Author's response to reviews

Title: Conceptualising the technical relationship of animal disease surveillance to intervention and mitigation as a basis for economic analysis

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Author's response to reviews: see over
Letter to the editor

Dear editor,

The authors thank you and the reviewers Dr Gibert and Dr Salman for the thorough revision of our manuscript and the useful comments made. We have revised the manuscript radically to reflect the considerations made and are pleased to submit our revised manuscript and responses to the editor’s and reviewers’ comments.

We were able to accommodate most of the comments made and believe that we could adequately address the issues and concerns raised by the reviewers. Where we disagreed with the reviewer’s comments, a detailed explanation is provided. Our point-by-point response to the comments is presented hereafter, highlighted in the following manner:

Editors and reviewers comments= in black
Author’s response = in blue.

Further, we have made minor edits throughout the manuscript to make it more concise and rewrote the abstract to take account of the changes made.

We hope that you receive our manuscript favourably.

Yours sincerely,

Barbara Häsler and co-authors

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Point-to-point response to the editor’s and reviewers’ comments

Editor’s comments:

1. Whether the title of the manuscript is appropriate. The manuscript appears to describe three stages of mitigation of hazards, i.e., sustainment, investigation, and implementation, in animal populations of interest, and relates the optimal surveillance and intervention at each mitigation stage to the economic impact. However, the title of the manuscript was “classification of veterinary surveillance to inform economic analysis.” As stated on page 23, “the classification system does not of itself provide any information about the most appropriate method of data collection, surveillance design, target pathogens or species.” Are you really classifying surveillance?

The title of the manuscript has been changed to account for these concerns. It is now: “Conceptualising the technical relationship of animal disease surveillance to intervention and mitigation as a basis for economic analysis”. Throughout the manuscript, the term “classification system” has been deleted and the respective sentences have been rephrased accordingly.

2. Please justify the need for Figure 2. Is there any additional information presented in Figure 2 that is not already present in Figure 1?

The authors agree that Figure 2 does not present any additional information and have deleted it. To underline the importance of the circular relationship, the following information has been added to the manuscript (p 8):

“Importantly, the three stages are a continuum, the starting point for analysis found anywhere on this mitigation continuum depending on the pathogen in question and the specific disease situation. Targeted pathogens include infectious diseases in animals, zoonotic diseases, food-borne hazards, vector-borne infections, and resistant pathogens and resistance genes. Their categorisation into endemic, (re-)emerging or exotic depends on the initial disease status of a country. Certain endemic diseases may have been present for a long time, while others may have emerged and become endemic, because there were no or insufficient mitigation measures in place. For the purposes of this paper, the starting point is set in the sustainment stage, an actual situation for many diseases in developed countries.”
Reviewer's report 1644956788515891 (CYNTHIA L GIBERT)

Major compulsory revisions

The manuscript is well-written and the proposed model for veterinary surveillance addresses in broad strokes the economic import of having a structured veterinary surveillance system in place that addresses the three facets of such surveillance – sustainment, investigation, implementation. There are no major compulsory revisions.

Minor essential and discretionary revisions

The three examples of responses to infectious pathogen-related outbreaks: the 2003 H5N1 highly pathogenic avian influenza outbreak in Vietnam, the more endemic issue of salmonella in poultry stocks in Europe beginning in 2003, and the sequelae of the 1992 foot and mouth disease vaccination ban in the EU, address the stages of the proposed veterinary surveillance system.

There should be some clarification in the scenario concerning the H5N1 outbreak in Viet Nam as it is written in the present tense and does not provide many details as to the duration of the surveillance, particularly, in the implementation phase, or of the economic costs of epidemic both social and momentary in this largely agrarian setting. It is not clear in this section what the time frames are and this should be clarified. The economic costs of the response to such an epidemic are not trivial yet the country itself may be poorly equipped to do the needed surveillance over time in the sustainment phase.

The paragraphs about the situation in Vietnam have been revised, the time frames have been indicated and the tenses adapted accordingly.

To take account of the economic costs of the epidemic (including response costs), the following addition has been made (p. 24-25):

“Economic analysis of a national mitigation programme will need to take into account the costs and benefits of all essential components of the system. For example, an economic assessment of HPAI H5N1 mitigation in Vietnam would need to incorporate valuation of all economic consequences at national level due to the benefit losses from disease and the costs of its mitigation. These include the effects of morbidity and mortality in the human population, on-farm production losses due to mortality or culling of poultry, implications of movement restrictions for trade, consumption and resource use, and the financial costs of all surveillance and intervention activities (e.g. wage and salary payments, costs of test kits, sanitary measures, protective clothing, and vaccines). Upstream and downstream effects on businesses, for example breeders and slaughterhouses, as well as spill-over impacts on other sectors such as tourism also should be evaluated. Problems of food security in the short term would also have to be considered in a resource-poor economy with a large agricultural sector. The benefits would accrue from the avoidance of the negative economic consequences of loss of output and capacity to produce, the personal and wider social and economic implications of human illness or premature death, the risk from replication of such effects by the spread of infection to other countries, and the attendant resource expenditures made in the attempt to constrain these sources of lost well-being.”

Some discussion could be included as to the feasibility of the sustainment phase in resource poor countries versus less resource poor countries, such as those in the European Union.
The following paragraph has been added to the discussion (p 25):

“However, the feasibility of implementing Stage I surveillance may differ considerably between developed and developing countries. For example, although wage rates for surveillance workers in labour-abundant developing countries are relatively low, skills may be lacking, increasing the risk of adverse consequences from Stage I failure. By contrast, the financial costs of Stage I surveillance may be high in developed economies, but their surveillance systems both technically and economically efficient.”

There needs to be more effort to demonstrate to policy makers at all levels the societal and economic benefits of veterinary surveillance.

The authors completely agree with this statement. However, describing all the benefits resulting from veterinary surveillance is beyond the scope of this paper.

The proposed model is logical but it is difficult to determine how this differs from the current systems in place for such surveillance. The authors should define how their model differs from such current systems.

This concern has been addressed in various ways: The title of the manuscript has been changed, and the term classification system has been deleted throughout the manuscript and relevant paragraphs have been rephrased accordingly. Moreover, the following paragraph now describes in detail the relevance of the technical relationships described (p 5-6):

“Technical efficiency refers to the physical relation between resources used and the related outcome and is a prerequisite for economic efficiency [2]. Therefore, the precursor to economic appraisal is acquired understanding of the technical relationships between surveillance, intervention and mitigation.

There is a wide range of definitions, concepts and characteristics of surveillance available. Moreover, several classification systems for surveillance are in place that focus on surveillance approach, design, management, networking and epidemiological criteria [3-5]. Even though such systems are useful in understanding the approach, structure and design of surveillance systems, they do not systematically address the technical relationship between key elements of mitigation essential to the economic analysis of mitigation. To the authors’ knowledge, no economic study has explicitly considered the basic technical relationship between surveillance, intervention and mitigation; aggregate conceptual units which are the fundamental elements for consideration when making recommendations for disease mitigation policies which are economically efficient.”

Another more difficult issue is the required coordination at the international level that is not addressed. For example, during the SARS epidemic organizations such as the WHO and CDC did not initially assist in controlling the epidemic in Taiwan because of political reasons despite the fact that the spread of the epidemic there not only threatened Taiwan but the larger global community.

The required coordination at the international level has been addressed by including the following paragraph in the discussion (p 29):

“Moreover, logical and sustained attention to such processes may facilitate the understanding of mitigation activities in other countries and the coordination of surveillance and intervention efforts at international level. This is of particular importance when dealing with the emergence and spread of
highly infectious diseases, such as the recent outbreaks of influenza A virus subtype H1N1 and severe acute respiratory syndrome.”

In the section on plans to reduce the prevalence of salmonella infections in poultry stocks in the EU some expansion of the discussion on the transition phase should be considered. The following amendment has been made (p 20):

“Member states implemented these plans and consequently have moved on to Stage III. Once the targets for Salmonella spp. in laying hens are achieved, transition to Stage I may be considered and the sampling protocols adapted accordingly.”

In the section on foot and mouth disease in Europe, it is not clear what is meant by the statement that “Europe passed all stages in the past 60 years” since the dates are not included. This has been made clearer by adding the following information (p 21-22):

“In short, in the years preceding the start of the mitigation programmes by vaccination (1953), the feasibility of an intervention campaign was assessed and effective vaccines were developed (Stage II). After nearly 40 years of vaccination to reduce and ultimately eradicate disease (Stage III), a vaccination ban stipulated in 1992 enabled the transition to the sustainment stage.”

Even though the three outbreaks chosen for discussion are representative of some of the issues involved when there is indeed an outbreak of an infectious pathogen, the discussion itself seems to overly simplify the true impact of the response to such outbreaks. These discussions are not as well thought out as those of the more theoretical model. The economic impact of response to such outbreaks is a key element in the economic assessment of disease mitigation. This should be clearer now with the detailed example about economic consequences of avian influenza outbreak and control in Vietnam (see first comment).

The use of scientific nomenclature in the manuscript should be reviewed and be corrected, if needed, to be in compliance with the journal requirements, as it is inconsistent. There are some other minor editorial changes that should be made and would be noticed by the authors upon review. In the scenario sections the use of tenses should be consistent throughout and not switch from the present to the past tense. The use of scientific nomenclature has been reviewed and corrected. Further, various minor edits have been made throughout the manuscript and the use of tenses has been revised.

**Decision re publication:** After some rewriting of the case scenarios and possibly some shortening of the initial discussion of the three phases of the surveillance model, the manuscript should be considered for publication. The topic of veterinary surveillance is of increasing importance. If the model discussion was somewhat abbreviated, since it is repetitive in places, the authors might appropriately discuss the issue of bioterrorism, in particular animal terrorism. The use of animal terrorism would potentially threaten livestock and migratory animal populations. Animal terrorism, the use of animal populations to introduce highly pathogenic zoonotic infections into such populations seeking to ultimately infect human populations, is a topic that does not get enough attention.
The repetitions in the description of the technical relationships between surveillance, intervention and mitigation have been removed. The spread of highly infectious diseases in animal populations has been included in the discussion (p 29):

“Moreover, logical and sustained attention to such processes may facilitate the understanding of mitigation activities in other countries and the coordination of surveillance and intervention efforts at international level. This is of particular importance when dealing with the emergence and spread of highly infectious diseases, such as the recent outbreaks of influenza A virus subtype H1N1 and severe acute respiratory syndrome.”

**Level of interest:** This article should be of interest not only to researchers and scientists but also to policy makers and the informed lay public as veterinary security issues and the, accordingly, mandated surveillance will be an ever increasing issue at the national and international level. The costs both economic and social, the related upheaval, and the required cooperation that must supersede political and geographic barriers will remain significant issues. Logical and sustained attention as outlined in this manuscript is mandatory.

**Quality of written English:** The manuscript is well-written, could be shortened is so desired. There are some minor edits that would be appropriate, and the use of the present and past tenses in the case scenarios addressed.

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:** I declare that I have no competing interests.
The aim of this manuscript is to report a study conducted to propose specific classification of the surveillance systems in veterinary medicine for the purpose of economic assessment of disease intervention strategies. My comments and concerns about this manuscript are general and not specific for paragraphs or sections of this manuscript.

The manuscript is mainly a philosophical discussion of surveillance and its link to economic issues. Most of the discussions are the opinions of the authors without sufficient literature or demonstration for background. The authors did not have sufficient justification for this classification. For instance, why would economic assessment require these classes?

The following addition has been made to the manuscript to make this point clearer (p 5-6):

“Technical efficiency refers to the physical relation between resources used and the related outcome and is a prerequisite for economic efficiency [2]. Therefore, the precursor to economic appraisal is acquired understanding of the technical relationships between surveillance, intervention and mitigation.

There is a wide range of definitions, concepts and characteristics of surveillance available. Moreover, several classification systems for surveillance are in place that focus on surveillance approach, design, management, networking and epidemiological criteria [3-5]. Even though such systems are useful in understanding the approach, structure and design of surveillance systems, they do not systematically address the technical relationship between key elements of mitigation essential to the economic analysis of mitigation. To the authors’ knowledge, no economic study has explicitly considered the basic technical relationship between surveillance, intervention and mitigation; aggregate conceptual units which are the fundamental elements for consideration when making recommendations for disease mitigation policies which are economically efficient.”

Further, the title of the manuscript has been changed to underline this. It is now: “Conceptualising the technical relationship of animal disease surveillance to intervention and mitigation as a basis for economic analysis”. Throughout the manuscript, the term “classification system” has been deleted and the respective sentences have been rephrased accordingly.

Also, the link between technical and economic efficiency has been emphasised in the following paragraph (p 30):

“Crucially, disease mitigation is both a technical problem and an economic problem, consideration of the latter dimension being relatively neglected. In a world of rapid population growth and increasing demand on scarce resources, allocating resources to surveillance and intervention in disease mitigation must aim for economic efficiency as well as technical efficiency.”

Are these classes well defined in real surveillance systems? I believe that most surveillance systems is combination of one or more of these classes.

The conceptual framework presented stems from observations of real-life processes and activities in veterinary services. To make this clearer, the following addition has been made (p 7):

“Therefore, the objective of this article is to show how the technical and economic relationships between animal disease surveillance, intervention and mitigation can be integrated as a conceptual framework to guide economic analysis in practical applications. The conceptual framework presented
builds on logical reasoning, practical experience and observations of how mitigation processes evolve over time in animal health services.”

A national surveillance system or programme for a specific hazard in a defined population can only be in one stage at a time. However, various surveillance systems of a country will be a combination of one or more of these classes. This has been made clearer by making the following amendment (p 24):

“In practice, mitigation for a defined pathogen in a target population (e.g. the poultry population of a country or region) can only be attributed to one stage at time. However, a national or regional strategy for animal health, such as the EU’s, will contain a mix of stages according to the status of the particular pathogens which are the foci of concern. Importantly, mitigation and its surveillance and intervention activities defined by technical considerations inevitably have implications for the data requirements of economic analysis.”

Surveillance by nature is in continuum steps with a dynamic process so it is hard to imagine that if the hazard is below the threshold then the investigation is triggered. Investigation is part of the surveillance whether the hazard is above or below the threshold.

The authors agree that the mitigation cycle is a continuum and that the surveillance steps must be dynamic. To underline this further, the following addition has been made to the manuscript (p 8):

“Importantly, the three stages are a continuum, the starting point for analysis found anywhere on this mitigation continuum depending on the pathogen in question and the specific disease situation. Targeted pathogens include infectious diseases in animals, zoonotic diseases, food-borne hazards, vector-borne infections, and resistant pathogens and resistance genes. Their categorisation into endemic, (re-)emerging or exotic depends on the initial disease status of a country. Certain endemic diseases may have been present for a long time, while others may have emerged and become endemic, because there were no or insufficient mitigation measures in place. For the purposes of this paper, the starting point is set in the sustainment stage, an actual situation for many diseases in developed countries.”

The “investigation” stage mentioned in the manuscript refers to the mitigation objective, i.e. it aims at assessing the present situation and to make a decision regarding possible Stage III mitigation.

Although the examples that used were appropriate, they have not supported the justification of the proposed classification of a surveillance system. A surveillance system also consists of comprehensive components that include but are not limited to these three proposed classes. The cost or the benefit from the system has to incorporate all the essential components of the surveillance system; otherwise the economic analysis would be a partial and not completed process. The authors agree that the economic analysis needs to incorporate all essential components. To emphasise this point, the following addition has been made:

“Economic analysis of a national mitigation programme will need to take into account the costs and benefits of all essential components of the system. For example, an economic assessment of HPAI H5N1 mitigation in Vietnam would need to incorporate valuation of all economic consequences at national level due to the benefit losses from disease and the costs of its mitigation. These include the effects of morbidity and mortality in the human population, on-farm production losses due to mortality or culling of poultry, implications of movement restrictions for trade, consumption and
resource use, and the financial costs of all surveillance and intervention activities (e.g. wage and salary payments, costs of test kits, sanitary measures, protective clothing, and vaccines). Upstream and downstream effects on businesses, for example breeders and slaughterhouses, as well as spill-over impacts on other sectors such as tourism also should be evaluated. Problems of food security in the short term would also have to be considered in a resource-poor economy with a large agricultural sector. The benefits would accrue from the avoidance of the negative economic consequences of loss of output and capacity to produce, the personal and wider social and economic implications of human illness or premature death, the risk from replication of such effects by the spread of infection to other countries, and the attendant resource expenditures made in the attempt to constrain these sources of lost well-being.”

In conclusion, this manuscript lacks some critical points and issues prior to considering it for publication. The authors should attempt to answer practical questions related to this classification specifically its economic soundness.

Various amendments have been made to the manuscript to corroborate the relevance of the manuscript (see above).

There is a need for a major revision of the manuscript and further review before a decision can be given about its publication.

**Level of interest:** An article of insufficient interest to warrant publication in a scientific/medical journal.

Hazard mitigation is not just a technical issue. It is also an economic issue, and one of increasing urgency given growing threats from disease and, especially, pandemics. Yet very few animal health journals make explicit provision for publishing economics-oriented papers. We believe that the combination of scientific and economic expertise potentially promotes both technical and economic efficiency, an important element in a world where demand on scarce resources is increasing.

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:** I have no conflict with these authors.