PART 2

COMMUNICATION, COLLABORATION and IMPLEMENTATION OF SURVEILLANCE

CONTEXT AND ATTITUDES

The cost, value and use of surveillance information – the policy challenge

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Abstract

This paper will explore, using examples, how surveillance information has been used in policy making in recent years, and challenge scientists to take more responsibility to explain the disease control benefit gained for defined investment in surveillance, and policy makers to use an 'intelligent customer function' approach to ensure that the surveillance they commission is fit for purpose while being the most cost effective way of achieving the objective. It will comment on how text book approaches to surveillance developed decades ago are still in common use, often at high cost, and ask why and where does the responsibility for the consequent poor value for money, and/or poorer quality surveillance, lie? Finally the paper will describe how the UK is trying to tackle some of these issues.

Keywords: policy, cost-effective surveillance, risk management.

Introduction

Surveillance information is widely used to inform animal health policy by ensuring animal disease threats are identified, measured and tracked. This allows prompt suitable action to reduce the cost and impact of animal disease. However the cost of capturing surveillance information must be proportionate to the benefit derived from it. The development of epidemiological principles some decades ago enabled sample based surveillance strategies to be designed that took into account the probability of detection, or accuracy of measurement. In 1982 Cannon and Roe published their field manual [1] which defined the appropriate sample size for a range of surveillance objectives, and this rapidly became the 'bible' for surveillance activities across the world. Despite substantial progress in epidemiological techniques that provide alternative, often more cost effective, approaches, or can adjust for the commonly unfulfilled assumptions that the Cannon and Roe numbers depend upon, these basic tables, as well as other early epidemiological approaches, are still in widespread use. This can lead to wasted resources and/or incorrect interpretation of surveillance results. This paper discusses how surveillance information is used to inform policy and the extent to which commissioned surveillance considers cost effectiveness, and describes approaches taken in the UK to enhance surveillance while improving its efficiency.

Use of surveillance information in policy making

Surveillance information has a number of uses in policy making, and the exploration and justification of the costs is more challenging for some than others. These uses include:

1. Measuring the level and extent of diseases to determine if a control programme is justified. Surveys of this kind can differ widely in cost, depending on assumptions made about the likely level and the precision required from the estimate. Policy makers are unfamiliar with these concepts and it is for scientists to characterise the criteria to be considered. The precision in particular can have a profound effect on the sample size and costs, for example the recent Johne's disease survey in the UK ultimately used a proposed sample size of 150 herds [2], a reduction from the original proposal of 200 herds, while still delivering sufficient precision. This lead to a cost saving of many thousands of pounds.
2. To support and inform targeted disease control. Surveillance carried out in conjunction with a targeted control programme is usually the most carefully designed and resourced, as the surveillance results are used directly to measure the effect of the programme and to target further action. For example bovine tuberculosis control in many countries depends on surveillance to detect infected herds for which specific control measures can be implemented.
3. Demonstrating regional or national freedom. This can have several forms, for example: a) routine surveys carried out annually to maintain international recognition of free status, such as are carried out in the GB to demonstrate freedom from Aujeszky's disease and *Brucella melitensis*. Such surveys have often been established for some time, and recent advances that enable cumulative evidence to be used to achieve a reducing sample size may not have been implemented. International requirements may be an important constraint in such cases. b) In contrast post outbreak surveillance can be undertaken with epidemiological input that includes risk based strategies to maximise the probability of detecting disease if present, while minimising resource costs. This was exemplified in the 2008 avian flu outbreak in England, when additional sampling beyond the minimum required by regulation was implemented, but restricted to premises where the event specific risk assessment indicated disease could have been missed by clinical inspection alone [3]. However in some cases the surveillance design and interpretation of evidence may be imposed by international regulation, for example for countries in the EU seeking to demonstrate freedom from Bluetongue [4]. Such regulations are reasonably based on previous experience, and require countries to be classified as infected until 2 years after the last case. As under current EU law infected status prevents the application of risk-based controls on imports from other regions classified as infected, this binary classification makes achieving free status challenging as the country must remain at similar risk of importing disease up to the time freedom is declared. In such cases policy makers and

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scientists have joint responsibility to use epidemiological methods to explore the risks and costs involved in defining alternative approaches, such as introducing a third category of status, and if indicated, changing international legislation.

4. Exploring and preparing disease control options for contingency planning. Predictive models are used to explore the effect of different disease control strategies and make use of surveillance information both in terms of the population at risk and a range of relevant risk factors. Such predictive models tend to be used in the context of developing policy which usually has a short timescale for delivery, yet the data required depend on structures that take substantial time and resources to set up and maintain. High costs have led to reduced scope and frequency of surveys to capture population at risk data in GB, with substantial statistical effort applied to minimise and adjust for the potential errors that can result. This is one of the more challenging areas where scientists must spend time clearly characterising the benefits and risks in advance of the policy requirement.
5. Early detection of new or exotic disease to inform control action. This is a challenging area in which to define how much effort is justified, and the approach to ensure detection of new threats differs between countries. The resource allocated often relates to the country's historic experience of the impact of such events, for example the UK developed and implemented a new surveillance strategy in response to the BSE epidemic and VTEC outbreaks, and subsequent CSF and FMD epidemics.
6. Reassurance that new or unexpected diseases are absent, to justify a change of policy or decision to take no action. The GB scanning surveillance system, which depends on a wide network of subsidised diagnostic laboratories and systematic collation and review or diagnostic data, has provided international reassurance in recent years. For example to support a change in policy for BSE controls, which was based on acceptance that the system would detect BSE in the unlikely event of its resurgence in younger animals, and also to reassure policy makers that despite the continental epidemic, bluetongue was absent in 2006. However quantifying the value of such surveillance, and assessing whether a less costly approach would have sufficed is challenging.

Issues and Discussion

Initial surveys to establish whether control measures should be put in place for a particular endemic disease require both the policy maker and the scientist to explore how the results will be used. The level of precision can and should be limited to that needed to inform cost benefit analysis of possible control measures, and sufficient for any repeat survey, following implementation, to detect the expected reduction in the level of disease. It is the scientist's responsibility to explain this, and the policy makers to characterise the resource availability and potential benefit of control. Defining the resources available for control and subsequent surveillance will inform decisions on the level of precision that can realistically be sought. If resources dictate, the frequency of surveillance can be reduced such that it seeks to measure the outcome of control measures at a later time when a greater impact is expected, thus allowing a reduction in sample size and therefore of costs.

Linking surveillance directly to risk management action, as in the case of targeted control programmes enables quantification of the objectives and the costs and benefits are explored and defined from the start. This is probably the context in which there is the least challenge. However once disease has been eradicated, policy makers and scientists meet to design surveillance for demonstrating freedom which may then continue for many years during which time changes in risk, or advances in methodology may undermine the value of the surveillance or the justification of the cost. In such cases scientists have the responsibility to establish a timetable for re-evaluating the surveillance and clearly advising policy makers of the risks and costs of not doing so. Given the frequency of changes in personnel in the policy environment, perhaps it is the responsibility of scientists working in the relevant disease field to maintain awareness of this evaluation timetable.

The use of predictive models to inform disease control options is becoming more widespread and carries the risk of all models that once an estimate has been produced there may be little interest from those using the outputs in the validity of the data and assumptions in the model. This is a challenging area for scientists, who must bear the responsibility of clear communication to manage and ensure the appropriate use of model outputs, reminding policy makers that models can only estimate possible outcomes rather than predicting reality. In the UK we have partly addressed this with brief, jargon free descriptive model summaries that policy makers have endorsed.

The retention of familiar approaches probably owes much to inertia and the lack of incentive to change, however the economic downturn may provide the necessary incentive and may be the opportunity to improve understanding and change structures and processes for the better, both nationally and internationally. Surveillance scientists should seize this opportunity to improve validity and minimise costs, considering the issues discussed above, and ensuring recent advances in epidemiological methods, together with substantial effort to explain and communicate the concepts underpinning their proposals. However epidemiological principles alone may not convince, for example public perception of BSE coupled with little understanding of the true cost of finding a case could make it hard to reduce surveillance. Political realities also restrict opportunities, for example in many cases it is likely that the most sensitive surveillance is carried out in places with sufficient wealth and/or public concern, rather than those at greatest risk or that would derive the greatest benefit from the investment. It is therefore important for scientists to extend their horizons and provide honest advice if surveillance for which they are responsible will not add sufficient value to be justified. For example high impact diseases will be reported regardless of the existence of systematic surveillance systems, so such systems are justified only if they can improve the speed of detection, and thus reduce the impact, sufficiently to justify their cost. Similarly if disease is more likely to occur elsewhere in the world scientists have a responsibility to advise that investing in surveillance in that location could provide a greater opportunity for control than local surveillance.

Conclusion

Targeted surveillance for diseases that are present is related directly to risk management is more focused than that for demonstrating disease freedom or seeking to detect new diseases, and is likely to be fit for purpose. However it still relies on scientists being honest about what can be achieved for a given resource, rather than focusing on the best science and demanding it is funded. The scientist must help the policy maker explore their risk appetite and so define acceptable levels of uncertainty. This can lead to a conflict of interest for the scientist if their livelihood depends on this resource, and makes the case for policy makers being advised by independent scientists who can form an intelligent customer function (ICF) on policy makers' behalf. This approach has been used to good effect in the UK, with scientists embedded in the policy core to guide or develop a strategic approach. For example, a dedicated ICF has been established to guide the commissioning, interpretation and use of modeling for policy development and advice.

In contrast ensuring that surveillance to demonstrate absence of disease, or to detect new diseases, is fit for purpose and cost effective is more challenging. International trade in animals and their products depends on international agreement on a country's disease status, which in many cases must be disease freedom. The definition of freedom is often set by international regulations which are time consuming and complex to change. However it is the responsibility of both scientists and policy makers to seek to ensure the legislation requires valid but cost effective surveillance. Recently proposals to replace prescriptive, process based legislation with outcome based measures, which would allow new methodologies to be adopted without a change in the legislation, have been proposed [6].

Defining the appropriate level of resource to spend on the early detection of new diseases through scanning surveillance is an almost impossible task, as every new disease has a different impact. However history can describe the costs of past new diseases such as BSE, and the frequency with which new diseases have occurred. Therefore scientists can advise on the probability and speed of detection for a given resource, should the same disease occur again, while emphasizing the uncertainty about the next threat. This can help policy makers explore their risk appetite and consequent resource allocation. It is then for scientists to use the best methodology to ensure early detection of new threats in the populations in which such threats could have the greatest impact. The same surveillance evidence can provide a level of reassurance about the absence of new threats.

The UK Veterinary Surveillance Strategy [5] has focused recently, as part of its implementation, on the area of uncertainty about resource allocation. Efforts to define cost effective methods for surveillance and explore reasons why new approaches were not implemented led to an international workshop to discuss these. The report from that workshop characterised the common issues that limited the implementation of improved surveillance globally and suggested mechanisms to address these [6]. Key findings included the need for improved communication between policy makers and scientists, standardisation of the terminology of surveillance and the need for scientists to co-operate more widely within the scientific community. The workshop also identified actions that could progress the implementation of these improvements, in particular (a) international engagement to keep legislators informed of valid, cost effective surveillance methods, including the value of outcome based measures; (b) association of surveillance activities directly with risk management measures whenever possible, so that costs and benefits can be clearly defined and (c) exploration of the potential for using existing data or activities together with expert epidemiological advice to minimise the cost of surveillance.

Since this workshop, among other initiatives, scientists and policy makers in the UK have shared its findings widely, engaged with the EU to discuss approaches to bluetongue surveillance, and have formalised the consideration of threats identified by surveillance.

However, as this article shows, improving surveillance cannot be done alone, and all players must work together to seek international agreement on basic principles and approaches that can then be tailored to a country or region's epidemiological situation and resources.

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Policy constraints and promoters of efficient surveillance strategies in Switzerland

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Abstract
Animal health and residue surveillance is the basis for international free trade of animals and animal products. However, active surveillance is very costly and time-consuming. The development of cost-effective tools for animal disease and food safety surveillance is therefore a priority to decision-makers in the field of veterinary public health. The objective of this paper is to demonstrate how a close collaboration and a mutual understanding and agreement between scientists and policy makers are essential for cost-effective surveillance. The examples presented are: (i) risk-based sample size calculation for repeated surveys to substantiate freedom from diseases, (ii) establishing a cost-effective national surveillance system for Bluetongue using scenario tree modelling and (iii) a framework for risk-based residue monitoring. An open, progressive policy making process stimulates research and science in developing targeted, risk-based and cost-efficient survey methodologies. And an early involvement of policy makers in scientific developments facilitates implementation of new findings.

Keywords: policy, regulatory framework, risk-based surveillance, economic aspects.

The full text of this paper will be published in a special edition of Preventive Veterinary Medicine.

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Challenges regarding implementation of the new legislation on Aquatic Animal Health Surveillance in Europe

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Abstract
Health of farmed aquatic animals has been regulated by European Union (EU) legislation since the early nineties. In order to keep up to the SPS-agreement and new knowledge on risk-based surveillance, a new directive was adapted in 2006. In this study, we have asked aquatic animal health professionals in the European Countries how the status is for implementing the legislation in their home country, and what challenges they face in relation to this. The main conclusion is that there is a will to implement the legislation, but that it has proven difficult to integrate it with the current organisation of the aquaculture production in many countries across Europe. It cannot yet be assessed if or when a full implementation of the new directive will be achieved, and whether this will improve the health status of farmed aquatic animals in the EU.

Keywords: Surveillance, Aquaculture, Policy, Implementation, Legislation

Introduction

Surveillance of diseases in European farmed aquatic animals has been controlled by way of legislation drawn up by the European Commission (EC) in the early 1990´s. The primary purpose of the legislation was to protect those states that were free of diseases, whilst imposing minimal restrictions on trade within the community [1, 2, 3]. Each Member State (MS) was required to develop contingency plans for the containment of exotic diseases (list I diseases) and to adopt a surveillance scheme for those diseases that were considered important, but not exotic to the EU (list II diseases).

Since the legislation was adopted in the early nineties, aquaculture production has expanded both in the number of aquaculture production businesses (APBs), in diversity of farmed species (especially marine), and in the types of production system used. This has led to a requirement for a somewhat more dynamic legislative framework able to adapt to these changes in production.

Thus, in 2006, a new Council Directive (CD) on aquatic animal health surveillance and control was adopted (CD 2006/88/EC) [4]. For the first time, this included crustaceans and their diseases alongside the fish and molluscs covered by previous legislation [5, 6]. One of the intentions of this CD was that disease control should be more cost-effective and be risk-based. The aim of the health surveillance schemes is to detect any increased mortality in the APBs, as well as to detect the listed diseases [7]. Therefore, all APBs are required to keep records of mortalities and adhere to good hygiene practice, and the MS must maintain a register of authorized APBs, to assist in the prevention, control and eradication of disease. Furthermore, risk-based surveillance is enforced through article 10 of the CD, which requires that all APBs holding aquatic animal species susceptible to one or more of the listed non-exotic diseases should be placed in one of five health categories, according to their disease status, and their risk of contracting and/or spreading specific listed diseases. The five health categories are: Disease-free (I), under an approved surveillance programme (II), undetermined (not known to be infected, and not subject to a surveillance programme, III), subject to eradication programme (IV), and infected (V). The categories determines which other APBs a specific APB may trade live animals with [5].

At the 13th annual meeting of the National Reference Laboratories (NRL) for fish diseases in May 2009, a mini-workshop on the implementation of CD 2006/88/EC was held. During this workshop, all participating MS were asked to provide information on the status of the implementation of CD 2006/88/EC in their respective MS. From this, and the ensuing discussions, it was apparent that there were some problems with the implementation of the CD in some MS [8].

The aim of the present study was thus to follow-up on the implementation on the aquatic animal health surveillance component of CD 2006/88/EC, and to bring forward the challenges encountered, for input in a discussion on aquatic animal health surveillance within EU.

Materials and methods

In order to obtain information on the implementation status in MS, a questionnaire-based survey was conducted. The questionnaire was arranged in 3 parts; A (concerning implementation of the internet-based register of APBs [9]), B (concerning implementation of CD 2006/88/EC), and C (concerning overall implementation of aquatic animal health surveillance). There were 11 questions in total, 10 of which were designed as multiple choice questions, each with follow-up questions where respondents were asked to expand upon their response in free text. The 11th question was open, giving respondents opportunity to add their own comments on the overall implementation. A copy of the questionnaire can be obtained from the corresponding author.

Using the network of NRLs, the questionnaire was distributed to 34 countries, including all the 27 MS

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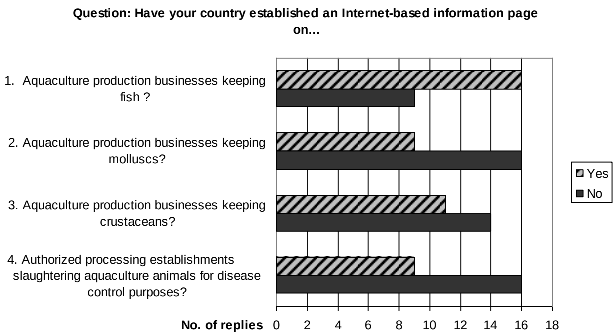
plus candidate countries and other countries within the European continent (all included in MS in the following). Completed questionnaires were returned from 25 respondents. Individual responses are kept anonymous.

Results and discussion

Of those responding, most MS appear to have established an internet-based register of APBs producing fish, whereas less than half have done this for molluscs, crustaceans or processing establishments (Figure 1).

Figure 1: Distribution of answers from the questionnaire, regarding implementation of article 2.2 of Commission Decision 2008/392/EC



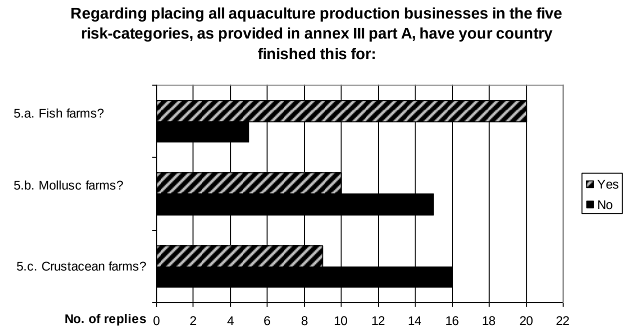
When asked about the reasons for not having registers for mollusc APBs, 9 of 16 states that their country does not have any commercial mollusc farming, for 6 MS the register is underway, and for 1 MS it is more difficult to obtain data on APBs than originally thought. For crustacean APBs, 9 of 14 MS have no commercial crustacean production, and the rest are working on the register. Equally, most MS do not have authorised processing establishments, slaughtering aquaculture animals for disease control purposes, but a few of such facilities are being authorized. Generally, the main reasons for not having finished the APB registers are related to problems with obtaining data, since these have not been collected centrally before, and that the work to do so is not being prioritized within the MS. These registers should have been in place by August 1st, 2009 [9]. On the official webpage of the EU (http://ec.europa.eu/food/animal/liveanimals/aquaculture/register_aquaculture_establishments_en.htm) there are links to registers from 10 countries, and so it can be expected that those MS who did not respond to our questionnaire all have no register in place.

Delay in establishing the registers naturally leads to delays in other areas of implementation. The lack of an overview of APBs is a possible hindrance to early detection and containment of disease.

The survey revealed that 20 of 25 MS have placed their fish APBs in to one of the five health-categories as described in article 10 of CD 2006/88/EC (Figure 2) for all listed non-exotic fish diseases. Of the negative responses, 10 of 15 for the ranking of mollusc farms and 10 of 16 of crustacean farms, related to the fact that the MS had no production of that species within their country.

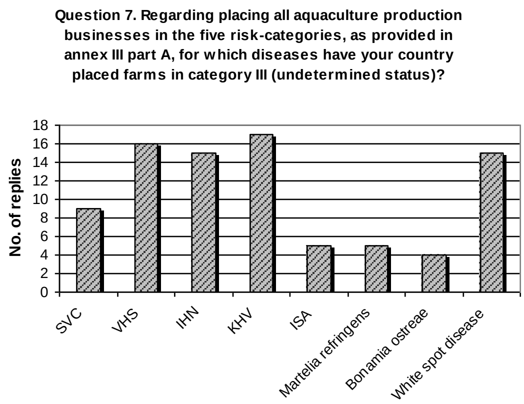
One country stated that they did not feel health-ranking of mollusc and crustacean APB was relevant, as the farms are situated in disease-free areas. The rest of negative responses were based on the work being under progression, and delays were due to uncertainties with how to perform the health-ranking, and not being finished with the registration of APBs.

Figure 2: Distribution of answers from the questionnaire, regarding implementation of article 10 of CD 2006/88/EC.



Most MS have placed APBs in category III (undetermined status) for one or more diseases (Figure 3). As we understand it, the original intention of the legislation laid down in CD 2006/88/EC, was that this health category should be used temporarily, while disease status was being determined or surveillance programmes drawn up. It is however, up to the individual MS to decide if they want to remain in this category or not. As a MS can only import from MS with the same status, it might be detrimental to trade for the individual MS to move to a category with higher health status.

Figure 3: Distribution of answers from the questionnaire, regarding implementation of annex III part A of CD 2006/88/EC.



Of the 16 MS that in our survey stated that they have mollusc production, only 4-5 had placed APBs in category III (with regard to *M. refringens* and *B. ostreae*). This means, that the rest either assumes to be free of these diseases or to be infected. From our survey, we cannot say anything towards which it is.

Of the 16 MS that have crustacean production, 15 of them have placed APBs in category III when regarding the crustacean disease, White spot disease. This most likely reflects the great uncertainty regarding the status of white spot disease in Europe.

In the survey, 4 MS stated that they have applied for approval of surveillance programmes to move farms from category III through II (in a surveillance programme) to I (disease-free), all of these surveillance programmes regards to the fish diseases VHS, IHN and KHV. Of the remaining 21 respondents, 4 inform that they are currently working on surveillance programmes to be submitted. Two respondents state that they have national surveillance programmes based on previous legislation, and that there has not been made any decisions on new surveillance yet. Four respondents state that it is not relevant for their country and six states that there is no justification for surveillance programmes at the moment, since it has not been deemed economically feasible by industry or government to do so.

The MS were also asked if they had applied for approval of surveillance programmes for farms in category V (known to be infected), and only 2 had done this, one for VHS and one for VHS and IHN. Eight other MS explained that they do not have any farms in category V, and 3 stated that they do not see the point in writing up a surveillance programme for *B. ostreae* as they think it is impossible to eradicate this disease in the MS since it occurs in natural oyster (*O. edulis*) beds within their country. One MS also stated that this work is not being prioritized within their country, and three that there was no interest in gaining disease-free status.

In the new legislation, recommended surveillance and inspection frequencies are laid out, according to health-category and risk level of APB [4]. However, as drawing up a surveillance programme is based on the registration and health categorisation of farms, the delays incurred with this is exacerbated.

Under the previous legislation, sampling plans were laid out for the listed diseases, without prejudice as to the risk of individual APBs, and so it was simpler for the MS to draw up surveillance programmes.

In our survey, we found that only 4 MS had drawn up and submitted a contingency plan regarding the handling of emerging and exotic diseases as described in article 47 of CD 2006/88/EC. None of these contingency plans had yet been approved by the European Commission (EC).

Fourteen MS stated that the contingency plan is under preparation. One MS states that it will be too expensive to implement a contingency plan, and for one MS it is not relevant. Thus, at the time of writing, no MS has an approved contingency plan for the handling of emerging diseases, even though this should have been in place in 2008 [4].

Writing up of contingency plans is not necessarily based on the register and risk-ranking being finished, so the main reason for not having finished these is probably lack of resources or prioritisation.

The last question was open: “Do you have any other comments regarding the implementation of Commission Decision 2008/392/EC and Council Directive 2006/88/EC that you wish to express?” Some MS had added comments that are reproduced here in abridged form:

- The implementation of approvals of aquaculture is long and difficult because of the complexity of the requirements inherent in this sector and the large number of APBs. This is the main reason for the late implementation of the rest of the legislation.
- The policy of the government is to ‘get their hands off’ the aquaculture sector within country - the active role requested therefore of the government is difficult to enforce.
- Commission Decision 2008/896/EC provided very useful guidelines which facilitated the development of an electronic epidemiological model for allocating risk scores to APB's based on the likelihood of the introduction of disease, and the spread of disease. This model is used in the country for indicating the frequency of inspections on fish and shellfish farms.
- Requirement for health certificate when moving animals between 2 farms under surveillance or control program in the same country is really expensive for the farmer. It could lead them to choose not trying to gain free-status.

Conclusion

This brief study has revealed that many EU MS has yet to implement the new legislation concerning aquatic animal health surveillance. Several MS are experiencing problems with inherent complexity of the legislation and the organisation of their production and thus the specific requirements that relate to their within-country scenario.

It seems that both in the EC and many of the MS, aquaculture is not prioritized as opposed to terrestrial animal farming.

Thus, as of now, the general aquatic animal health has not yet benefited much from adaptation of new legislation.

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Acknowledgements

All respondents are acknowledged for their contribution by answering the questions and providing their opinions in the survey.

Institutional Analysis to Enhance Performance of Surveillance Systems

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Abstract

Surveillance systems are social institutions that bring together a diverse range of stakeholders whose interactions are governed by both formal and informal rules. By informal rules, one refers to the customs, expectations, values and attitudes that shape the behavior of surveillance system participants. Institutional analysis can lead to a fuller understanding of the complexity of surveillance institutions and aid in assessing and enhancing surveillance systems through more explicit recognition of their component parts and the processes that mediate system results. This process can assist leaders to craft more inclusive visions for the future of health surveillance that can help drive change.

Keywords: Surveillance, Institutions, Institutional change, Participatory, Epidemiology.

Introduction

Globally, it is recognized that effective health surveillance plays a critical role that requires ongoing reinforcement in helping to assure the well-being of the earth and its living populations. . This recognition is taking place within a context of a renewed call for more effective and comprehensive integration of health efforts under headings such as 'One Health' or 'Ecohealth', which assume inclusion of human, animal, and ecosystem health.

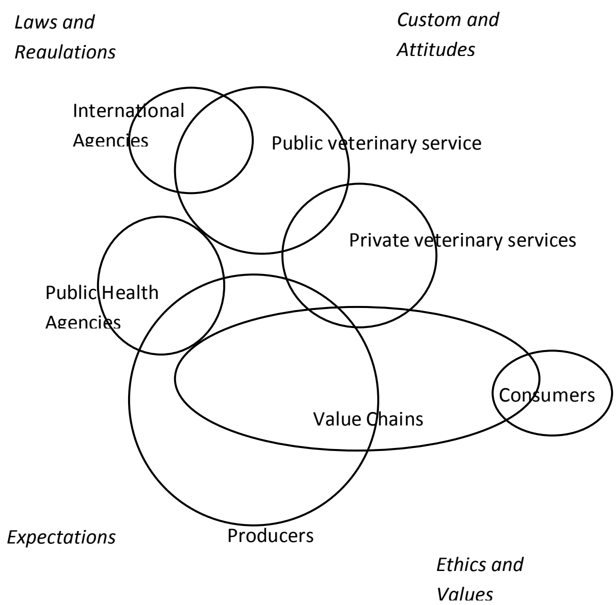
Health surveillance is a complex activity that brings together a broad range of actors and organizations whose interactions are governed by sets of formal and informal rules. Achieving effective health surveillance has been challenging within the context of conventional health science institutions. This has resulted in part from approaches in the past that have emphasized technical issues over the reality of how people are motivated to work together and share information. The current excitement about One Health approaches stems in part from the added value that integrated institutions can bring to activities such as health surveillance. However, the One Health approach also brings new challenges and transaction costs. In order to succeed in enhancing surveillance and capturing the added value of One Health approaches, it is important that these challenges, incentives and disincentives are explicitly recognized.

The Participatory Epidemiology Network for Animal and Public Health (PENAPH) advocates for an institutional approach to capacity building that starts from an assessment of institutions and institutional objectives [1] In the social sciences, an "institution" is defined as a combination of actors and the mechanisms through which they interact to achieve a common purpose [2]. The authors wish to suggest that the inclusion of an institutional analysis framework into evaluations of surveillance systems can provide new insights into surveillance performance, optimization and sustainability [3]. By explicitly including elements of attitudes, expectations, customary practice, and values a better understanding of why information is or is not moving can be achieved. We believe institutional analysis is an essential tool for leaders in health surveillance institutional change. In this paper we present an example of an institutional framework for designing surveillance systems, formulating and targeting capacity building activities, and evaluating success.

Animal Health Surveillance Institutions

The drawing of institutional maps can help to visualize the components and interactions within an institution [4]. Figure 1 presents a Venn diagram of selected parts of an institutional map of animal health surveillance for a hypothetical country.

Figure 1: Illustration of selected components of animal health surveillance as an institution



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7 African Epidemiology Network
8 Vétérinaires Sans Frontières – Belgium
9 UN-Food and Agriculture Organization

Linkages across public, private and civil stakeholders are shown as well as from local to international, and animal to human. At the center of the diagram are producers and other value chain stakeholders (traders, abattoir workers, inspectors, *etc.*). Who is the ultimate source of the majority of animal health information.

Note that the interactions of the component organizations and actors are governed by laws and regulations, customs and attitudes, expectations and values and ethics. These forces help to shape behavior and, when they interact with economic interests, are part of incentive systems.

Surveillance structures

Many professionals define surveillance systems in terms of the technical elements of a surveillance system's structure, including forms, databases, reporting channels, posts and their associated job descriptions, information packaging, *etc.* These technical elements are ideally articulated in system descriptions and standard operating procedures and supported by laws and regulations. In more innovative systems, surveillance structures now link across public-private-community boundaries and can be industry driven.

A good surveillance system structure, adapted to the system's objectives, is a prerequisite for the system to achieve its objectives. For example, if the objective of a surveillance system is to provide information for action to counter new disease introductions, then rapid flow of timely information for decision-making will be aided by time-bound, clearly-defined reporting procedures. Estimates of the response window available to avert a global pandemic of highly pathogenic avian influenza were measured in weeks from the time of onset of effective human-to-human spread and some estimates suggested that the first cluster of human cases had to be identified in order to limit spread [5].

Structures must also be adapted to local context. One size does not fit all. Approaches that are adapted for federal systems of government, highly decentralized democracies, or integrated multi-member international communities need to be carefully developed to match perceptions of the disaggregation of rights, responsibility and authority across the different forms of government.

Drivers of surveillance performance

However, a good structure alone is not sufficient to assure that surveillance objectives are achieved. It is well recognized that the positive feedback that actors in the surveillance system receive is a major determinant of future performance. Thus, making compliance with surveillance activities a component of job performance reward systems in the civil service is important. Including stakeholders in the design of surveillance activities also helps ensure that they have ownership and will actively work to make the system a success.

Yet, both the developed and developing world have had high profile examples of where information did not move through surveillance channels, contrary to what purely technical and logistic criteria had suggested. Examples can be taken from the early days of human immunodeficiency virus and bovine spongiform encephalopathy, Rift Valley fever epidemics and several instances of trans-boundary animal disease introductions.

Often institutional factors have a great impact on system performance, including attitudes, expectations, values, ethics, and economic forces. These forces form part of 'the rules of the game.' For professionals, our training and subsequent professional experience shape our attitudes and expectations of what is ethical, professional practice including practice as it relates to surveillance and the sharing of information. Particularly in the case of animal health, surveillance information can have enormous economic and political impact. However, these behavioral determinants of surveillance system performance can run much more deeply and relate to perceptions of the value of transparency, the rule of law, gender equity, *etc.* When it comes to public health surveillance, the impact of custom and culture as it relates to gender issues and sexual practices cannot be overemphasized. For example, in many societies, girl children are less likely to be taken for medical attention when ill or are taken later than boys [6]. These formal and informal rules mediate the performance of surveillance structures and can markedly enhance or distort outcomes.

Changing surveillance institutions

When setting out to enhance surveillance, the authors would like to suggest that the process should begin with an assessment of existing surveillance institutions and surveillance objectives. Such efforts should start by articulating specific surveillance objectives, identifying all relevant stakeholder groups and organizations, and, to the extent feasible, giving each a role in mapping existing surveillance institutions. This information can be used to develop plans for creating more effective surveillance institutions and a roadmap for moving from the present situation to achieving the desired goals. Effective leadership is an essential ingredient for success.

All partners would need to recognize and accept that the process is one that would require institutional change. We must examine issues from the perspective of each stakeholder and consider how proposed changes would affect their livelihoods and the things they value. Additionally, the power relationships between groups need to be considered. With this knowledge, advocates for change must craft a new vision for how the institution will function and effectively communicate that model in a sensitive and concerned manner that recognizes the important contributions of all stakeholders. The net benefit of a new vision must be compelling enough to motivate stakeholders and decision makers to risk change.

Part of this process will be a dialogue about appropriate roles and structures, but more importantly on actions to enhance those factors that promote surveillance effectiveness and performance. The outcome of this process will be an investment and training plan that seeks to create the structures, human resources and intangible assets that will lead to higher quality surveillance information.

In the case of One Health surveillance, an institutional analysis is essential to the design of a rational surveillance system that enjoys the support of the stakeholders. The value systems of key professional groups are dramatically different. Human life is generally described as beyond value whereas livestock are principally considered economic units. Value systems relating to ecosystems range from exploitation through 'healthy ecosystems for healthy people' to 'if we could just get rid of people…' The key to success in One Health will come through the merging of professional cultures; functional structures will follow.

Evaluating surveillance institutions

Good work has been done on methods to evaluate surveillance systems including defining the attributes of effective surveillance [7], performance monitoring approaches to measuring surveillance effectiveness [8] and key components of the evaluation of the Performance of Veterinary Services (PVS) as conducted by the World Organisation for Animal Health [9]. However, the complexity of surveillance is increasing and the range of actors that must be mobilized to carry out surveillance in an increasingly commercial, open-market, fast-moving, global economy requires that new tools be developed to help understand and analyze relationships, roles, and drivers.

Conclusion

Surveillance institutions are complex interactions that bring together diverse stakeholders guided by sets of formal and informal rules. Sustainable enhancement of surveillance systems is a process of institutional change and each change affects multiple stakeholders in different ways. As professionals, we are hearing and heeding the call for meaningful integration across the human-animal-environmental interface. However, care must be given to balance surveillance activities to deliver maximal benefit across the range of surveillance system participants and to address the tangible and intangible rules that govern the systems operation. Forging effective collaborations between human, animal and environmental health institutions will require an explicitly institutional approach to succeed.

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Overcoming barriers to the implementation of output-based surveillance standards

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Abstract
Output-based standards for the demonstration of freedom from infection offer significant advantages over the traditional input-based approach including better resource allocation, safer trade, lower costs and greater empowerment of stakeholders. However, implementation of output-based standards has been limited. Technical requirements for implementation include effective integrated surveillance data management and decision support tools. Policy-makers need to take a new approach to drafting regulations for output-based standards.

Keywords: output-based standards, freedom from disease, information system, regulation, policy.

The full text of this paper will be published in a special edition of Preventive Veterinary Medicine

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Participatory animal disease surveillance, Panacea to the bane of animal disease under-reporting in Nigeria

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Abstract
Under-reporting of animal disease outbreak is a common feature in most developing countries with poor disease reporting system where majority of animals are held by rural livestock farmers. Participatory Animal Disease Surveillance, which involves local rural livestock farmers, has been proven to improve disease reporting, monitory and surveillance in many developing countries. This article reports its application in Nigeria, a typical developing country, where the participatory surveillance approach has applied under the Early Detection, Reporting and Surveillance for Avian Influenza in Africa (EDRSAIA) Programme.

Keywords: Participatory Disease Surveillance, Disease Under-reporting, Panacea, Bane, Nigeria.

Introduction

Livestock production is of immense importance to the socio-economic system of a developing country like Nigeria. However, because of problems of infectious diseases, livestock productivity is generally low with subsequent reduction in income [1]. Broader negative impacts of disease on productivity can restricts trade in livestock and livestock products because of the resultant low productivity [2].

The disease process (epizootics) is a dynamic process. New ones emerge and new strains of existing pathogen evolve, that demands either new control strategy or modification of the existing system through effective surveillance [3]. These diseases cause heavy economic losses in Nigeria, due to their enzootic and epizootic patterns. The disease process (epizootics) is a dynamic process. New ones emerge and new strains of existing pathogen evolve, that demands either new control strategy or modification of the existing system through effective surveillance [3]. Effective planning for control and prevention of epizootics depend on accurate data on the occurrence and distribution of epizootics in animal population [3].

The first step in the diagnosis, monitoring, surveillance and control of animal diseases is its rapid identification followed by prompt reporting to the appropriate authorities within the area of jurisdiction. Disease reporting can serve as an early-warning mechanism against diseases outbreak and spread [4]. An efficient disease reporting is basic requirement for the success of any nation's veterinary services [5]. The purpose of disease reporting system is to provide qualitative and quantitative indicator or measure of the health status of animal populations towards the objective of disease monitoring, surveillance and control [6]. The National Disease Reporting System (NDRS), now National Animal Disease Information System (NADIS) in Nigeria has passed through many political changes that took place in the country. Thus there is need to evaluate the operational procedure from the grass root level, highlighted certain parameters that may be useful in the determination of the efficiency of the animal disease reporting system as ACCURACY of data, COMPLETENESS (ADEQUACY) in recording and reporting of the data and TIMELINESS of the information flow [6, 7].

Possible under reporting of bird flu infections in China and other Southeast Asian countries may be promoting an illusory sense that human infections are very limited. Yet, there are enormous problems getting accurate data, especially in a country like China with a population of more than a billion."Reporting a suspected bird flu infection in bird or humans is a very unlikely event," said Dr. Shoshana Zimmerman of the eHealth Institute. "There are very few incentives to report, and lots of reasons to refrain from reporting. From the viewpoint of local rural small farmers, there is little to be gained and much to be lost by reporting an infection. The worse threat is that their flocks could be killed, leaving them destitute." [8].

Participatory Epidemiology is an emerging field that is based on the use of participatory techniques for harvesting qualitative epidemiological intelligence contained within community observations, existing veterinary knowledge and traditional oral history. It relies on the widely accepted techniques of participatory rural appraisal, ethno-veterinary surveys and qualitative epidemiology [9]. This information can be used to design better animal health projects and delivery systems, more successful surveillance and control strategies or as new perspectives for innovative research hypotheses in ecological epidemiology. The PDS approach was developed in Africa as an accurate and rapid method to understand the distribution and dynamics of Rinderpest [10].

Participatory animal disease surveillance has been recognized as a panacea to the existing bane of animal disease underreporting in third world countries. In Pakistan, Participatory Disease Surveillance has been a useful tool to collect reliable data that can be utilized for the control/eradication of animal diseases in Pakistan [11].

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In Indonesia, the participatory disease surveillance and response (PDSR) approach to highly pathogenic avian influenza (HPAI) in Indonesia has evolved significantly from the participatory disease surveillance (PDS) system developed for Rinderpest eradication in Africa and Pakistan [12]. The ongoing evolution of the PDSR program aims to establish a sustainable community-based program within provincial and district livestock services that enhance the prevention and control of not only HPAI, but also other zoonotic and priority animal diseases.

A study was designed to evaluate the effectiveness of the operational system of the animal disease reporting system of Oyo State, Nigeria, one of the 36 States in Nigeria, by examining the following criteria for the period 1995 to 2005, on six animal disease of the list "A" Notifiable diseases, namely: African swine fever (ASF), Foot and mouth disease (FMD), Contagious bovine Pleuro pneumonia (CBPP), Avian influenza (AI), Rinderpest and Peste des petits ruminants (PPR). [13]. Accuracy of data received by examining the records for dual notifications and adequacy of the diagnostic method used for each case;

Notification Efficiency NE (completeness) - the ratio of the number of cases reported to the total actual infection of clinical cases [1]; measured at the three stages of reporting: - Primary stage: reports from the farmers to the veterinarians; Secondary: reports from the veterinarians to the State monitoring officers; Tertiary: reports from the State monitoring officers to NADIS offices and speed of data reported.

Retrospective survey of relevant data was carried out by going into records for outbreaks of the specified diseases of this study kept in the State Monitoring Office, Zonal Office of the Pan-African Programme for the Control of Epizootics (PACE), National Monitoring and Recording Office of the Federal Livestock Division and Pest Control Services (FLDPCS) and National Animal Disease Information Systems (NADIS) of the PACE, Abuja. Open-ended interview was utilized when necessary to get a clearer picture of the past and present status of system's operations. Respondents included veterinarians, animal health staff, laboratory scientist and auxiliary staff in the State and federal. Checklist were used for the open-ended interview

Result

NE% (completeness) at the primary stage could not be determined because of: reluctance on the part of the farmers in reporting cases, lack of awareness of need for disease reporting in rural areas, uneven distribution of the veterinarians, to the detriment of the rural areas, where the bulk of the animals are found, the distance of Vet clinic/hospital(s) and inappropriate recording of cases in the clinic. Notification inefficiency was observed in the secondary and tertiary stages due to insensitive attitude towards discharging of duties by the reporting staff who failed to submit all the reports they received to the State monitoring officers and inability of the system to fully incorporate reports from the private practitioners.

Determination of accuracy revealed that before the establishment of PACE in Oyo State (2000), all the records of disease outbreaks reported within the State and from the State to the NADIS, Abuja, were grossly inaccurate and incomplete. Diagnoses of the cases reported were based on signs of the diseases. Between 1995 and 2005, only 18.2% of the cases reported were confirmed. The confirmation came much later, except in rare cases, when the University of Ibadan laboratory was promptly consulted for diagnosis. For the period of 10 years, there were a total of 11 reported disease outbreaks- One (1) each of CBPP and FMD in 1995, no report in 1996-2000, 2002-2003, six (6) outbreaks of ASF in 2001, one (1) outbreak of FMD in 2004 and two (2) outbreaks of FMD in 2005 (but with detailed trace back investigation, it was discovered that the two recorded FMD outbreaks was a dual notification, that is, multiple reporting of a single outbreak).

The speed of information flow was greatly hindered by:-the bureaucracy associated with reporting of disease outbreak from the officer- in-charge at the grass root to the State and finally the Federal (NADIS), problems of communication and transportation and waiting for laboratory result.

Generally Oyo State has been grossly ineffective in active reporting of animal diseases cannot serve as an early-warning mechanism for prediction, prevention and control of disease outbreaks, thereby exposing both animal and human population to trans-border diseases and diseases that are of public health and socio-economic importance. For the effectiveness of the ADRS to be attained and maintained there is need for improving on training/awareness campaign for staff, farmers and general public, capacity building as it concerns diagnosis, transportation and communication facilities, staff recruitment, welfare and monitoring and reducing the bureaucracy and over-long channels of reporting

Discussion

The application of Participatory Disease Surveillance in Nigeria, Early Detection, Reporting and Surveillance for Avian Influenza in Africa (EDRSAIA) Programme has been reported [14]. The overall PDS objectives was to improve national, sub-regional and regional capacity for risk based approaches to targeting surveillance resources so as to enable rapid response for highly pathogenic avian influenza (HPAI), to improve national surveillance and reporting capacity in general and to enable sub-regional cooperation and coordination, and regional support, to undertake HPAI investigations, report disease and manage HPAI relevant information. It was being implemented in 7 West African countries: Togo, Benin, Sierra Leone, Liberia, Burkina Faso, Cote D'ivoire and Nigeria. A major objective of the exercise was the iintegration of PDS into the existing National Animal Diseases information and surveillance (NADIS) network

In October 2008 and February 2009, participants (16 and 4 respectively) were trained on basic concepts and techniques of PE for 2 weeks followed by refresher training in June 2009 for 5 days. The PDS though targeted at AI, data were collected through a broad, unbiased framework of open-ended enquiries

Principal tools used were:

i. Semi-structured interviews where respondents were asked to identify the principal animal health problems they encounter or have encountered in the past, which are further probed and

ii Proportional piling, matrix scoring, seasonal calendars, mapping and transect walks/observations to understand the priorities of farmers, livelihood impact of diseases and their epidemiology.

As at 15th May 2009, a total of 239 villages in 23 Local Government Areas of the 773 LGAs in Nigeria participated in the PDS activities. Major findings indicated that awareness of farmers on Avian Influenza was high and they were able to describe the clinical signs. In conclusion, the study showed that

i. PE can play a major role in determining diseases priorities, decision making and control/ prevention/eradication options

ii. PE has led to greater interaction especially with rural farmers who showed willingness to cooperate in all Government disease control interventions.

iii. Farmers' knowledge on various channels of disease reporting has been improved.

iv. PDS is logistically inexpensive, flexible and will lead to timely control of diseases

v. PDS is flexible and can easily be integrated into the existing ESSN

vi. PE when combined with conventional medical and veterinary diagnoses can assist both professionals gain a better understanding of Veterinary/Public health issues and dynamics.

Accordingly, policy makers in Nigeria make provisions for disease surveillance and disease management practices that involved the incorporation of (livestock) farmers" [Ogunwale, 2006].

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Use of participatory appraisal to evaluate relative incidence and impacts of Foot-and-Mouth Disease among livestock owners of Svay Rieng province in Cambodia

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Abstract

The economic and social impacts of Foot and Mouth Disease (FMD) for livestock owners in developed countries have been extensively documented over the past few years. In developing countries like Cambodia, the lack of accurate data makes it difficult to evaluate FMD perception by local communities and its current impact at household level. In this study, we decided to use a range of participatory tools in order to assess the knowledge, the perception and the 2009 relative incidence of FMD in 51 villages in the Svay Rieng province of Cambodia. The detection of antibodies directed to the non-structural FMD virus proteins (NSP) at village level was used to cross-validate results from participatory epidemiology. Matrix scoring agreements of pair-wise disease ranking and losses due to FMD, respectively W=0.13 and W=0.22 P<0.0001, showed a significant importance and similar perception of FMD for all districts visited. The average disease relative incidence for all species at village level for 2009 was evaluated by proportional piling at 12% [Min-Max 0-46]. The observed proportions of positive agreement between both serological and participatory approaches for 2009, varied between 42% for village status and 68% for animal status. Our study shows that even if FMD is considered as the second most important disease, livestock owners see no benefit in reporting it since the disease is known to have low direct impacts. Participatory methods have proved useful in evaluating the effect of FMD at household level but seem to overestimate the presence of the disease.

Keywords: participatory epidemiology, foot-and-mouth disease, seroprevalence, Cambodia.

Introduction

Foot-and-mouth disease (FMD) is still a major constraint to livestock productivity and international trade in countries of South East Asia (SEA) [1]. In Cambodia serotype O and A have been circulating in the livestock population for the last 15 years, with the latest outbreak reported in 2010 [2]. The Asia1 serotype was identified for the last time in 1997 [3].The disease is known to be present but not enough accurate data is available to inform the development of realistic and affordable control strategies [1]. Indeed under-reporting of FMD cases is likely to occur, especially in view of the shortage of financial and human resources in the official reporting chain [3]. National socio-economic impacts of the disease have been investigated by numerous projects, in several countries, but few studies, like the one carried out by Perry *et al*. in Laos [4], have explored the local perception of smallholders and effect of FMD in the rice-livestock system [5]. In the present study, participatory epidemiology was applied in the province of Svay Rieng, bordering Vietnam, to assess the epidemiological situation of FMD at village level and to evaluate the significance and impacts of the disease for individual producers. The agreement between seroprevalence results and farmers' declaration was measured.

Materials and methods

Study methodology: Six districts in Svay Rieng province were included in this study: namely Chantrea, Svay Teab, Kampong Rou, Svay Chrum, Rumduol and Romeas Hek. A total of 51 villages, selected for their high level of cattle, buffalo and pig movement (main risk factor described for FMD [1, 3]) were interviewed during the study period. Visits were first organized in each village to introduce the project to local authorities, and to schedule the next meeting with farmers. Local translators, key informants and checklists (semi-structured interviews) were used to generate information on the breeders' knowledge of cattle, buffalo and pig diseases and to identify their impacts on farmers' day-to-day life [6]. The mixed groups of male and female breeders varied from 10 to 20 persons. The participatory tools included pair-wise ranking, matrix scoring and proportional piling.

Pair-wise comparison and ranking: The informants groups were first asked to list the main diseases affecting cattle, buffaloes and pigs and then to compare these diseases in pairs, in order to rank them according to importance. The level of agreement between villages was assessed using Kendal's coefficient of concordance (W), calculated by STATA.09. Weak, moderate and strong agreement were given for W-value less than 0.26 (P>0.05), between 0.26 and 0.38 (P<0.05), and over 0.38 (P<0.01) respectively.

Matrix scoring: The five top ranked diseases based on pair-wise ranking were scored against a list of losses, listed along the y-axis of the matrix. Farmers were briefed each time and checked as to whether they correctly understood the exercise. A group was given twenty-five stones per type of loss and asked to distribute them between the five diseases. Adjustment of the scoring by farmers was possible. A global score, including all losses and their relative weight, was calculated for each disease in every village. The agreement of loss scoring was assessed, for each disease and between villages, using W.

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Proportional piling: In order to estimate FMD 2009 relative incidence and mortality, we asked farmers to divide 100 stones between two groups: sick and healthy animals regardless of cause or disease. They were then asked to distribute the stones from the pile of sick animals among all the diseases previously listed in the interview, in order for us to estimate relative disease incidence. Finally mortality was assessed for FMD. For the entire exercise, cattle and buffaloes were considered together, and pigs apart.

Blood sample analysis: Serological samples were collected in each village from cattle and buffaloes, from four months to two years-old. The minimum number of 21 animals needed to detect the disease was calculated taking into account the estimated prevalence within the village of 20% [7], with a risk α of 5%, and Elisa test characteristics (PrioCHECK® FMDV NS) of 100% sensitivity (for non-vaccinated) and 99.2% specificity. A serum was positive if its percentage of inhibition (PI) exceeded 50%, for an optic density, calculated at 450nm with Microplate Manager®6 software. A village was considered positively infected with FMD in 2009 if at least two sera were found positive in it.

Results

The clinical description of FMD was similar between villages, the main clinical signs for all species being: ulcers and vesicles in the mouth, tongue, gums [88%] and feet [69%], secondary infections and worms in the wound [73%], painful legs [65%], sialorrhea [49%], fever [41%], and anorexia [41%]. For pigs, red spots on the body were mentioned by 65% of the villages. Only 49 villages were used in the analysis of farmers' disease ranking and scoring. There was a common agreement (W=0.13; P<0.0001) amongst farmers to place FMD as the second major disease of the area after Hemorraghic Septicemiae (HS) and before Classical Swine Fever (CSF). Between all villages, we found strong agreement in the scoring of losses, whatever the disease (W=0.51; P<0.0001). For FMD we found weak agreement in the notation of each type of loss (W=0.22; P<0.0001) the most important being losses due to impacts first on rice field production and then on reproduction capacity. Loss scoring agreement was higher with FMD than with HS and CSF (W=0.08; P<0.0001).

The average estimations at village level of 2009 FMD relative incidence and mortality, given by participatory tool in the 51 villages, were respectively 12% [Min-Max 0-46] and 4% [Min-Max 0-29], all species considered. 47% of the villages declared having had FMD cases in 2009 and 2010, and 20% every year since 2008. Of the 627 animals sampled, 450 samples from 33 villages of three districts (Svay Chrum, Rumduol and Romeas Hek), were analyzed, and 39% of the villages were classified as FMD infected. The observed proportion of positive agreement for the year 2009 between participatory appraisal and ELISA test results were of 68% and 42%, respectively, for the FMD status of sampled animals and for village FMD status.

Discussion

FMD is considered as the second most important and prevalent disease in Svay Rieng. Farmers mainly see it as a curb to cultivation and reproduction rather than, as for other disease such as HS, in terms of direct loss of animals.

The natural cycle of infection-immunity, for a given serotype, leads to an inter-epidemic period of over two years in an endemic area, such as Cambodia [8]. In the study, 20% of our villages declared having FMD outbreaks each year since 2008. This proportion is probably higher, regarding the fact that 22% of the villages infected in 2009 and 2010 had missing data for the 2008 FMD infection status. The simultaneous circulation of serotype O and A in the country and their high level of antigenic diversity [8], could explain the yearly recurrence of clinical signs in cattle and the establishment of persistent infections in Svay Rieng. Moreover, the presence of the Asia-1 serotype virus in SEA and especially in Vietnam between 2005 and 2007 [9] could also be considered, even if this strain was last detected in Cambodia in 1997 [3]. However other diseases present in SEA such as Malignant Catarrhal Fever (MCF) or Bovine Viral Diarrhea (BVD) [10, 11], with similar clinical signs in cattle, could lead farmers to mistake their diagnosis and overestimate the presence of FMD in their village. To overcome this confusion between FMD and other similar infections, matrix-scoring between diseases and their symptoms would have been useful in our study to assess farmers' FMD characterization and its correlation with a common case-definition.

The proportion of infected villages declared both by farmers and by our diagnostic test is low. One of the reasons could be an overestimation of cases due to confusion with other diseases, thus indicating a lack of specificity in our participatory method. Another explanation could likely come from the lack of representativeness of our serological sample. The rice season period of our study limited the choice of animals to sample. We were able to include in our study only the few animals that farmers had prepared for us regardless of their origin. Restricting our selection to one animal per family could have helped improve representativeness. The size of our sample per village was also too small to really detect the presence of the infection. We managed to collect on average only 15 animals per village, so we needed to find at least two sera positives to declare the village with FMD in 2009. Furthermore the sensitivity of the Elisa test we used has been shown to drop to 50% after 100 days post-infection [12], which certainly was the context of our study, since the animals tested were asymptomatic and could have been in contact with the virus in the last two years of our study. Taking this into account, the number of false-negatives in our serological results was certainly very high, decreasing the proportion of positive agreement observed between the two methods. One solution could be to change the cut-off value of our Elisa test, from 50% optical density (OD) threshold to 30% or 20%, in order to increase sensitivity [13].

This will be evaluated once all the samples taken during the study have been tested.

Even if the use of participatory epidemiology seems in our case to overestimate the presence of FMD in villages, the method proved to be very informative, especially in Cambodia's context of little data, and could be a good additional epidemiological tool to understand the economic drivers of infectious disease risk management by farmers in a rice-livestock system.

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Acknowledgements

This study was carried out in the framework of the DGAL-funded FRIA-08-009 REVASIA project. We thank Dr. Sorn San Director of the National Veterinary Research Institute for his technical support and the Svay Rieng province vet services for field work implementation. We are grateful to Hélène Ou and Eav Chan for their valuable translation during farmers' interviews. We finally thank Dr. Ronelo Abila, coordinator of the SEACFMD campaign and Dr. Alexandre Bouchot sub-regional representatives of OIE in Southeast Asia, for supporting this work.

Involvement of the public for the collection of health data on Danish roe deer (*Capreolus capreolus*)

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Abstract

A disease in the roe deer *(Capreolus capreolus)* population was reported in 2002 on Funen. The disease is characterized by increased mortality associated with diarrhea and emaciation of unknown etiology. Affected individuals were reported to stagger around, and having lost the orientation and their natural shyness in the terminal stages of the disease. Sampling of demographic data was implemented in 2010. The results showed the difficulties in engaging and activating the public despite very good coverage from the news media and high activity on the homepage. It was concluded that more time is needed in order to collect sufficient data for the statistical analyses.

Keywords: Roedeer, *Capreolus capreolus,* communication, demography, citizen science.

Introduction

In 2009, the Danish National Centre for Wildlife Health (NCWH) was established as a research based collaboration between veterinarians, biologists and managers from The National Veterinary Institute, Technical University of Denmark, The National Environmental Research Institute, Aarhus University, and The Danish Forest and Nature Agency.

NCWH facilitates a multidisciplinary approach through a network of wildlife health experts and resources. NCWH performs wildlife health surveillance, coordinates field investigations of disease events, facilitates research and provides information about wildlife health to the public.

In 2002, the first reports of a syndromic roe deer (*Capreolus capreolus*) disease (SRS) were reported in Denmark on the island of Funen. SRS is characterized by increased mortality associated with diarrhea and emaciation of unknown etiology. Affected individuals were reported to stagger around, lose orientation and their natural shyness in the terminal stages of the disease. The syndrome has no distinct pattern in relation to season, sex or age. The outbreak caused a decline in the population on Funen, which was reflected in a reduction of the hunting bag [Noer *et al.* 2009] and a dramatic decrease in the number of roe deer hit by cars (pers. comm. A.B. Rasmussen, Falck Denmark A/S).

Sampling and examination of dead roe deer, which is carried out by the National veterinary Institute, is highly dependent on the submission of carcasses by the public. However, this method does not allow for the assessment of prevalence, incidence or potential impact at the population level of certain diseases. Furthermore, the lack demographic data of Danish roe deer populations weakens the conclusions, which can be made on the basis of the submitted material.

Therefore, it was decided to involve the public in a citizen science project to collect demographic data of Danish roe deer. The purpose of this paper is to present the applied method for the data collection, the communication plan and the obstacles encountered during the process.

Materials and methods

An online questionnaire was designed and provided at the NCWH website containing the following:

Name and address of the rapporteur; sample date; sample method (shot; road kill; dead; other); sex (male; female); if female – lactating (Yes/No); age (kid; < 1year; adult); length of left metatarsal bone (in cm); body weight (in kg) – intact or eviscerated carcass; extended cloves (Yes/No); ticks in a 10x10 cm area in the groin (none; 1-5; >5); larvae of *Cephenomyia stimulator* in the pharyngeal cavity (Yes/No); Diarrhea (Yes/No); *Trichodectidae* (Yes/No); Provision of fodder in the hunting area (Yes; Yes, all year round; Yes, only during winter; No); if fodder is provided – indicate ingredients. The parameters were all accompanied with photos and instructions (http://www.vildtsundhed.dk/Vildtsundhedsdata.aspx).

In Denmark the open season for male roe deer is from 16th of May-15th of July. It was therefore decided to introduce the questionnaire at this time in 2010 and again when the season opened for all roe deer (1st of October-15th of January). A press release was submitted to national news agencies prior to the hunting seasons.

Local deer hunting groups (n=20) were visited at their annual meetings in order to give a general introduction of the disease status of the roe deer in Denmark as well as a presentation of the questionnaire.

Furthermore, we participated in two national hunting fairs (in April and September), where necropsy of a roe deer was carried out live "on stage" to increase awareness of the data collection among the Danish hunters.

In 2007/08, the hunting bag of roe deer in Denmark was 110.000 based on bag return statistics [Noer *et al.* 2009]. It was anticipated that data from 10% of the roe deer bag, which corresponds to approximately 10.000 individuals, would be reported to the data base.

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Results and Discussion

The statistics of the NCWH website are presented in Table 1.

By December 2010, data from a total of around 400 roe deer were reported by 250 persons, which were primarily hunters.

Table 1: Statistics of the NCWH website from March-November 2010.

	Total hits	Unique visitors	Visitors of the questionaire
March	661	164	
April	527	144	
May*	2,260	825	377
June	933	304	207
July	848	247	112
August	538	183	75
September	549	186	57
October*	2,078	657	280
November	1,322	433	188
Total:	9716	3143	1108

* Press release

Knowledge about health and management of Danish roe deer is crucial to understand the possibilities for controlling diseases in the population. Collection of this kind of information is unique for several reasons: first, the Danish geography separate deer populations on islands or areas that have been managed differently in decades or centuries, which provide researchers with a unique opportunity to assess the management strategies. Despite an increasing hunting bag roe deer is still highly appreciated by hunters in Denmark and the health status of local populations is a subject of concern.

Taking into account that > 130,000 roe deer are killed by hunters every year on a total land surface of 43,000 km^2, even a modest response frequency of around 10% should generate an adequately large data set for analyses of spatial variation in health parameters and the relation with local landscape conditions and proxies for population densities. On a temporal scale, changes in prevalence of various diseases could be parameterized and used as basis for spatially explicit population models for the dynamics of diseases and parasites.

We were impressed by the amount of traffic, which was generated by the press releases and the concomitant media coverage. We estimate that NCWH on average has been in the national newspapers twice a month as well as in the national television four times.

We were therefore extremely disappointed to evaluate the success rate of the questionnaire, which corresponds to 0.5% of all roe deer killed during the sampling period.

Subsequently, we contacted hunters to obtain information on the reasons for the poor feedback. Many hunters replied that they “had not heard of the system”, “did not have the time to report”, or “was not sure what to report”. These answers shall be viewed in the context that all Danish roe deer hunters all are very dedicated to the game and licensing areas for roe deer hunt in Denmark is extremely expensive. Even the threat of a significant reduction of the population is not enough to engage hunters in such a collection of data, which requires only a small amount of time to fill in at the website questionnaire

Our conclusion is therefore, that communication of the data sampling has to be direct to individual hunters through personal contact. This can only be achieved by continuous contact with the “public” through the press, meetings and maybe the use of a prize or lottery.

As a result of this we cannot expect to have a national coverage but only patchy clustered information. This reduces the strength of the analyses, which can be performed on the data set.

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Acknowledgements

Veterinarians and technicians on National Veterinary Institute, Technical University of Denmark and National Environmental Research Institute are acknowledged the assistance.

This project is funded by Danish Forest and Nature Agency (J-Nr.SNS-304-00001), National Veterinary Institute (DTU-J.nr.:55013-0814) and National Environmental Research Institute (DMU-J-nr.:51-00084).

Dairy farmers' perception(s) of biosecurity – a field study

E.B. Jakobsen[1] and E.L. Kristensen[2*]

Abstract
Policy-makers and researchers hoping to improve animal health surveillance and biosecurity measures at dairy farm level could benefit from a tailored communication to the groups of farmers identified in this study according to their shared perception of (and approach to) biosecurity at farm level.

Keywords: Biosecurity, farmers' perception, Q-methodology.

Introduction
Rational choice models have little predictive effect on farmers' attitudes and subsequent behavior at farm level [1]. Likely, farmers' biosecurity efforts will follow the health-believe model [2], where people's preventive measures are determined by a) the perceived threat (perceived vulnerability and perceived severity), and b) the perceived effectiveness of proposed measures (perceived benefits and barriers). Identical findings have been reported from the field of animal health [3] where farmers' mutual mistrust (and general mistrust in the authorities) prevented improvements of collective biosecurity measures.

Lately, herd health management has been characterized by an integrated, holistic, proactive, data-based and economically framed approach to preventive medicine [4], which may be combined with disciplines like sociology, psychology, behavior science and communication into what we have suggested should be labeled 'social epidemiology' [5]. Social epidemiology offers new methodological possibilities to animal health surveillance as the social sciences have a longer tradition to address individual differences, which may be considered central to a) understand and affect the cognitive dissonance between farmers' biosecurity attitudes and their behavior, and b) to tailor communication to groups of farmers sharing opinions on biosecurity [6].

The objective of this study was to identify possible groupings of Danish dairy farmers who might share perception of (and approach to) biosecurity at farm level.

Materials and methods
We explored dairy farmers' perception of risk of introducing disease into dairy farms by asking the participating farmers to rank a number of statements on a layout guide according to their individual perception of the term 'biosecurity'. The core research tool of this study was Q-methodology [7], which provides a foundation for the systematic study of subjectivity; which is 'a person's viewpoints, opinion, beliefs, attitude, and the like' [8]. We followed the generally accepted method for designing a Q-study [*e.g.* 9]. It follows that Q-methodology does not aim at estimating proportions of different views held by the 'farmer population'. Rather, Q identifies qualitative categories of thought shared by groups of respondents, *i.e.* dairy farmers.

In a stratified design (to make sure that all regions of Denmark were represented) we selected 25 farmers owning very large dairy herds. Within each region, we selected the largest farms and a number of farms that largely reflected cow density in Denmark. To provide the study population with the largest possible comprehensiveness we tried to avoid including more than one farm associated with the same practicing veterinarian by selecting the next farmer on the list. Thus, the study population was a sample of dairy farmers, who were likely to have an interest in biosecurity and probably would have clear and interesting viewpoints on the subject, and, because of that quality, could define a factor. The selected farmers were invited, by a covering letter, to participate in the study and a subsequent phone call by the authors within the following week to make the necessary practical arrangements. Farmers did not receive any compensation for their participation.

In Q-methodology a 'concourse' refers to 'the flow of communicability surrounding any topic' [8]. A concourse is the technical definition of a contextual structure of all the possible statements, which respondents might make of their personal views to reply to a single research question. In this study, we constructed the concourse based on our reflections on viewpoints in literature, experience, input from the Danish National Board of Health and previous interviews and discussions with veterinarians, researchers, dairy farmers, financial lenders in the agro-business, the dairy industry, consumer and animal welfare organizations, *etc.* Essentially, in the construction of the concourse we included people on the farm, those surrounding the farm and others with a possible interest in dairy farming. This approach was time consuming, however necessary, in order to provide the concourse with enough breath and comprehensiveness to cover the subject. Subsequently, we broke the concourse down into as many, yet distinctly different, statements (in total 27 statements) that could potentially answer the research question:

From your point of view – which of these issues are most effective in preventing introduction of diseases into a dairy herd?

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Farmers were asked to rank the statements with minimum interference from our side. The statements were sorted on a layout guide along a quasi-normal distribution (mean 0, SD 2.25) ranging from ‘agree mostly’ (+4) to ‘disagree mostly (-4). Each statement was typed on a separate card and marked with a random number for identification (Figure 1).

Figure 1: The ranking shown on this layout guide relates to farmer # 16 (shown horizontally)

- 4 :	16	17			
- 3 :	8	19			
- 2 :	10	14	25		
- 1 :	4	9	11	20	
0 :	3	7	15	24	26
1 :	1	13	18	21	
2 :	2	12	22		
3 :	6	23			
4 :	5	27			

Following the sorting procedure, farmers were asked to elaborate on the contextual structure and thematic saturation of the concourse to face-validate the concourse.

Farmers’ rankings of statements were analyzed by means of ‘PQMethod’ [10] that is tailored to the requirements of Q-methodology. PQMethod computes correlations among respondents (the variables or columns in the data matrix) that were characterized by the sorting procedure, *i.e.* each of the 27 statements was represented by one row in the matrix. This is equivalent to reversing the correlation matrix used in traditional ‘R-factor analysis’, which is based on correlations between variables characterizing respondents. Respondents, who were highly correlated with respect to their ranking of statements, are considered to have a ‘familiar’ resemblance, *i.e.* those statements belonging to one family being less correlated with statements defining other families. A principal component analysis was chosen in PQMethod to estimate the total explained variance, and the variance attributable to each identified factor (family of perspective). Factors with eigenvalues less than 1.00 were disregarded. A factor loading was determined for each respondent as an expression of which respondents were associated with each factor and to which degree. Loadings are correlation coefficients between respondents and factors. The remaining factors were subject to a varimax (orthogonal) rotation to obtain the necessary rotated factor loadings. Scores and difference scores of each factor were estimated to present the normalized weighted average statement score of respondents defining that factor. The weight (w) was based on the respondent’s factor loading (f) and was calculated as: $w=f/(1-f^2)$. The weighted average statement score was then normalized (with a mean of 0.00 and SD = 1.00) to remove the effect of differences in number of defining respondents per factor, thereby making the statement’s factor scores comparable across factors. Thus, we took into account that some respondents were associated more closely with the factor than others by constructing an idealized Q-sorting for each selected factor. The idealized Q-sorting of a factor may consequently be considered to illustrate how a hypothetical respondent with a 100% loading on that factor would have ranked all the statements. The limit for statistical significance of a factor loading was calculated as: Factor loading/(1 divided by the square root of the number of statements). If this ratio exceeded 1.96, we regarded the loading as statistically significant ($P < 0.05$).

Following the quantitative analysis we performed three different qualitative analyses to understand and describe the logic within and differences between the identified families of perspectives. At first, we classified all statements into four thematic groups related to the origin of biological risk and the farmer’s possibilities to rapidly improve biosecurity as described by the statements. This procedure did not by itself provide us with a clear picture of differences between farmers’ perspectives on biosecurity. Next, we sorted the statements according to their in-built level of abstraction. Statements were classified into three categories: a) feasible and easy to understand; b) either feasible or easy to understand, and c) neither feasible nor easy to understand. Finally, we focused on the statements related to rules and legislation to study possible patterns of defection from legislation and expressions of selfish behavior.

Result

The concourse consisted of a number of issues which we separated into 27 statements. A large proportion (61%) of the variation in statements could be explained by 4 factors (families of perspectives) with eigenvalues > 1. Family 1 focused on risk from the outside world. Family 2 and Family 3 were rather unsystematic in their perception of biological risk to the herd. Family 3 ranked statements related to rules and legislation much lower than Family 2. Family 4 focused on internal herd management procedures. The general trend of all families of perspectives was that statements being ‘feasible and easy to understand’ received a higher ranking; however, Family 1 could easily place a positive value on statements related to external biosecurity, even if those statements were classified as ‘neither feasible nor easy to understand’. In contrast, Families 2-4, especially Family 2, tended to place a negative value on statements classified to be on a higher level of abstraction. Family 4 ranked our ‘somebody else is responsible’ indicator statements much higher than Families 1-3.

The idealized Q-sortings were assigned with informative names with input from the most distinguishing statements for each identified family and the qualitative analyses: Family 1: Cooperative; focused on external biosecurity.

Family 2: Confused; unsystematic, trouble with abstraction.

Family 3: Defector; unsystematic disregarded rules/laws.

Family 4: Selfish; ‘somebody else is responsible’.

Discussion

Farmers' perception of biosecurity could meaningfully be classified into four families of perspectives. Family 1 (cooperatives) were knowledgeable about preventive measures and perceived the outside world to present the highest biological risk to the herd. Nonetheless, a year after the implementation of biosecurity legislation none of the farmers participating in the study had conducted the mandatory biosecurity plan. This leads to the notion that some of the farmers associated with Family 1 (to some extent) could represent a response bias, *e.g.* social desirability, which may shatter the picture of a cooperative approach?

Social desirability could potentially explain why these farmers, despite the apparent 'correct' perception of biological risk to the herd, defect legislation even though they, by their ranking of statements, expressed a point of view that appeared to be cooperative with the intentions in the current biosecurity legislation. If this was the case, then some of farmers in Family 1 (cooperative) may actually perceive biosecurity more like Family 3 (defector strategy).

Farmers associated with Family 2 (confused) expressed a viewpoint on biosecurity which appeared rather confused. No obvious pattern was identified by their ranking of statements; however, we realized that biosecurity measures on a higher level of the abstraction-ladder tended to be ranked low compared to the other families. Thus, we contend with the observation that Family 2 may have specific needs for tailored and 'not too complex' communication.

Family 3 (defectors) disregarded statements related to rules and laws and may actually represent a larger proportion of the participating farmers (because some of the farmers associated with Family 1 probably belong here). In fact, farm level biosecurity may be inhibited, if improvements are supported by official rules [11]. We interpret Family 3 as having a defector strategy prompted by the farmers' perception of improvements of biosecurity measures as being a business decision rather than a decision related to ethics or the common good.

Family 4 (selfish) was characterized by focusing on internal herd management procedures and the perception that 'somebody else is responsible' for the herd's external biosecurity. We speculate if this strategy was chosen deliberately by farmers with the intent to profit from other farmers' investment in biosecurity?

'The assumption of complete connectedness between groups of farmers is inappropriate' [3] indicating that each group of farmers (or every farmer?) must be understood according to their viewpoint and how they perceive biosecurity. Likely, each group needs tailored communication [6], as indicated by the identified difference between families of perspectives related to capability in handling statements on a higher level of abstraction. Finally, we want to stress the notion that social desirability is an important response bias that must be taken into account when implementing and evaluating biosecurity at farm level.

The challenge to policy-makers and researchers will be to capture the fundamental relationships between farmers' coping strategies and ambivalence towards biosecurity, incentive structures, risk (and risk perceptions) of animal diseases, the pricing of these risks, and the sharing of the direct and consequential costs associated with a disease outbreak. Such knowledge is not available in typical databases or possible to calculate in a computer. There is still a need to place researchers in the field to investigate early events that may drive prevention and control actions [12].

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Acknowledgements

The authors wish to thank the participating farmers for investing their time to improve our understanding of their perception of biosecurity effectiveness at farm level.

This project has been subsidized by the European Community and the Danish Ministry of Food, Agriculture and Fisheries.

Biosecurity: A social dilemma

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Abstract

Policy-makers and researchers interested in animal health surveillance must acknowledge that biosecurity at farm level presents a social dilemma, where collective interests are likely at odds with the farmer's private interests. This became evident when we explored Danish dairy farmers' non-compliance with new biosecurity legislation.

Keywords: Biosecurity, social dilemma, decision frame.

Introduction

In Denmark it was stipulated by law in 2008 that farmers owning large herds should conduct a herd-specific biosecurity plan to be approved by the competent veterinary authority. Supposedly, this would force farmers to improve on precautionary measures in order to reduce the risk of introducing animal diseases into their herd and minimize the impact of outbreaks, should they occur. However, to motivate farmers into changing their daily procedures is a well-known challenge, and biosecurity measures may be particularly difficult to implement by law as outcomes are more likely to benefit society than the individual dairy farmer, *i.e.* a social dilemma.

Social dilemmas are situations characterized by two factors: a) at any given decision point, individuals receive higher payoffs for making selfish choices than they do for making cooperative choices regardless of the choices made by those with whom they interact, and b) everyone involved receives lower payoffs if everyone makes selfish choices than if everyone makes cooperative choices [1].

Interesting to this conceptual approach to biosecurity is the discussion why subjects' belief in other subjects' contributions to a social dilemma situation will ultimately determine how much they decide to contribute to the common good [2], and the discussion about group formations' impact on the dynamics of social dilemma settings as intergroup activity are known to cue mechanisms, such as fear or greed, which again may drive competitive behavior [3]. Thus, farmers' participation in more or less loosely defined groups may define and frame a social dilemma situation to the group as a situation in which selfish behavior is unlikely to be sanctioned or punished socially [4].

Rational choice models often downplay social influence processes and overall utility which limit the explanatory power of such models when applied to most social dilemmas [3]. Therefore, we draw on knowledge on motivational factors from other research disciplines like psychology, sociology and economics when discussing possible reasons for Danish dairy farmers' compliance or defection related to biosecurity legislation.

Materials and methods

In a stratified design reflecting cow density in Denmark we selected 25 farmers from a list of 168 farmers owning dairy farms affected by the new biosecurity legislation. Within each stratum we selected the farmers with the largest herd. To provide the study population with the largest possible comprehensiveness we tried to avoid including more than one farm associated with the same practicing veterinarian by selecting the next farmer on the list within the same stratum. Thus, the study population was a sample of dairy farmers, who were likely to have an interest in biosecurity as they were affected by the new legislation and because of that quality were likely to have clear and interesting viewpoints on the subject. Each farm was visited one year after introduction of the biosecurity legislation for a qualitative research interview lasting approximately one hour. The selected farmers were invited to participate in the study by a covering letter and a subsequent phone call by the authors to make the necessary arrangements within the following week. Farmers did not receive any compensation for their participation. The interviewer wore his own (clean) farm clothes and (disinfected) rubber boots upon arrival at the farm.

Questions asked were:

a. May I see your biosecurity plan?
b. Is your level of biosecurity satisfactory?
c. In our perspective; what is the main risk of introducing disease into your herd?

Result

None of the farmers were able to provide a biosecurity plan, and a few of the farmers were unaware of the legislative requirement. None of the farmers had implemented a systematic biosecurity program; however, all farmers perceived their level of biosecurity as satisfactory. None of the farmers requested or even asked the interviewer to change his clothes or disinfect his boots before entering the stable. Further, none of the farmers had been contacted by the competent veterinary authority about their missing biosecurity plan, and none of the farmers were familiar with stories about colleagues having being contacted or punished as a consequence of non-compliance with biosecurity legislation. All participating farmers considered the main risk of introducing a disease into the herd as being the purchase of animals from established dealers. This perception was inconsistent with the fact that nine of the participating farmers had purchased animals from more than three established dealers in the year preceding this study.

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Our study revealed two different kinds of social dilemmas: a) Farmers were forced to prioritize between short-term private interests and the long-term interests of dairy farming, and b) Farmers were forced to make a decision; to defect or accept legislation, *i.e.* a surveillance and sanctioning dilemma.

Discussion

Surveillance and sanctioning systems have been widely used to monitor and motivate people, but have also been criticized for not promoting ethics, *e.g.* 'failure to seriously monitor and reward/punish the performance of individuals on the ethical plan will leave codes of conduct operating in a vacuum, of little use in actually promoting ethical behavior' [8]. Surveillance and sanctioning systems may consequently leave farmers with the impression that responsibility for biosecurity rests with the system, *i.e.* society as represented by the responsible veterinary authority and not with the individual farmer. As a result, farmers may become less interested in the 'right' behavior, which may again lead to a 'vacuum' to be exploited by free-riders. Consequently, a sanctioning system may eventually increase the unwanted actions whenever 'the system' is not watching [9]. To force farmers to cooperate is difficult, if not impossible, because defection is very hard to detect at farm-level. Consequently, the goal of a sanctioning system must be to promote collective efficiency and at the same time to reduce defection by changing the payoff structure [1]. Further, sanctions may change farmers' expectations of other farmers' behavior by reassuring reluctant (and potentially defecting) farmers that they will not be exploited by free-riders.

It follows that a sanctioning system can transform a social dilemma, where the farmer must decide to comply or defect, into a situation where the farmer may start measuring penalties against rewards. Research on decision making in social dilemmas indicate that people's understanding and perception of the decision situation is important [9]. The term 'decision frame' refers to the decision maker's conception of the acts, outcomes and contingencies associated with a particular choice [11]. Thus, decision frames actively influence the level of cooperation. The decision frame surrounding a social dilemma may affect the farmer's tendency to cooperate, *i.e.* a social dilemma primarily framed in a business context may produce less cooperation than a dilemma primarily framed in a non-business or ethical context, even though both dilemmas relate to the same payoff [10]. Therefore, it is important to identify, which factors may evoke the desired decision frame. Surveillance and sanctioning systems may be such factors.

The presence of a sanctioning system in this study may have prompted some of the participating farmers to consider their decision to defect biosecurity legislation to be nothing a business decision. Weak sanctions have been known to prompt humans to focus on the business aspects of a decision, whereas, in a sanction-free situation, the same decisions are more related to ethical considerations [9].

The finding that nine of the participating farmers had purchased animals within the past year is important, because all farmers considered the purchase of animals from established dealers to be the highest risk for introducing disease into their herd. Some of these farmers probably operate in a state of cognitive dissonance as their behavior is very different from their perception of biosecurity. This serves to illustrate the multifaceted reality to biosecurity at farm level.

None of the farmers in this study had conducted the mandatory biosecurity plan, and none of them had been confronted with their non-compliance by the responsible veterinary authority. We speculate if these farmers considered the level of surveillance and associated sanctions (apparently non-existing) too weak to motivate compliance. This could have prompted a decision to defect legislation based on a business decision or these farmers lack trust in other farmers' motivation or ability to maintain adequate biosecurity?

We urge policy-makers and researchers involved in animal health surveillance to expand the methodological tool-box beyond quantitative research and start to bridge the gap from theory to implementation at farm level. This process could benefit from the knowledge of the farming community already available from studies focused on social epidemiology, which we consider central in order to understand the cognitive dissonance between farmers' biosecurity attitudes and their behavior and to tailor communication to specific groups of farmers [12].

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Acknowledgements

The authors wish to thank the participating farmers for investing their time to improve our understanding of the biosecurity dilemma. This project has been subsidized by the European Community and the Danish Ministry of Food, Agriculture and Fisheries.

Animal Disease Surveillance. The future EU Animal Health law

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Abstract

The European Union (EU) Commission along with the 27 Member States is constructing a future Animal Health Law following the commitments of the EU Animal Health Strategy (2007-2013). The aim of this law is to lay down the general principles of animal health, animal health requirements for trade of live animals and their products and also to set the principles and measures for disease control. In this context, animal disease surveillance and biosecurity will be the main tools to achieve the prevention approach of the law. The Spanish Presidency of the EU during 2010 carried out a survey in order to assess the current EU disease surveillance programs. The results of the survey provided inputs from the Member States to the Commission in the process of constructing the new Animal Health Law.

The finding of this study along with a technical seminar held in April 2010 in Seville acknowledged disease surveillance as key element in any animal health legal requirement. Therefore it should be a pillar of the future EU Animal Health Law.

Keywords: Surveillance, EU, Animal-Health-Law.

Introduction

The Animal Health Strategy for the European Union (AHS) (2007-2013) aims to provide the best possible framework for animal disease control in Europe, based on the principle that "prevention is better than cure" [1]. This approach also takes into account our international commitments and tries improving the coherence between the EU animal health policy and other European policies. These objectives can not be achieved by acting alone, it is necessary to deepen and strengthen the existing collaborative approach, maintaining effective partnerships at all levels.

The AHS has identified that a more 'prevention-driven approach' is needed to improve the animal health in the best cost-effective way. This approach will be the base for the future Animal Health Law (AHL) that the EU is constructing. The new law will request a shift in the emphasis from disease control to prevention. Two aspects will be of utmost importance: appropriate biosecurity at farm level and disease surveillance.

Surveillance systems provide early warning and prompt detection of animal diseases, together with tracking and analysis of the way diseases occur and spread [2]. Thus, building a common understanding of the importance of disease surveillance is essential to improve animal health in the EU and worldwide [3].

The aim of this study was to assess the EU surveillance programs in order to provide inputs from the Member States to the Commission in the process of constructing the new AHL.

Materials and Methods

The Spanish Presidency of the European Union (first semester of 2010) carried out a survey using self-administered questionnaires in the 27 Member States plus Norway and Switzerland between February and March 2010 with the aim of assessing the animal disease surveillance systems implemented within the EU.

The close-question questionnaire covered four main surveillance features: general aspects, technical aspects, coordination and communication and challenges (Questionnaire available upon request).

The results of this survey were discussed at a seminar hold in Seville (Spain) from 13th to 16th April 2010. The seminar was attended by the Chief Veterinary Officers (CVO) of the 27 Member States plus Norway and Switzerland, a representation from the EU Commission and from the European Council. Three well-known experts on disease surveillance were also invited to the seminar to steer the discussion and provide authority opinions.

Result

Twenty out of the 29 countries consulted answered the questionnaire, achieving a response rate of 70%.

General Aspect of Surveillance

The survey tried to identify the most relevant aspects in a well established surveillance program. Most of the countries reckoned that setting clear objectives and having an appropriate design are the most important factors that lead surveillance programs to success.

The cost/benefit ratio of the surveillance was also assessed. Apparently the most appropriate expenditure is allocated to classical swine fever and rabies surveillance. On the other hand, the TSE surveillance programs were deemed to have an excessive cost. Blue tongue and avian influenza are also diseases that were considered not to have an appropriate economic ratio having an excessive cost (Figure 1).

In order to gain efficiency of the resources allocated to surveillance, most of countries (61%) also thought it would be most appropriate to implement mixed surveillance systems, which according to the circumstances may be more focused on the animal species or on the pathogen under surveillance.

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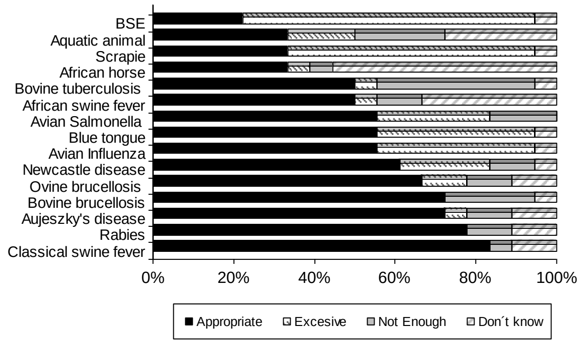
Figure 1: Perceived cost/benefit ratio of the surveillance systems implemented within the EU



A well-designed surveillance system must be able to cope with epidemiological changes; however only 61% of countries thought the current surveillance systems were dynamic and could be easily adapted to new circumstances. In addition, some countries (39%) thought their programs were not revised with the appropriate frequency. The main reason for the inflexibility seemed to be due to rigid normative but also because the apparent lack of coordination among surveillance stakeholders.

Technical Aspect
The information generated by surveillance systems must be able to be compiled in order to be analysed properly. It is essential to lay down clear definitions of the important aspects of the surveillance system. Most of the responder countries (67%) believed that some of the key definitions within the surveillance systems in the EU were sufficiently clear and harmonized. There were still almost a third of the countries that raised their worries regarding the definition of epidemiological units in some surveillance programs. In order to achieve an appropriate harmonization of the definitions, around 60% of the countries though it would be better to have specific and well detailed guidelines instead of a set of minimum requirements.

An issue that remained unclear was if the right population was targeted. Only half of the countries thought the population under surveillance was always the most appropriate. Wildlife, livestock species reared as pets and backyard farms were sometimes not considered in an appropriate level. Nevertheless, 100% of the countries reported to have specific surveillance programs for wildlife.

Scientific-based evidences must be present in the surveillance systems. Almost 80% of the countries believed that the current EU surveillance systems were well supported by national or international scientific institutions. Regarding the national scientific support, half of the countries had permanent scientific assistance and the other half often created 'ad hoc' groups. Most of the times, the scientific contribution was swift; however it still remained unclear whether this input had an appropriate cost-benefit ratio.

Risk based surveillance (RBS) may be an option when designing surveillance programs. The great majority of the responder countries (90%) reported to have implemented RBS programs. The most common criteria used in these programs were the susceptibility of the animals followed by the farming system. Some countries also reported that they used the risk criteria determined by geographic location and movement patterns such as dangerous contact among farms.

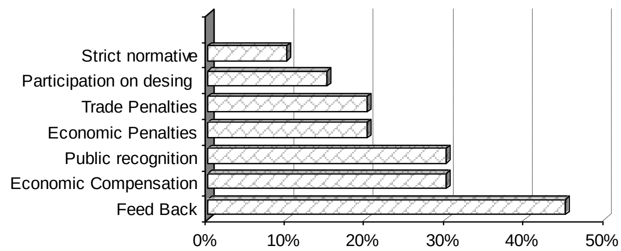
When asked about the purpose of RBS they believed it could be a good approach in terms of saving funds and human resources and also to meet the objective of establishing an early disease detection system. However, around 60% of the countries believed that RBS might be difficult to implement. On the other hand, it might not be the best approach in order to obtain a broad picture of the health status of the country neither to gain evidences of disease freedom.

Coordination and communication (C&C)
Risk areas for certain diseases commonly share borders with territories from different countries. Good C&C among the veterinary authorities of the concerned countries is essential to manage the disease risks. Countries reported to have a relatively good C&C among other Member States (MS), nevertheless there were still a third of them that believed this relationship could be improved. They also felt that C&C between MS and international institutions such as FAO, OIE, WHO appeared to be unsatisfactory. Similar circumstances seemed to happen with the C&C between MS and neighbor third countries.

Involving the right participants in surveillance is a key element to guarantee the correct C&C. Good implication and motivation of all participants will help to determine the success of the surveillance system. Countries reported that most of the times the appropriate stakeholders participated in the current EU surveillance systems. Nevertheless, there are still some stakeholders such as private vets, hunters and slaughter houses, which might not be sufficiently considered.

Countries identified several factors that might help to improve the commitment and motivation of stakeholders. Periodical training and regular feed backs with the results of the surveillance might be the most effective ways of raising their commitment motivation (Figure 2).

Figure 2: Aspect that could improve the stakeholders' commitment on surveillance.



Challenges
Rapid detection of changes in the epidemiology of animal diseases is the main challenge of surveillance system [2]. Countries were asked about the alerts

generated during 2009 in their countries either by active or by passive surveillance.

Several alerts were reported of being generated by active surveillance. The most common diseases involved were blue tongue, avian influenza, rabies and poultry salmonellosis. Routine sampling proved to be one of the most effective methods in active surveillance, followed by sampling based on risk analysis.

The alerts generated by passive surveillance were mostly due emergent or exotic diseases such as foot and mouth swine vesicular disease, Q-fever, *etc*. Over all, stakeholders` notification, closely followed by the notification of private vets, seemed to be the most effective methods in passive surveillance.

Once again, C&C was pointed out as an aspect that should be enhanced in order to gain efficacy on the surveillance systems. Information campaigns and good laboratory diagnosis can also help to improve the response time.

Discussion

Animal disease surveillance was recognized as one of the key elements of any animal health policy. The current epidemiological circumstances within the EU and also the technical and scientific advances indicate that it is a very convenient moment to strengthen the importance of disease surveillance in the context of the new Animal Health Law.

This study identified several key aspects of surveillance. Among those the most relevant seemed to be to lay down clear objectives and to improve the surveillance design with the aim of generating reliable, transparent and accessible epidemiological data.

Surveillance at EU level should be based on harmonized parameters and criteria, including agreed surveillance definitions and laboratory methodologies [3]. They should be adapted to different epidemiological scenarios.

The cost of surveillance should be proportionate to its overall benefits [3]. However, the cost-effectiveness ratio of some EU surveillance programs might not be sufficiently assessed. Mixed surveillance systems addressing several pathogens or even disease syndromes could improve the efficiency with which surveillance resources are used. Scientific advances, epidemiological tools such as risk analysis and current laboratory capability could enable the design of more effective and efficient surveillance systems.

There was an agreement among countries that risk based surveillance, broadly used within the EU, is a highly effective and efficient surveillance system. However, it may also have certain limitations when assessing the diseases status of the countries and it may also add difficulties in terms of the harmonization of surveillance systems among MS. Therefore, it must be well designed and correctly implemented, in particular if it is aimed at providing evidence of disease freedom.

Coordination and two-way communication with international institutions and third countries is also desirable for effective surveillance [3]. It is necessary to reinforce them in order to guarantee an appropriate flow of transparent epidemiological information and a common understanding of surveillance objectives and methodologies. In order to ensure safe trade, UE should take into account the surveillance systems put in place in, both, EU MS and third countries.

To ensure the motivation and the commitment of stakeholders and other surveillance participants it is recommended to provide them with periodical feedback of surveillance results and also to implement continuous training programs in order to guarantee their adeptness to new epidemiological scenarios.

In conclusion, a well designed and harmonized animal disease surveillance based in scientific evidences is considered of paramount importance to guarantee the optimum health status of the EU livestock. Therefore, disease surveillance should be a pillar of future EU Animal Health Law.

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Acknowledgements

The authors would like to recognize the contribution of all the participant countries and the valuable inputs of Prof. JM Sánchez Vizcaíno, Dr. G. Capporale and Dr. P. Fernández during the Animal Disease Surveillance Seminar.

Communication about the cattle health surveillance in the Netherlands

L. van Wuijckhuise[1*], P. Kock[1] and G. van Schaik[1]

Abstract

Since 2003, the Animal Health Service Ltd (AHS) has implemented a national cattle health surveillance system (CHSS). Objectives of the surveillance system – as defined by the stakeholders - are:

- to monitor well known but for The Netherlands exotic OIE list diseases
- to detect new or emerging diseases
- to analyse trends and development of cattle health aspects over time.

To reach these objectives a number of complementary surveillance components have been developed to collect information either passively or actively. Great emphasis is put on interpretation of information from different sources. A bottom-up approach of information and data collection, aggregation and interpretation is put in place involving specialists in various fields of expertise (veterinary medicine, pathology, laboratory, epidemiology and statistics) who meet on a regular basis. Results and findings are reported quarterly or in case of emergency, instantly to the stakeholders. In addition the AHS advises stakeholders on possible actions.

It is pivotal for any surveillance system to motivate the "eyes and ears" in the field by supplying feedback to practitioners and farmers through presentations, magazines and websites. By providing a direct feedback to practitioners and farmers they feel acknowledged and rewarded for reporting adverse-health events now and in the future.

Keywords: cattle health surveillance, information sharing.

Introduction

Since 2003, cattle health surveillance in The Netherlands is conducted for private and public stakeholders. The overall aim of the surveillance is to collect relevant information on cattle health and food quality for stakeholders. For stakeholders the information is compiled in such a way that they can act instantly in problem situations as well as can adapt policies over time.

Materials and methods

The three objectives of the surveillance program are set to be:

- Monitoring of well known exotic OIE list diseases;
- Detection of new or emerging diseases
- Description and analysis of trends and developments of various aspects of cattle health.

To meet these objectives three complementary surveillance components have been developed to collect information:

1. collection of information on symptoms and signs in cattle
2. prevalence studies on endemic cattle diseases
3. combination of data from six nationally operating organizations

The first component is a reactive component whereby farmers and practitioners can report information on (un) known symptoms and signs in cattle to a nationally operating group of ruminant health specialists. Each week, this information and results of laboratory submissions (clinical chemistry, bacteriology, parasitology, immunology, virology, toxicology and post-mortem + histology results) of the same time period are discussed for its relevance as indication for an emerging disorder or early detection of a highly contagious, non-endemic disease.

The second component is pro-active. Every two or four years, prevalence studies on endemic cattle diseases (*e.g.* BVD, IBR, Leptospirose, Neosporose, Salmonellose) are conducted in those farm populations that are not certified free for these infections. Over time, national prevalence estimates are generated with known precision and equal accuracy.

In the third component, census data from six nationally operating organisations responsible for identification and registration, herd improvement, disease-free certification, milk quality, collection of cadavers on farms and regular herd-health checks are combined into key performance indicators (KPI) on cattle health. KPI are analysed per quarter over 5-years periods to quantify biologically relevant trends.

Results

Information of all three surveillance components is discussed regularly and interpreted by specialists in cattle health, statisticians and epidemiologists in relation to the three goals defined. Results of all surveillance activities are compiled into a quarterly report.

A surveillance steering committee, composed of representatives of the stakeholders and AHS, meets every 6th week after the end of a trimester to discuss the report and to decide on further actions. In cases where immediate action is considered essential, members of the steering committee are informed directly. In situations where a need is felt to conduct additional research, this is implemented after agreement of the steering committee.

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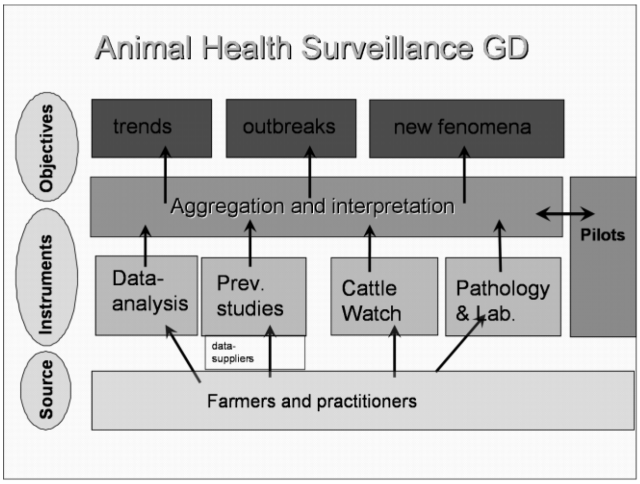

The reactive component is very important for the first two objectives of the surveillance program. As the practioners and farmers are the "eyes and ears" in the field and the information on unusual/new clinical symptoms lies with them, it is very important to give them feedback on reported events. For this purpose the AHS uses websites, magazines and presentations. Results are always reported in the following order: first stakeholders, than practitioners end finally farmers. For the practitioners AHS has a closed website for direct communication and a monthly magazine. By supplying practitioners with information before the farmers, they can answer questions from their clients. For farmers there is a quarterly magazine and an open website.

If plausible a scientific article on a new disease or syndrome is written usually for the Dutch veterinary magazine with the practitioner(s) as co-author(s) [1-6].

In a yearly report for practitioners tables on 1. frequencies of telephone calls on symptoms and diagnosed diseases, 2. necropsy diagnosis and 3. antibiograms of laboratory cultures are presented.

Discussion

It proved pivotal for our surveillance system to motivate the "eyes and ears" in the field by supplying feedback to practitioners and farmers through presentations, magazines and websites. By providing a direct feedback to practitioners and farmers they feel acknowledged and rewarded for reporting adverse-health events now and in the future.

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