are necessary for both national authorities that wish to monitor their own progress towards establishing effective surveillance programmes and international authorities that need to objectively and reliably certify countries as free from a disease. Performance indicators will also provide neighbouring countries or importing countries with a reliable method for assessing the quality of information provided by the reporting country. Within the context of the WTO SPS Agreement, PIs will provide a transparent measure of data quality which can then be incorporated into quantitative risk analysis. Simply stated, PIs are objective measures of the capacity of a surveillance system to detect the target disease or agent, if it is present.

Materials and methods

Definition and objectives of performance monitoring

Performance indicators are defined in relation to system objectives and activities. In terms of output, effective surveillance programmes must fulfil three principal requirements and PIs are designed to measure the degree to which the system fulfils these requirements, as follows:

- sensitivity: the ability to detect a high percentage of field events that have a clinical or epidemiological appearance compatible with the disease in question
- specificity: the ability to provide a definitive diagnosis for a high percentage of disease-compatible field events upon investigation
- timeliness: the ability to detect, diagnose and report results within time-frames related to the transmission cycle of the disease in question.

Different aspects of the surveillance system focus on different requirements. The combination of techniques aims to provide a series of complementary checks and balances that result in a complete system that is more effective than the mere sum of its parts.

Performance indicators are time-delimited, denominator-based statistics. An example of a time-delimited numerator is 'the number of districts filing reports within thirty days of the end of the month.' An example of a time-delimited denominator is 'per total number of districts over a twelve-month period.' Table I is an example of the reporting format, containing the system of PIs and standards developed and implemented by GREP, which is used by national surveillance programmes when reporting to GREP or the Pan African Programme for the Control of Epizootics.

Two types of denominators are used: 'number of administrative districts' and 'population of susceptible species at risk'. Indicators are calculated on a calendar year basis unless otherwise stated. Performance is evaluated in comparison with defined standards. Participants should define performance standards through dialogue that recognises both objective principles and practical realities, so that performance standards represent a balance between minimal requirements and objectives for improvement.

Definitions required for the calculation of performance indicators

The surveillance activities of the rinderpest eradication effort were initially targeted at the detection and diagnosis of field outbreaks of a clinical syndrome: stomatitis-enteritis (SE),

Table I

An example of the reporting format completed by delegated representatives of national surveillance systems when reporting to the Global Rinderpest Eradication Programme. The performance indicator standards are listed in the last column as a point of reference for the reporting organisation

Performance indicator (PI)	Numerator	Denominator	PI value	PI standard
1) General disease reporting Number of districts, per total number of districts, forwarding general disease reporting formats within 30 days of the end of the month, at least 10 months of the year				> 80%
2) Active disease searching Number of districts, per total number of districts surveyed, using active disease search techniques (participatory, questionnaire-based and clinical) with results reported within 90 days				10%-20%
3) Active disease reporting Number of reports of stomatitis-enteritis (SE) received at headquarters per month, per 100,000 heads of susceptible species				80% of SEO ^(a)
4) Stomatitis-enteritis outbreak investigation The proportion of SE outbreaks investigated by a competent veterinarian or trained field investigator within 7 days of receiving the report				100% of SEC ^(b) and ASEC ^(c)
5) Rinderpest diagnostic testing Number of cases, per 100,000 heads of susceptible species, examined by serological, immunohistopathological, RNA or antigen detection techniques with preliminary results reported within 3 days of receipt of samples				100% of SEC and ASEC
6) Definitive diagnosis Number of SE cases (e.g. RP, BVD, MCF, ECF, etc.) per 100,000 heads of susceptible species, diagnosed definitively by laboratory methods at national and/or reference laboratories within 60 days of receipt of samples				80% of SEC and ASEC
7) Serosurveillance Number of serum samples, per total number of populations identified in the country, collected and tested with results reported within 120 days of collection				4,000
8) Wildlife surveillance (special indicator) Number of serum samples, per thousand heads of susceptible species, collected and tested with results reported within 90 days of collection				

BVD: bovine viral diarrhoea
ECF: East Coast fever
MCF: malignant catarrhal fever
RNA: ribonucleic acid
RP: rinderpest

a) the term used to describe the number of SE outbreaks (the number of SE outbreaks reported should be at least comparable to the number of clinical outbreak reports of bovine viral diarrhoea, infectious bovine rhinotracheitis, malignant catarrhal fever, etc. received by the Veterinary Services through the general disease reporting system)

b) the term used to describe the number of SE cases detected through the general disease reporting system (the number of SE cases sampled and tested should be comparable to the number of clinical case reports of BVD, IBR, MCF, etc.)

c) the term used to describe the number of cases detected through active search and reporting systems (the number of SE cases sampled and tested should be comparable to the number of SE cases detected by the active disease surveillance system)

which was derived from a case definition characterised by discharge, diarrhoea and death. Following the spread of a rinderpest virus strain which has been shown to be mild in cattle, the initial case definition was changed to include the more mild manifestations shown by this virus strain. The clinical outbreak definition of SE is presented in Figure 1.

Once detected, SE outbreaks are investigated and categorised according to the SE outbreak classification scheme presented in Figure 2. If the investigating veterinarian observes symptoms compatible with the SE outbreak definition (entry point of the outbreak classification scheme), then a full investigation should be initiated. The tactical objective is to obtain a definitive diagnosis for as high a proportion as possible of the outbreaks that meet the clinical outbreak definition (3).

Stomatitis-enteritis clinical outbreak definition

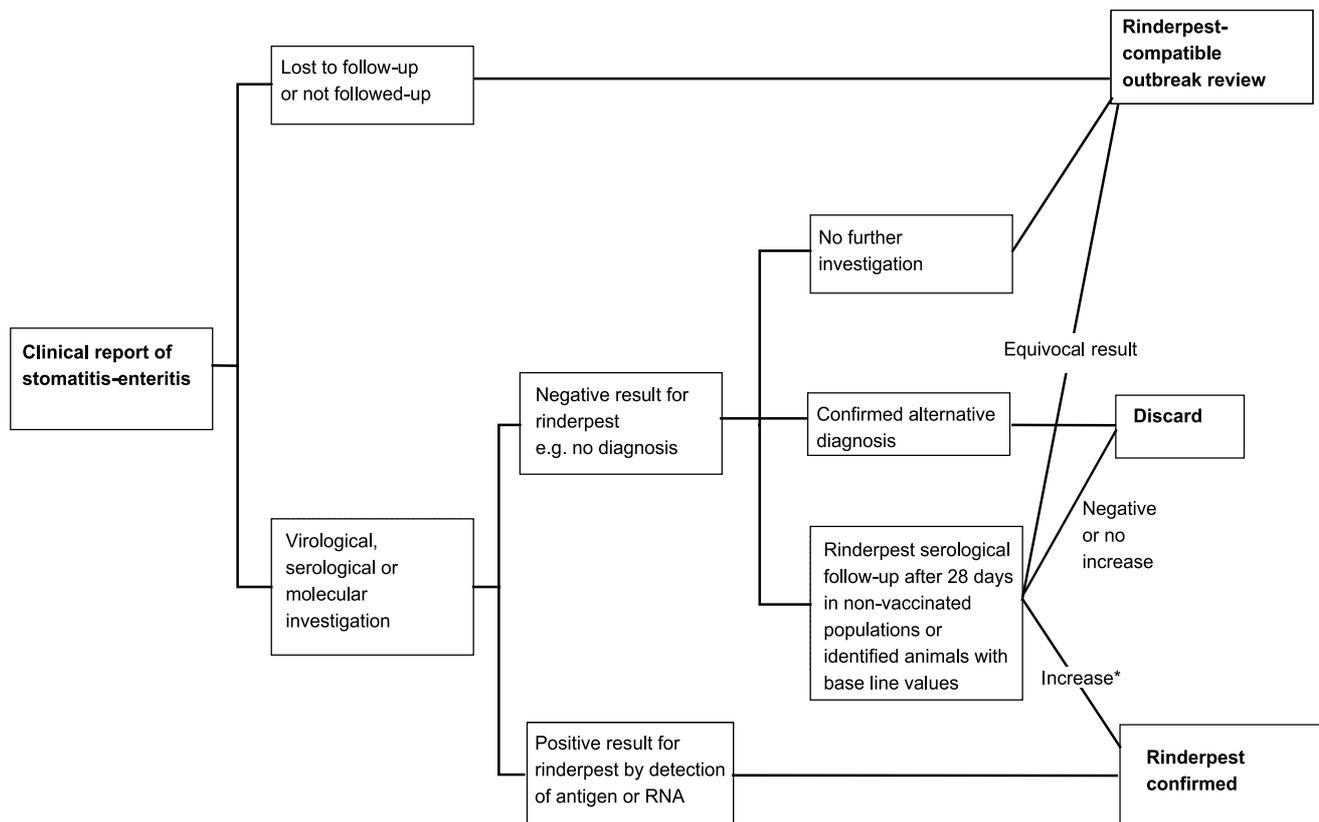
Ocular discharge and nasal discharge

Together with any two of the following:

- Fever
- Oral erosions/lesions
- Salivation
- Corneal opacity
- Diarrhoea
- Death

Outbreaks of contagious disease exhibiting discharges (ocular and nasal) and any two of the other above-mentioned symptoms should be reported as stomatitis-enteritis outbreaks. Note that it is the outbreak that must meet the criteria, not individual animals

Fig. 1
The clinical outbreak definition of stomatitis-enteritis used by the Global Rinderpest Eradication Programme



* Increase: a four-fold increase in titre in identified animals or a significant increase in seroprevalence between two appropriate sample sets

Fig. 2
The stomatitis-enteritis outbreak classification scheme used as part of the Global Rinderpest Eradication Programme

There are three possible outcomes of an SE investigation (Fig. 2):

a) Confirmed rinderpest – laboratory tests either isolate a live virus or detect rinderpest antigen, ribonucleic acid (RNA) or a four-fold rise in rinderpest specific antibody titre in paired samples from identified animals.

b) Discarded – the SE outbreak is conclusively shown not to be rinderpest. There are only two ways of proving that this is the case. The preferred method is that a definitive alternative diagnosis be confirmed by laboratory methods. The second method is that the outbreak is proven to be rinderpest negative by virus, antigen and RNA detection methods and negative on repeated serologic investigation. ‘Negative on repeated serology’ means either a four-fold rise in titre was not observed in paired samples or no statistically significant increase in seroprevalence was observed between two purposive serosurveys.

c) Rinderpest-compatible outbreak – this category includes all clinical reports that either were not investigated or for which a definitive diagnosis was never made and a valid paired serological investigation was not accomplished. Most serological investigations in endemic areas or areas with vaccinated populations are inconclusive because of animals with residual antibodies. Therefore, the serological pathway out

of the rinderpest compatible category is only available to countries that are in the process of verifying disease freedom and have ceased vaccination for at least two years.

The rinderpest compatible outbreak category could be described as the rinderpest suspect category. It contains all those outbreaks for which rinderpest was never entirely ruled out. In performance monitoring, the rinderpest compatible outbreak category is the red flag category. The goal of the surveillance programme is to keep this category as small as possible. A panel of experts from the national veterinary service, the national diagnostic facility and relevant international authorities should periodically review outbreaks classified as rinderpest compatible.

In some instances, SE outbreaks occur that are both clinically consistent with the SE outbreak definition and are epidemiologically characteristic of rinderpest. These outbreaks are considered rinderpest-probable outbreaks. Probable outbreaks are treated in the same manner as other SE outbreaks in the outbreak classification scheme. However, all means should be exhausted to confirm the outbreak as quickly as possible. Special action may be warranted to contain the outbreak prior to the availability of a laboratory diagnosis.

Performance indicators by component

General disease surveillance and reporting

General disease surveillance and reporting should be a routine national activity that collates monthly reports on disease occurrence for all significant diseases. Typically, such systems cover all diseases which are of international significance in terms of trade (OIE [World organisation for animal health] List A and B diseases) as well as diseases of local importance. General disease surveillance and reporting is a requirement for the 'provisional freedom from rinderpest disease' designation as defined by the OIE (20, 22). Unfortunately, effective systems are not in place in many countries. For this reason, a practical standard of 80% of the districts reporting on time, ten out of twelve months of the year, has been set.

Active disease surveillance

For performance monitoring, active disease surveillance is divided into two activities: active disease searching and active disease reporting. A PI is presented in Table I for each of these activities. Active disease surveillance determines the overall sensitivity of the surveillance system. 'Active' signifies that the rinderpest surveillance system initiates and maintains field level surveillance with the sole purpose of detecting the SE syndrome. Active disease surveillance is not a search for rinderpest disease; it is a search for clinical syndromes compatible with the SE outbreak definition. If active disease surveillance is functioning correctly, outbreaks of bovine viral diarrhoea (BVD), malignant catarrhal fever (MCF) and infectious bovine rhinotracheitis (IBR), amongst others, should be detected, sampled, diagnosed and reported.

Active disease surveillance includes techniques such as report (or rumour) registries, questionnaire surveys (7), participatory epidemiological investigations (10, 18), and clinical surveillance. In questionnaire surveys and participatory epidemiology, the livestock owner becomes a key link in the surveillance system. Livestock owners, particularly pastoralists, can readily recognise major disease problems such as rinderpest.

Active disease searching techniques have been used only in a few countries to date but have contributed to a more precise recognition of the extent of endemism and epidemics (18). When applied in non-infected countries, negative disease searches enhance the confidence of decision-makers to cease vaccination and to make the provisional declaration of freedom from rinderpest. In setting the standard for this activity, the countries involved in the development of the system considered the trained manpower requirement for this activity and agreed that completion of active disease searches in 10%-20% of the districts was an achievable standard.

In active disease reporting, personnel take action to facilitate the reporting of SE outbreaks. Field personnel should maintain active contact with the livestock owning public, express interest

in their current problems and take special note of any reports of SE. All countries within GREP should be detecting and investigating SE outbreaks every year, if not every month. The appropriate performance standard is set based on the national incidence of diseases such as BVD, IBR and MCF. Studies to estimate 'usual' SE outbreak rates are a prerequisite. The minimum standard for active disease reporting at the present time is that the number of active disease reports should at least be comparable to the number of outbreaks of BVD, MCF and IBR and other SE compatible reports received through the general disease reporting system. The number of SE outbreaks has been termed the SEO.

Stomatitis-enteritis outbreak investigation

The objective of outbreak investigation is to collect descriptive field data and diagnostic samples for all SE outbreaks within seven days of the initial report or recognition. This means collecting information and samples that would facilitate either a diagnosis of rinderpest or a definitive alternative diagnosis.

As with reports, investigations are usually concerned with groups of affected animals that are linked epidemiologically. An investigation of ten cases spread over three adjacent herds might constitute one investigation. Occasionally, an isolated animal will meet the SE outbreak definition and will constitute one investigation. This PI is measuring two important steps in the diagnostic process: clinical detection and sampling within seven days, and the DIs under this PI reflect this. The SE outbreak detection rate is a sub-component of this indicator.

Performance indicators for outbreak reporting and outbreak investigation, as well as the SE outbreak definition itself, are all directed towards outbreaks, as opposed to individual cases. However, once an outbreak is diagnosed clinically as SE, it is individual cases that are sampled and later tested in the laboratory. Once one case is definitively diagnosed in the laboratory, all cases from the outbreak are included because they are linked epidemiologically.

The definition of the minimum standard for outbreak investigation is that at least 80% of disease reports should be investigated within 48 h of receiving the report and 100% within seven days.

Preliminary and definitive laboratory diagnosis

The objective of laboratory confirmation is to provide a definitive diagnosis of SE outbreaks within sixty days of receipt of samples. The definitive laboratory diagnosis PI is calculated using the outbreak classification scheme and only those investigations that are classified as positives or discards are entered into the numerator. Laboratories are required to continue with more extensive testing beyond the preliminary tests, regardless of initial test results. Negative rinderpest diagnostic test results do not rule out rinderpest. The SE

outbreak will remain a rinderpest-compatible event and therefore 'suspect' until either:

- a secondary serological investigation shows no four-fold rise in rinderpest antibody or
- an alternative diagnosis is confirmed by laboratory methods.

Countries are expected to undertake a number of laboratory investigations related to the clinical incidence of SE. The result of the rinderpest diagnostic testing PI will be evaluated on the basis of the number of case reports of rinderpest alternative diagnoses (BVD, IBR, MCF, etc.) obtained through the general disease reporting system and the number of SE cases detected through active disease search and reporting activities. The number of SE cases detected through the general disease reporting system is termed the SEC and the number of cases detected through active search and reporting systems is the ASEC. Preliminary rinderpest testing should be completed and reported within three days in all cases. If preliminary rinderpest tests are negative, laboratory investigation should continue until an alternative diagnosis is confirmed on at least 80% of samples.

Serosurveillance

The objective of rinderpest serosurveillance is to detect the presence or confirm the absence of rinderpest virus infection in a population, at the level of statistical significance prescribed by the OIE pathway. Rinderpest serosurveillance currently uses a competitive enzyme-linked immunosorbent assay (ELISA) test (1, 2) endorsed by the OIE. It does not allow differentiation between antibody responses to wild and vaccine viruses, and this limits specificity in vaccinated populations. Disaggregated seroprevalence data analysed in the light of descriptive data from other surveillance activities and vaccination statistics are useful for interpretation of results in recently vaccinated or infected populations. Nevertheless, the absence of rinderpest virus circulation in a population can only be confirmed serologically once vaccination has ceased.

A statistically valid serosurveillance programme covering at least two years is the key requirement of the OIE pathway for 'definitive freedom from infection' status (22). Statistical validity for rinderpest eradication is a survey providing 95% confidence of detecting rinderpest virus at a level of 1% herd prevalence with a within herd prevalence threshold of 5% (9, 14).

The serosurveillance PI also measures the timeliness of the entire serosurveillance activity from sample collection until reporting of results to the national co-ordinator. If the information truly is to be useful, it must be current. The minimum standard for the serosurveillance PI for those countries collecting data for definitive freedom from infection is 4,000 sera per population.

Wildlife surveillance

The OIE pathway requires wildlife surveillance in those countries that have large populations of highly or moderately susceptible wildlife species (22). Although negative results from wildlife surveillance cannot rule out the presence of rinderpest in cattle, the use of wildlife populations as sentinel populations has demonstrated virus circulation (5, 14) on a number of occasions over the last four decades. Wildlife surveillance is an essential component of a comprehensive surveillance programme.

Diagnostic indicators

The DI reporting format is presented in Table II. This form is only completed when PIs are sub-standard, in an attempt to diagnose the problem. The first three DI measure the availability of the basic infrastructure necessary for a passive reporting system. The fourth, fifth and sixth are concerned with the level of knowledge and training concerning disease reporting in the various districts. The seventh DI measures the output of the system in terms of reports to the OIE and feedback of information to providers.

Field-testing

The PI system was field tested in six countries. The field tests consisted of one to two week visits by a veterinarian familiar with the national veterinary infrastructure and regional rinderpest epidemiology. The veterinarian presented an overview of the system and then worked with national experts to collect the data required to calculate the performance and DIs from existing record systems. The field-testing team identified areas of the surveillance system requiring strengthening, gaps in the record system, and improvements or clarifications required in the performance monitoring system.

Results

The specific data collected by countries in the field-testing exercises are considered confidential. However, Table III gives information from one country on the results obtained, and the comments and recommendations given indicate how the system is used as a management tool to improve surveillance. Overall observations made by the implementers and participants in the six countries included the following:

- the implementation of the indicators often highlighted the need for specific improvements in record-keeping and the need to develop disease information databases
- the dating of events or individual steps in the chain of investigations was often inadequate for establishing the timeliness of response
- the SE outbreak detection rates were below levels consistent with assumptions regarding the occurrence of SE events
- the performance indicator system was an effective tool for highlighting gaps in surveillance activities

Table II

An example of the reporting format used by national surveillance programmes when performance indicators are sub-standard. This form is used to try to diagnose the problem, either as part of an internal follow-up or as part of a follow-up assessment by the Global Rinderpest Eradication Programme or the Pan African Programme for the Control of Epizootics

Diagnostic indicator	Numerator	Denominator	Value	Standard
Proportion (%) of districts that have functional veterinary infrastructure (in terms of veterinary clinics and resources for conducting veterinary practice in the region)				> 80%
Proportion (%) of districts that have a qualified veterinary professional or a trained disease reporting agent				> 80%
Proportion (%) of districts that have been supplied with reporting formats during the last two years				> 80%
Proportion (%) of districts that have filed at least one correctly completed disease reporting format during the year				> 80%
Proportion (%) of districts that have filed incorrectly completed disease reporting formats during the year				< 20%
Proportion (%) of districts that have filed general disease occurrence reports using non-standard formats or through non-standard channels				< 20%
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 to the OIE 4 to national stakeholders

Table III

The results from one of the six countries that field-tested the performance indicator (PI) rinderpest surveillance system

Indicator	PI	Comments	Recommendations
Percentage of districts forwarding general disease reporting formats within 30 days of the end of the month at least 10 months of the year	100%	Reporting discipline for general disease reporting is high and all the regional veterinary officers submit timely summary reports on a monthly basis. Contact between the DVS and the regional offices is by telephone on a daily or at least weekly basis	Reporting frequency and reporting discipline is high due to the well established contact between the DVS and the regional offices. There is a large amount of data available at regional level (and at central level) which is not used to its full potential. At regional level data capture should be computerised to facilitate submission and analysis of data at central level. Relevant training should be provided at regional level. A disease database should be introduced at both regional and central level
Percentage of districts surveyed using active disease search techniques (participatory, questionnaire-based and clinical) with results reported within 90 days	67%	Active disease search is carried out in all regions using the standard OIE methodology. However, submission of the reporting forms is sometimes delayed in some of the regions. The majority of staff received some training in rinderpest surveillance	Active disease search is carried out but it is not sensitive enough for low levels of disease which do not occur as epidemics. The concept of SEC [®] detection in individual cattle, reporting and investigation, needs further strengthening. Increased awareness of the need to report and investigate <i>all</i> SEC is needed
Number of reports of stomatitis-enteritis, per 100,000 heads of susceptible species, received, recorded and forwarded within 30 days	0.06	Single stomatitis-enteritis cases are not reported on a regular basis, discussions at the veterinary clinic showed that such cases are detected and often recorded in the case books of the clinics. Outbreaks of SEC would be reported. Consequently PI 3 (active disease reporting) is low. Zero reporting is only done by one region	More focus on the reporting and investigation (including sample taking) of individual SEC is needed. Recording and evaluation of SEC reports would be greatly facilitated by establishing a centralised database
Number of reports of stomatitis-enteritis, per 100,000 heads of susceptible species, investigated and appropriately sampled by a veterinary professional trained in rinderpest surveillance within seven days of report	0.06	If disease is reported, follow-up actions and investigations are carried out without delay. There are no cases in cattle reported which meet the stomatitis-enteritis case definition criteria, SEC in small ruminants (PPR) is reported, sampled and followed-up	Reporting is fast, and follow-up investigations are prompt if the initial disease event is considered important enough. Sample taking by animal health assistants and field veterinarians needs to be encouraged and strengthened so that it is carried out on a routine basis whenever the diagnosis needs to be confirmed and not only in outbreak situations

Table III (contd)

Indicator	PI	Comments	Recommendations
Number of cases, per 100,000 heads of susceptible species, examined by rinderpest antigen, serological, immuno-histopathological and/or RNA detection techniques with preliminary results reported within three days of receipt of samples	0.57	If SEC are reported and sampled, the laboratory investigations are carried out without delay. No SEC in cattle were investigated by the laboratory. The cases investigated are limited to small ruminants. There is no differential diagnostic capacity established and no samples were submitted to regional or international reference laboratories	Sample collection and submission to the laboratory for confirmation of SEC needs to be improved, in particular the awareness of SEC in the veterinary clinics needs to be strengthened and laboratories/veterinarians should be encouraged to sample all suspected cases
Number of stomatitis-enteritis cases (e.g. RP, BVD, MCF, ECF, etc.), per 100,000 heads of susceptible species, diagnosed definitively by laboratory methods at national and/or reference laboratories within 60 days of receipt of samples	0.22	PPR, e.g. outbreaks of SEC in small ruminants, are detected and followed-up and finally are confirmed by laboratory techniques. However, no investigations are carried out in cattle and no differential diagnosis apart from PPR can be carried out	The diagnostic capacity for the differential diagnosis of rinderpest should be strengthened. The submission of samples to regional and international reference laboratories for confirmation and for differential diagnosis should be encouraged
Number of serum samples, per total number of populations identified in the country, collected and tested with results reported within 120 days of collection	4,162	Random serosurveillance is carried out on a regular basis following OIE standards (15 animals from 300 secondary sampling units). Reagent supply at the laboratory is very limited. No serological follow-up is carried out (paired serological sampling). Serology is not used as a tool in outbreak investigations	Serology in outbreak investigations and in follow-up investigations (paired serology) must be used on a regular basis. The awareness and understanding of serology as a valuable tool in disease investigations needs to be increased and included in the next training workshop
Number of serum samples, per thousand heads of highly or moderately susceptible wildlife species, collected and tested with results reported within 90 days of collection	n.a.	There are no significant wildlife populations available in the country	Wildlife surveillance is not a significant part of disease surveillance in the country

DVS: Department of Veterinary Services
 PPR: Peste des petits ruminants
 n.a.: not available
 a) the number of case of stomatitis-enteritis

RP: rinderpest
 BVD: bovine viral diarrhoea
 MCF: malignant catarrhal fever
 ECF: East Coast fever

- training of national participants on the PI system is required to implement performance monitoring
- continued efforts to simplify the PI system are required.

Discussion

The results indicate that the PIs are useful, but that they must be both simple and practical in application. They should not contribute unnecessarily to data collection and record-keeping requirements. The design team and participants have made every effort to respond to international requirements, the comments of epidemiologists, and the reality of existing resources and data. Experience from similar programmes suggests that PIs require dialogue, reflection and field-testing over a period of years.

Case definitions need to be adapted to the goals of the surveillance programme (11, 23). Clinical syndrome based surveillance is an approach adapted from the system of acute flaccid paralysis surveillance used in polio eradication (27). Acute flaccid paralysis is a clinical diagnosis that includes Guillain Barré syndrome. This syndrome occurs at a stable rate

worldwide. The polio campaign measures the performance of polio surveillance based on the ability of a particular country to detect this syndrome. For rinderpest, no such similar disease syndrome occurs at a known stable rate in cattle. However, it is a safe assumption that all countries are experiencing outbreaks of clinical syndromes consistent with the case definition of SE because agents or exposures that produce these lesions (BVD, MCF and IBR, among others) are ubiquitous. Therefore, if their surveillance programmes are sensitive, all countries should be finding and investigating SE outbreaks.

An assessment of the general disease reporting system in Nigeria during the resurgence of rinderpest in the early 1980s (19) found a reporting efficiency of no more than 65% at the field level. The study stated that it was difficult to estimate the number of outbreaks that went unreported but that all outbreaks reported by farmers were communicated to the national level. It was stated that reports represented the 'tip of the iceberg' and that poor reporting originated from problems at the veterinary profession-farmer interface in the field. The authors concluded that the general reporting pathway was useful in monitoring trends but could not serve as a sensitive early warning system.

Passive reporting systems are most useful in the early stages of eradication programmes when disease incidence is high (6). Clarkson and Fine (12) found a strong positive correlation between passive reporting efficiency and the incidences of pertussis and measles. However, as eradication programmes progress and disease events become rare, focused active surveillance systems are essential (23). More than any other PI, the definitive diagnosis PI is meant to challenge countries. Many countries do not currently have differential diagnostic capabilities. But for surveillance to be fully effective, all rinderpest compatible field events must be fully investigated in the laboratory.

Thacker *et al.* (26) described guidelines for the extensive evaluation and review of surveillance systems that assess the quality of surveillance, the cost of surveillance programmes and their impact on health policy and interventions. Seven attributes that define the quality of surveillance were identified: sensitivity, specificity, representativeness, timeliness, simplicity, flexibility and acceptability. Sensitivity, specificity and timeliness are characteristics of surveillance output that can be measured in performance monitoring systems. Representativeness is an important qualitative characteristic of surveillance output that is difficult to quantify. In societies made up of multiple ethnic groups, or production systems with both sedentary and transhumant components, detection bias or a lack of representativeness has been a constraint in rinderpest

eradication. Simplicity, flexibility and acceptability are prerequisites for effective surveillance systems, and assessments of surveillance programmes using DIs should be interpreted with due regard to these attributes.

The GREP is now assisting countries to implement the approach outlined in this document. The scheme presented here for the measurement of sensitivity, specificity and timeliness of surveillance is applicable to focused disease detection as part of eradication programmes. Clearly there will be man-power and training implications for those countries seeking to show freedom from rinderpest and the OIE will need to accept the PI data as providing evidence of freedom from the disease.

If the risk-based trade paradigm of the WTO SPS Agreement is to succeed, overall transparency and confidence in disease reporting will require performance monitoring. The use of PIs is applicable to the measurement of the effectiveness of general disease surveillance systems as well as to the substantiation of disease freedom. The quantitative PI approach can be used to measure the effectiveness of Veterinary Services, allowing objective assessment of this important criterion in risk analyses. This will ultimately need to be endorsed by the OIE and the WTO and provide a basis for setting standards for transparent livestock trade negotiations. ■

Suivi de l'efficacité de la surveillance de la peste bovine à l'aide d'indicateurs quantifiables

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Résumé

Les auteurs décrivent un système de suivi de l'efficacité de la surveillance des maladies. Ce dispositif, dont la conception est le fruit d'une concertation entre pays africains, a été introduit dans le cadre du Programme global d'éradication de la peste bovine de l'Organisation des Nations unies pour l'alimentation et l'agriculture. Il s'appuie sur une définition des cas cliniques de stomatite-entérite, un système de classification des enquêtes sur les foyers et une série de huit indicateurs de performances permettant d'évaluer la sensibilité, la spécificité et la rapidité du système de surveillance. Les essais effectués sur le terrain confirment l'efficacité de la démarche, lorsque les registres sont bien tenus, et soulignent l'importance du dialogue pour faciliter la compréhension et l'acceptation du système. Ce dernier fournit une mesure quantitative de l'efficacité des programmes nationaux de surveillance des maladies et de la qualité des données issues de ces programmes qui serviront à la lutte

internationale contre les maladies, à l'échange d'informations zoosanitaires et à l'analyse des risques liés aux échanges commerciaux.

Mots-clés

Analyse des risques – Commerce international – Éradication – Indicateur – Performance – Peste bovine – Service vétérinaire – Suivi – Surveillance.



Monitoreo del funcionamiento de los programas de vigilancia de la peste bovina mediante indicadores cuantitativos

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Resumen

Los autores describen un sistema para supervisar el funcionamiento de la vigilancia zoosanitaria, elaborado a raíz de una serie de conversaciones con diversos países africanos e integrado en el Programa Mundial de Erradicación de la Peste Bovina de la Organización de las Naciones Unidas para la Agricultura y la Alimentación. Componen ese sistema de control los siguientes elementos: una definición de los signos clínicos de estomatitis-enteritis; un sistema de clasificación de las investigaciones de brotes; y un conjunto de ocho indicadores de funcionamiento que miden la sensibilidad, especificidad y prontitud del dispositivo de vigilancia. De las pruebas practicadas sobre el terreno se desprende que el método funciona cuando se mantiene un correcto registro de los casos y que el diálogo es un factor de gran importancia para lograr que todas las partes entiendan y acojan favorablemente el sistema. Éste proporciona una medida cuantitativa de la eficacia de los programas nacionales de vigilancia y de la calidad de los datos obtenidos a partir de ellos con vistas al control internacional de enfermedades, el intercambio de información zoosanitaria y el análisis de riesgos ligados al comercio.

Palabras clave

Análisis del riesgo – Comercio – Erradicación – Indicador – Peste bovina – Rendimiento – Seguimiento – Servicio veterinario – Vigilancia.



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